Mental Health Chatbot for University Students Support and Encouragement

Conference Paper · July 2024

DOI: 10.46254/EU07.20240156

4 authors, including:

Sibusisiwe Dube
National University of Science and Technology
53 PUBLICATIONS **180** CITATIONS
SEE PROFILE

Fungai Jacqueline Kiwa
Chinhoyi University of Technology
39 PUBLICATIONS **46** CITATIONS
SEE PROFILE

7th European Conference on Industrial Engineering and Operations Management
Augsburg, Germany, July 16-18, 2024
Publisher: IEOM Society International, USA DOI: 10.46254/EU07.20240156
Published: July 16, 2024

Mental Health Chatbot for University Students Support and Encouragement

Tapiwa Tauro, Belinda Ndlovu and Belinda Ndlovu
Department of Informatics and Analytics
National University of Science and Technology
P.O Box AC939, Ascot, Bulawayo, Zimbabwe
belinda.ndlovu@nust.ac.zw, sibusisiwe.dube@nust.ac.zw

Fungai Jacqueline Kiwa
Department of ICT and Electronics
Chinhoyi University of Technology
Private Bag 7724, Chinhoyi, Zimbabwe
jkiwa@cut.ac.zw

Abstract

Mental health issues affect university students, particularly from developing countries, who are mostly faced with social, economic, and environmental challenges, which significantly impact students' academic performance and well-being. Furthermore, the literature shows that seeking professional mental health support is usually associated with excessive costs and stigmatization. Moreover, existing generic Chatbots do not address the specific contextual needs of students. This paper therefore presents a Chatbot tailored for students from a developing country context. Qualitative data were collected from ten final-year undergraduate students with a mental breakdown who are currently enrolled at a single university case in Zimbabwe. A thematic analysis of collected data provided key constructs for designing a Chatbot that employs natural language understanding techniques to afford university students a convenient platform for acquiring mental health support. Kanban methodology was employed to develop the machine learning Chatbot using the Rasa open-source framework which is a development framework that provides open-source tools and libraries for building conversational chatbots, leveraging a collection of different pre-trained and customizable machine-learning models for varying tasks within the chatbot such as intent classification, entity recognition, and natural language understanding. The findings from this research reveal that university students appreciate this innovative approach that promotes a private and user-friendly environment for their mental health care. The findings also suggest that students who experience mental breakdown only prefer to use Chatbots as an alternative intervention rather than a replacement for mental health professionals due to the unpredictable performance of chatbots, which sometimes results in inconsistent and varying solutions for mental health care. These findings add value to the knowledge body and impact university students who can now freely access mental health support without stigmatization. The parents or guardians of affected students can now be relieved from incurring high costs for some avoidable professional mental health services for their children. Lecturers can lecture and impart knowledge to mentally relieved, present, and attentive students. The findings also add to the university management's understanding of the student's mental health needs and, can be able to strategize policies aimed at minimizing students' mental breakdown and recurrences.

Keywords
Chatbot, Mental health, University Students, Support, Encouragement, Rasa

1. Introduction

Mental health refers to a person's psychological, emotional, and social well-being and it affects and influences how people feel, think, and act. One of the main risk factors for mental health problems among university students is the stress associated with campus life such as homesickness, academic pressure, financial stress, social isolation, cyberbullying, relationship problems, and trauma among other stressors. These stressors can take a toll on students' mental health, leading to symptoms of mental breakdown such as depression, stress, and anxiety (Koulouri et al. 2022). Mental health is important to overall well-being, particularly for University Students. This demographic is at risk of developing recurring mental health problems due to stigma, reluctance, and skepticism in seeking professional mental health support. These problems can have a significant impact on their academic performance and well-being. Suicide rates, school dropout, and the increasing prevalence of anxiety and depression among university students have become a growing concern within Zimbabwean universities (Gora 2022; Gwasira 2021). These issues are often a result of unaddressed stressors such as academic pressure, financial challenges, social adjustments, and the burden of expectations (Dekker et al. 2020; Nyashanu et al. 2020). The impact of these challenges extends beyond academic performance, hence, affecting not only the students but also their families, (Nyambara 2019). Furthermore, university counseling services and therapists often fall short of meeting demand due to limited resources (Koulouri et al. 2022).

To better understand and address these mental health issues, there arose a need for new tools and resources to help university students, staff and mental health professionals understand and address the mental health issues affecting this demographic. The development of a Chatbot for the support of university students' mental health helps to provide an accessible way for the students to learn about mental health, seek support, identify coping strategies to their problems, and improve their academic performance (Balcombe 2023; Coghlan et al. 2023; Tagarot 2022). Chatbots are computer programs powered by natural language understanding and artificial intelligence that can simulate human conversations. Chatbots are an ever-evolving technology that is becoming popular, ubiquitous, and appreciated by its widespread users for its ability to provide quick responses to user queries. The foundational history of chatbot evolution was laid by Allan Turing when he proposed the Turing test in the 1950s with the first Chatbot dating back to 1966 when the first known Chatbot, ELIZA, was created by Joseph Weizenbaum using the LISP programming language at the Massachusetts Institute of Technology (MIT) to demonstrate the Turing test. Chatbots are made to learn and improve their conversational capability over time to provide service, support, and knowledge to human beings. Since then, the development of Chatbots has incorporated the use of sophisticated machine learning and artificial intelligence algorithms that enable Chatbots to engage in more intelligent and interactive conversations with humans, (DSouza 2023; Ina 2022; Zhu et al. 2022).

Building on the framework for transitioning to virtual classes during the COVID-19 pandemic (Mutunhu et al. 2022), this chatbot can provide additional support for students facing challenges in the online learning environment beyond just the academic domain. While the previous work addressed the logistical and technological challenges of adapting to remote learning environments, the Mental Health Chatbot addresses the broader emotional and psychological well-being of students during times of disruption and uncertainty such as issues like isolation, procrastination, and difficulty staying motivated, which were identified as areas requiring attention in the framework. Offering emotional support, resources, and strategies to manage these challenges, can contribute to a more positive and successful virtual learning experience for students and even lecturers (Dube et al. 2023).

It is against this background that a mental health Chatbot was developed as an alternative and accessible solution to support university students experiencing mental health distress in Zimbabwe. The mental health Chatbot for university students' support and encouragement is aimed at providing students in distress with mental health support in the form of coping mechanisms, and other resources. There is limited research on mental health Chatbot for handling mental health issues in Zimbabwe. The generic Chatbots that are sometimes used to respond to frequently asked questions on mental health topics fail to address cultural and local beliefs. Thus, the main aim of this paper is to develop a mental health Chatbot tailor-made for university students

2. Literature Review

Mental health is an important component of human health and mental health disorders are a growing concern worldwide with 1 in every 8 people in the world living with a mental health disorder (World Health Organization 2022). Anxiety disorders (2.8%) and depression disorders (4.0%) are prevalent mental health concerns in Zimbabwe, according to the 2022 Prevention and Management of Mental Health Conditions in Zimbabwe report. Many university students are affected by these concerns, which affects their quality of life (Gora 2022a; Nyambara 2019). The need

for improved mental health services is hampered by limited human resources and funding (Abd-Alrazaq et al. 2020; Saunders and Bristow 2023). In that regard, mental health Chatbots are an alternative way to complement professional mental health services by providing support, and encouragement to university students experiencing mental distress (Koulouri et al. 2022). Existing literature has evaluated the acceptability and effectiveness of using Chatbots as mental health interventions among university students. The reviewed chatbots use a combination of algorithms such as natural language processing, machine learning, dialogue management, and rule-based systems.

Acceptability. Several studies found positive user experiences with Chatbots. Students in studies by Nelekar et al. (2021) (n=61) and Gabrielli et al. (2021) (n=71) reported feeling less stressed after interacting with Chatbots. Interestingly, some students (Nelekar *et al.*2022) continued talking to the Chatbot even after the study ended indicating that they accepted Chatbots as an intervention. However, in a survey by (Gbollie *et al.* 2023) which recruited 17838 South African university students found that 79.6% considered online mental health resources, including Chatbots, to be helpful, but only 4.5% reported having previously used Chatbots for their mental health.

Effectiveness. One study by Gabrielli et al. (2021) used a mixed-methods approach with 71 university students (primarily female, aged 18-34) to investigate the effectiveness of Atena, a psychoeducational Chatbot. They found a statistically significant decrease in stress symptoms (measured by PSS-10) following interaction with the Chatbot (t39=2.0; P=.05).

Mixed Results for Anxiety and Depression. Klos *et al.* (2021) conducted a pilot RCT with 181 Argentinian university students (87.2% female, aged 18-33) to assess the effectiveness of Tess, a Chatbot designed for anxiety and depression. The intervention group showed a decrease in anxiety symptoms within the group, but this difference compared to the control group receiving a psychoeducation book was not statistically significant. No significant changes were observed in depression symptoms.

Reduced Depression and Anxiety. Liu *et al.* (2022) employed a randomized controlled trial with 83 Chinese university students (aged 19-28 years) to investigate the effectiveness of XiaoNan, a CBT Chatbot. The study reported significant reductions in both depression and anxiety among participants using the Chatbot compared to the control group receiving Bibliotherapy.

User Acceptability and Satisfaction. Studies highlight user acceptance and satisfaction with Chatbot interventions (Klos *et al.* 2021; Nelekar *et al.* 2022; Gbollie *et al.* 2023) reported that students found the ECA helpful and continued interacting with it even after the study ended. (Klos *et al.* 2021) noted positive feedback regarding the Chatbot's acceptability among participants. Gbollie *et al.* (2023) found that students expressed willingness to use online mental health solutions, including Chatbots if they addressed their concerns about safety and effectiveness compared to traditional therapy. These findings suggest chatbots can be engaging and potentially bridge the gap for students seeking mental health support.

Emerging Promise. Studies by Gabrielli et al. (2021), Nelekar et al. (2021), and Liu et al. (2022) offer promising evidence for Chatbots' effectiveness in reducing anxiety and stress among university students, suggesting they may provide valuable support for managing common mental health concerns. However, studies by Dube et al. (2024) raised concerns about overreliance on chatbots among university students.

User Acceptability and Satisfaction. Studies by (Klos *et al.*2021; Nelekar *et al.* 2022; Gbollie *et al.* 2023; Dube 2024) highlight user acceptance and satisfaction with Chatbot interventions, indicating that Chatbots can be engaging and potentially bridge the gap for students seeking mental health support.

Gaps identified. Existing chatbots offer generic mental health responses that are not necessarily specific to university students particularly students from a developing country perspective. It was also noted that although some universities' mental health resources exist, they are yet to be integrated with Chatbots as a complement intervention and this may otherwise contribute to students' mental health breakdown. To address these gaps, the researcher ensured that the development of this mental health chatbot included intents that address mental health related to university students' academic stress, socio-economic challenges, and mental well-being with a fusion of text and images in the Chatbot's responses to increase engagement and enhance the user experience.

3. Methods

The researcher employed a qualitative approach to understand, examine, and analyze stakeholder perspectives. A structured approach using the Kanban methodology was applied to define the requirements, develop the project, test, and deploy the chatbot. Kanban is an Agile-based project management framework that provides a versatile and transparent way to visualize tasks and work capacity using physical or digital boards. To define the requirements, the researcher created a 5 column Kanban board with tasks placed under To-Do, In Progress, Testing, Abandoned, and Done headings. To define the requirements, with a good To-Do list, the researcher gathered user stories that capture the user needs which were then used to outline the mental health intents. After defining the requirements, and in the development phase, the researcher created intents training examples, defined rules for the conversation flow, and tailored responses relevant to the intents. In the testing phase, unit tests were done using the command line interface to ensure that the natural language understanding, and the core components functioned as intended. Test subjects were used through a web-based chat widget interface to get feedback from the end user's perspective on the chatbot's usability. The tasks were categorized and managed following the Kanban core principles.

i. **Visualization of Workflow.** The researchers created task cards arranged under columns specifying the stage of the task activity. The Kanban board was divided into columns with To-Do, In Progress, Testing, Abandoned, and Done headings. This visualization allowed for the tracking of task status and workflow prioritization.
ii. **Limit Work in Progress (WIP).** To limit work in progress and avoid overwhelming the process, the researchers ensured that the tasks currently being worked on, were less than those in the previous column to easily handle and complete them without losing focus. Limiting work in progress improves productivity.
iii. **Efficient workflow management.** In applying this principle, the researchers ensured that interruptions and blockers that hinder progress were permanently fixed or abandoned to focus on effective areas that required attention.
iv. **Take feedback.** Feedback was sought for continuous improvement of the system.
v. **Continuous improvement.** The processes were regularly reviewed, identified bottlenecks, and implemented necessary changes to enhance productivity.

4. Data Collection

The researchers used qualitative research to identify the requirements for the study through open-ended questions in a focus group and interviews in which participants' opinions, and experiences, were gathered. Key themes and patterns related to mental health topics were manually captured from the participants' responses, suggestions, and contextual information. The researcher also leveraged existing literature and dataset analysis to identify frequently asked questions, recurring themes, and patterns applicable to the Chatbot. Identified themes and patterns were coded and organized into intents, entities, user input phrases, and bot responses. The intents, entities, and responses were defined in the rasa open source nlu, domain, and stories yaml files for training the natural language understanding models and evaluation metrics. The heliosbrahma/mental_health_dataset was scraped from hugging face using a script in the rasa open-source actions.py file. The dataset consisted of a single column with dialogue pairs of user queries, and chatbot responses curated from other blog sources such as the WebMD, Mayo Clinic, HealthLine, and online frequently asked questions. The dataset was anonymized to remove unwanted characters and personally identifiable information. The dataset's main attributes comprised user queries titled "HUMAN" with mental health topics such as symptoms, types, and general advice, and dataset responses titled "ASSISTANT" with definitions, explanations, symptoms, descriptions of mental disorders, and mental health advice.

5. Results and Discussion

The requirements gathered and the information obtained from the collected data were used to design a working mental health Chatbot which was iteratively improved with user feedback. The chatbot was designed using the Rasa open-source framework, and Python. The Chatbot was integrated with a simple interface that uses a web-based widget to interact with the users, and the user interface was designed using HTML, CSS, and JavaScript. To start interacting with the Chatbot the user clicks the chat widget icon on the bottom right corner of the screen.

Figure 1. below shows the sequence diagram of how the user interacts with the chatbot and how the chatbot interacts with its components. The user sends their message through the user interface to the chatbot framework where the Rasa Core extracts the intents, and entities from the user input and classifies them. The Dialogue manager then receives the

classified intents, and entities from the Rasa Core and predicts the most suitable action or response which it passes back to the User Interface.

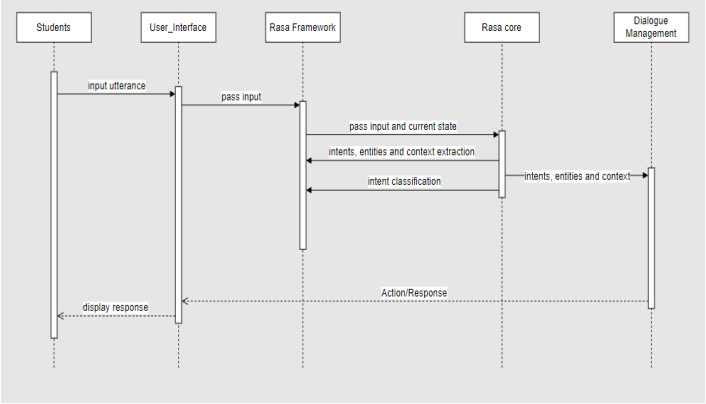

Figure 1. The chatbot sequence diagram

Figure 2 below is a use case diagram that shows how the user communicates with the Chatbot through a web chat widget user interface. The students engage the Chatbot intending to seek support, encouragement, and resources for coping with anxiety, stress, and depression (mental distress) which the Chatbot provides.

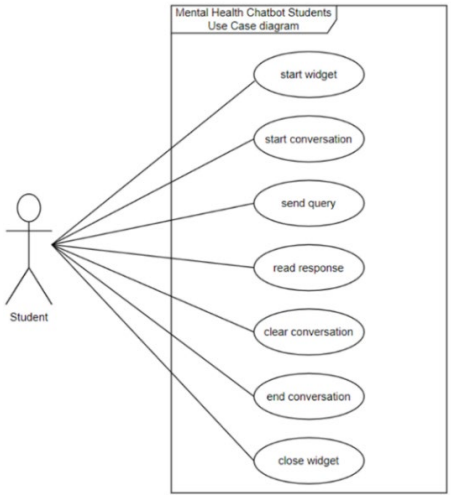

Figure 2. A student use-case diagram

5.2 Natural Language Understanding

The identified themes and patterns and categorized and defined into different user intents, used varied phrasing examples to enhance the natural language understanding of the Mental Health Chatbot. Example words, phrases, and statements were differently phrased to define each possible user intent. The chatbot managed to identify the defined intents and entities, it recognized user intents from their input and its natural language understanding performance and dialogue management were measured through the rasa open-source built-in evaluation metrics which measure precision, recall, f1 score, and the number of supporting examples, these metrics are stored with their weighted averages in a JSON file named intent report. Figures 3, 4 and 5 below are some of the results from these measures.

Contextual responses.

Generally, the chatbot correctly predicted appropriate responses for the user input related to the defined mental health intents. However, there were times when the chatbot predicted incorrect responses after users had entered unexpected or ambiguous statements, particularly not mental health related. The researcher compared such responses to what an

actual human being would have said and activated the chatbot to use default fallback messages in such cases. While the chatbot responses improved, some occasional unexpected hallucinations can still occur, where some responses do not align with the user's context.

Conversational Flow

The chatbot uses defined core functionality elements such as stories, intents, and entities and employs a rule-based conversation flow that leverages in-memory basic rasa machine learning algorithms. While this approach might not be advanced compared to intentless chatbots, its simplicity allows it to respond relevantly to the students' mental health queries. Figure 3 below highlights the flow chart with start and end nodes, and shows different scenarios that may take place when the user interacts with the university students' mental health chatbot.

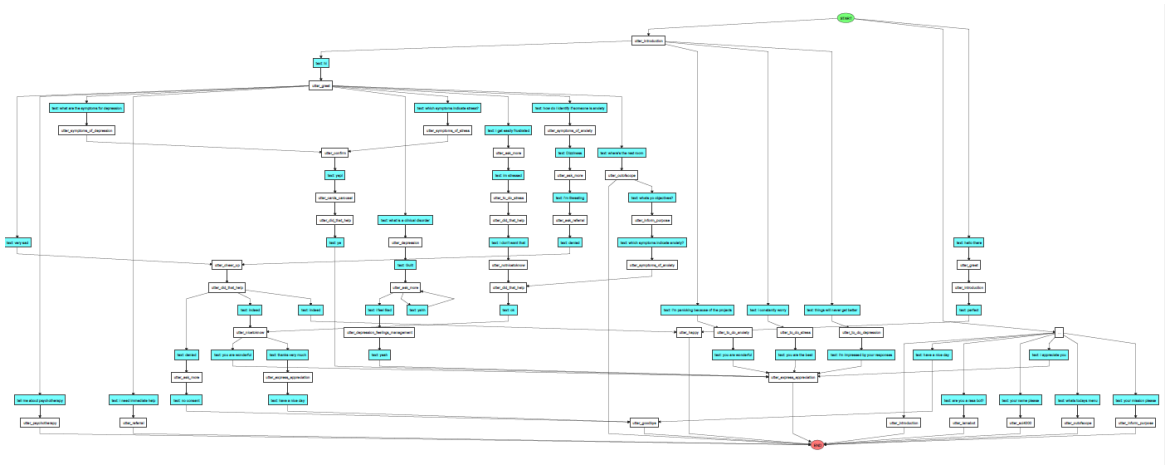

Figure 3. An example flow chart of the chatbot processing pipeline

Accuracy and Relevance

Figure 4. Shows the intent prediction confidence distribution which evaluates the confidence levels for each user intent. The Intent Prediction Confidence Distribution is a handy tool used to visualize the probability of each recognized user intent based on the training data and whether the intent prediction has high confidence or low confidence. The diagram below shows that the intents were predicted with a high confidence score range between 0.96 and 1 and no incorrectly predicted intents. The absence of incorrectly predicted intents, to some extent, may also mean overfitting where the model performs well on training data but may incorrectly predict actual user data.

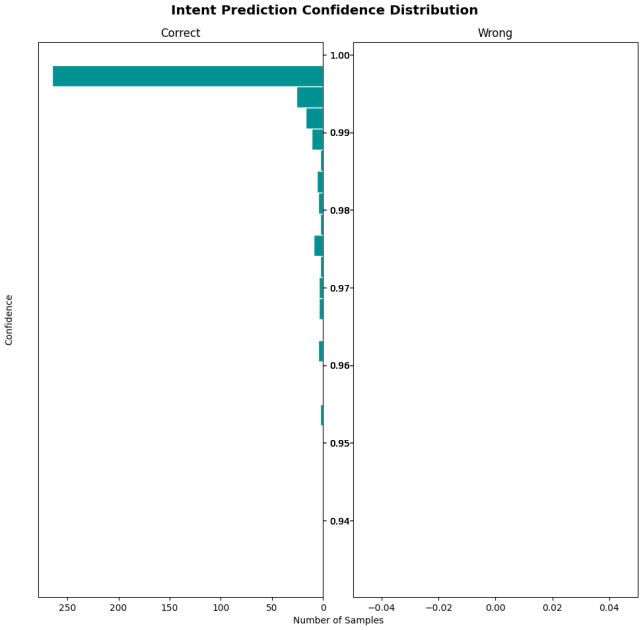

Figure 4. Intent prediction confidence distribution

Figure 5 below shows an Intent Confusion Matrix. The intent confusion matrix evaluates and visualizes the intent prediction results of the natural language understanding intent training examples. The matrix visualizes the intents and the number of example phrases used for each intent that the Chatbot was trained to recognize, in rows and columns. Each cell corresponds to the number of times an intent was correctly predicted compared to other predicted intents. To arrive at the intent confusion matrix, metrics such as Precision which indicates the number of correct predictions, Recall which indicates the number of actual intents that were correctly predicted, F1 score indicates the balance between precision and recall and, Accuracy which provides the overall view of how well the Chatbot is performing in predicting user intents, were used. Figure 5 below shows the intent confusion matrix with the number of predictable examples for each cell.

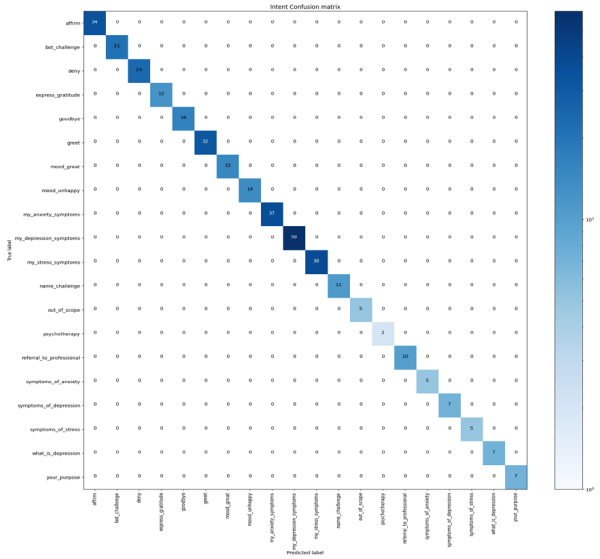

Figure 5. The intent confusion matrix

Personalization

Figure 6 below shows the user interface with a chat widget icon on the bottom right corner of the web page. The user is prompted by the widget welcome message to click the widget icon to start the conversation with the chatbot. When users click the icon, the chat widget displays the text input area, the send button, and the response output area. The chatbot provides each user session with a unique ID which is mostly helpful when the chatbot engages multiple users at the same time.

Figure 6. The user interface of the Chatbot

Figure 7 below shows a user-bot interaction on the popped-up chatbot widget with user input and integrated text and image bot responses. In the Figure 8, the image responses are in a carousel that supports horizontal scrolling.

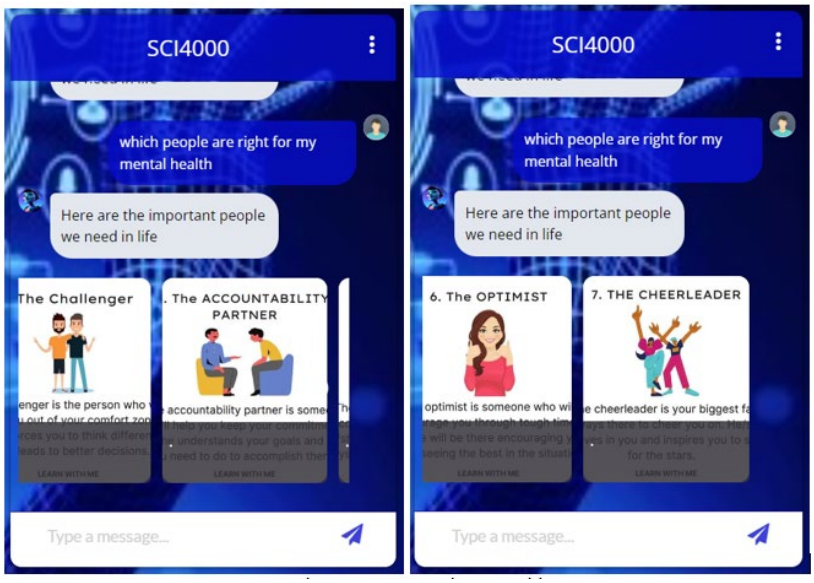

Figure 7. Integrated Text and image responses

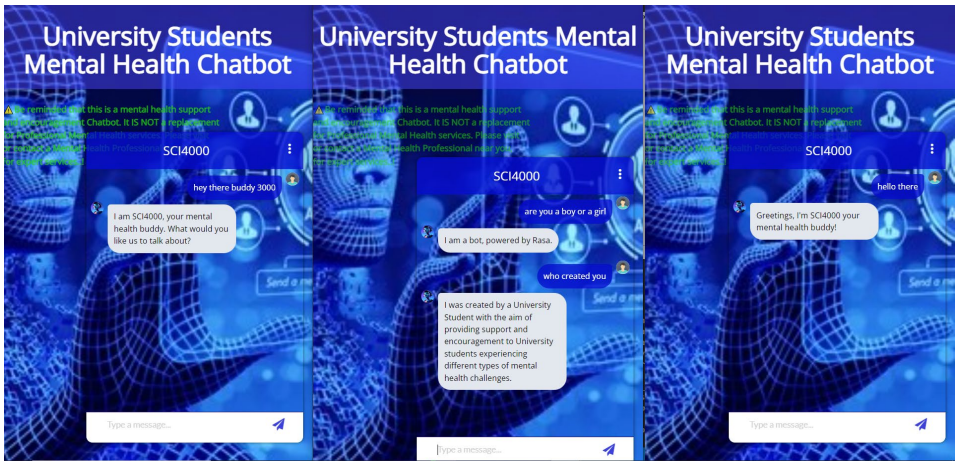

Figure 8 shows the chatbot handling multiple users at the same time

Error Handling
The chatbot handled most errors as expected by using the default and customized fallback messages where necessary. The chatbot displays technical error messages in the backend, while user-friendly error messages are displayed in the frontend to maintain the users' confidence and encourage them to try again later.

Continuous Learning
The chatbot improves its performance and accuracy when trained with new intents, and additional data. While it can update its knowledge graph with new information, it does not currently learn new intents through real-time interaction with its users.

Integration
The chatbot used the standardized rasa REST API to integrate with the user interface chat widget. However, integrating the chatbot with messaging channels Facebook Messenger and Telegram,faced page creation challenges and country restrictions upon attempting integration with the Chatbot with their interfaces. Figure 9 shows Integration with Telegram failed due to Ngrok country restrictions through the user's IP address shown in Figure 10, and Figure 10 below shows a failed Facebook/Messenger page creation.

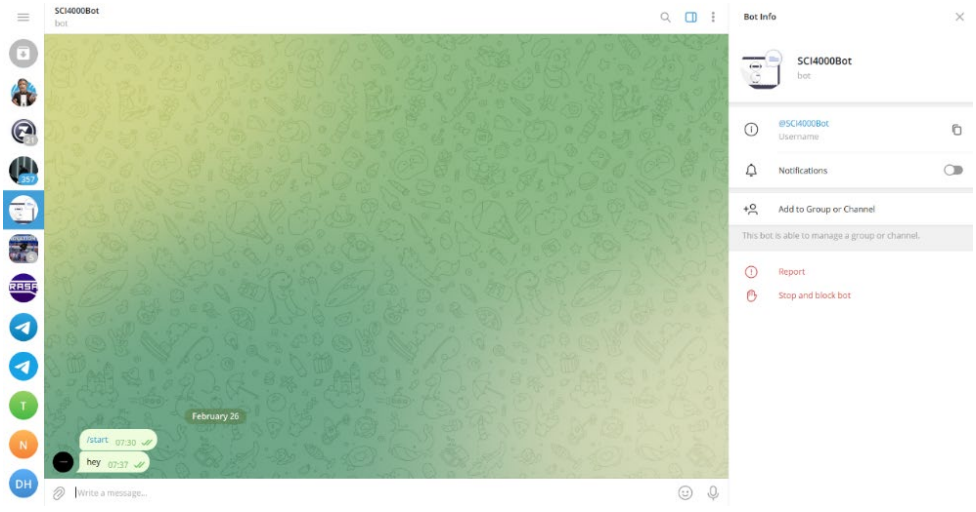

Figure 9. Telegram User Interface for Sci4000Bot

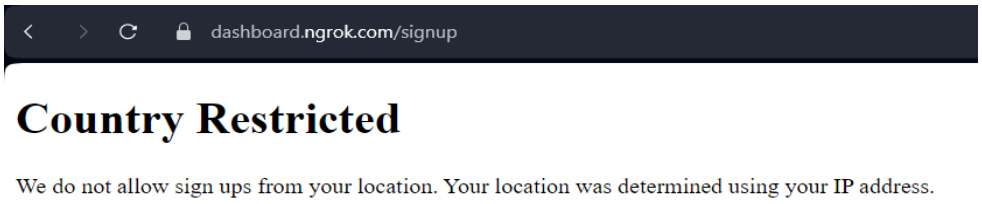

Figure 10. Ngrok image showing country restrictions

Figure 11 below, after generating the token secret key, the developer would have created the application page where they get the page-access-token which they use for the integration. However, creating the page faced persistent page creation error messages.

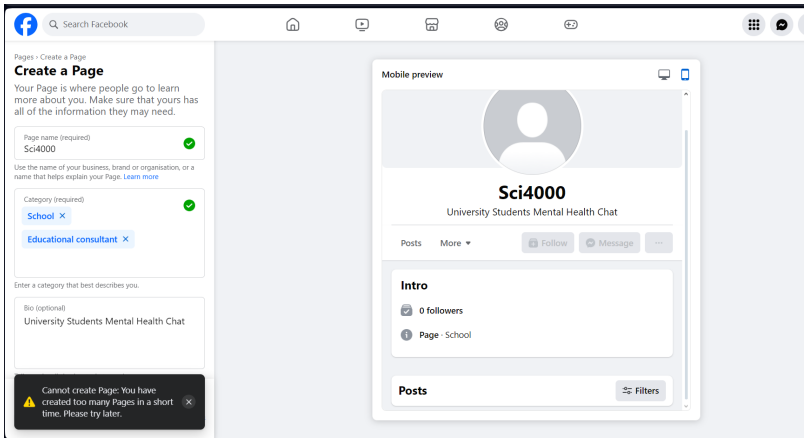

Figure 11. Persistent Facebook error message

5.3 Proposed Improvements

Investment in advanced computer systems, and Chatbot frameworks like RASA Pro with Conversational Artificial Intelligence Language Model (CALM) model will improve the chatbot's continuous learning, improve user experience, and ensure that the system continuously and efficiently works. Improvements may also include having the Chatbot make use of avatars that can be used to express facial expressions and hand gestures. The introduction of chat rooms could allow peer-to-peer and group counseling sessions and discussions on mental health-related topics.

The researchers aim to collaborate with other stakeholders and robotics experts to develop a mental health chatbot integrated with a physical robot capable of expressing multimodal expressions and with multiple language support to accommodate all official languages in Zimbabwe. The chatbot robot could be developed and used as a social companion that can readily provide support and companionship to distressed individuals, thereby reducing social isolation and loneliness for introverted individuals who shy away from social gatherings and activities. The researchers also aim to integrate the chatbot with wearable devices that can detect signs of distress and provide individuals with personalized support and encouragement.

5.4 Validation

Validating the Chatbot performance was a crucial aspect of Chatbot development as it ensured that the chatbot performance fulfilled its objectives and helped provide improved user experiences. The validation was done through various performance tests during model training, Unit Testing, Integration Testing, System Testing, and the Likert Scale for user feedback. Figure 12 below shows validation during chatbot model training in which intents, story structure, utterances, and the uniqueness of the stories and intents are validated.

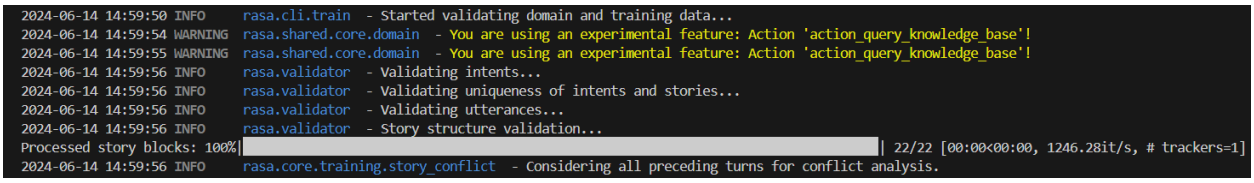

Figure 12. model training validation

6. Conclusion

This study introduced a mental health Chatbot for university students' mental health support and encouragement. Chatbot was made to employ natural language understanding behavioral activation, and self-confidence training. This will help the students better manage their feelings, thoughts, and actions and improve their quality of life. The study also examined the effectiveness of mental health Chatbots in addressing and reducing mental health challenges among university students. The findings indicated users generally accepted the use of mental health Chatbots if they are not used as a standalone but as a complement for professional mental health services during times of distress and when they need some knowledge related to mental health and coping mechanisms. However, more research to fully understand the long-term effectiveness of chatbots in handling mental health issues can be further explored as the behavior of the chatbots differs and mental distress affects individuals differently.

Furthermore, integrating a chatbot with existing university support systems is also necessary. There is also a need for University Program Recommendation systems such as (Ndlovu et al. 2023) in addition to considering personality type and academic results, to incorporate a student's mental health status. By understanding a student's current mental well-being, the system could recommend programs or resources that can better support their academic success and overall well-being. This could include recommending programs that focus on stress management, time management, or study skills, depending on the student's specific needs. However, cyber security, privacy and awareness concerns need to be addressed to safeguard the use of these systems (Maguraushe 2024). This chatbot can be integrated with the Cybersecurity and Awareness Framework (Mutunhu et al. 2022) to provide students with information on identifying and avoiding cyber threats, protecting their personal information, and practicing safe online habits. By promoting digital literacy alongside mental health support, the chatbot can contribute to a more well-rounded student experience.

References

Abd-Alrazaq, A. A., Alajlani, M., Ali, N., Denecke, K., Bewick, B. M., & Househ, M., Perceptions and Opinions of Patients about Mental Health Chatbots: Scoping Review. *In Journal of Medical Internet Research (Vol. 23, Issue 1, p. e17828)*.2021. https://doi.org/10.2196/17828

Abd-Alrazaq, A. A., Rababeh, A., Alajlani, M., Bewick, B. M., & Househ, M., Effectiveness and safety of using chatbots to improve mental health: Systematic review and meta-analysis. *Journal of Medical Internet Research, 22(7)*. 2021. https://doi.org/10.2196/16021

Balcombe, L., *AI Chatbots in Digital Mental Health*. 2023.

Coghlan, S., Leins, K., Sheldrick, S., Cheong, M., Gooding, P., & D'Alfonso, S., To chat or bot to chat: Ethical issues with using chatbots in mental health. *Digital Health*, *9*. 2023. https://doi.org/10.1177/20552076231183542

Dekker, I., De Jong, E. M., Schippers, M. C., De Bruijn-Smolders, M., Alexiou, A., & Giesbers, B., Optimizing Students' Mental Health and Academic Performance: AI-Enhanced Life Crafting. Frontiers in Psychology, 11(June), 1–15. 2020. https://doi.org/10.3389/fpsyg.2020.01063

DSouza, J., *The history of chatbots: From MIT to your website*. Engati. 2023.

Dube, S., Mutunhu, B., & Dube, S. P., Lecturers' Experiences in Teaching STEM Courses Online During COVID-19: Case of a Zimbabwean University. *The IAFOR Conference on Educational Research & Innovation: 2023 Official Conference Proceedings*, *July*, 53–65. 2023. https://doi.org/10.22492/issn.2435-1202.2023.5

Dube, S., Dube, S., Ndlovu, B. M., Maguraushe, K., Malungana, L., Kiwa, F.J., & Muduva, M., *Students' Perceptions of ChatGPT in Education: A Rapid Systematic Literature Review.* Intelligent Computing: Proceedings of the 2024 Computing Conference, (Volume 4. Pp 258-279). 2024. Springer, Cham. https://doi.org/10.1007/978-3-031-62273-1_18

Gabrielli, S., Rizzi, S., Bassi, G., Carbone, S., Maimone, R., Marchesoni, M., & Forti, S., Engagement and effectiveness of a healthy-coping intervention via chatbot for university students during the COVID-19 pandemic: Mixed methods proof-of-concept study. JMIR MHealth and UHealth, 9(5), 2011. https://doi.org/10.2196/27965

Gbollie, E. F., Bantjes, J., Jarvis, L., Swandevelder, S., du Plessis, J., Shadwell, R., Davids, C., Gerber, R., Holland, N., & Hunt, X., Intention to use digital mental health solutions: A cross-sectional survey of university students attitudes and perceptions toward online therapy, mental health apps, and chatbots. Digital Health, 9, 2023. https://doi.org/10.1177/20552076231216559

Gora, P., Zimbabwe: Suicides among students raise concern over mental health. *University World News Africa Edition.* 2022

Gwasira., Rise In Suicides Among Zim Male Tertiary Students Exposes Need for Peer-to-Peer Counseling in Zim Universities and Colleges. Health Times. 2021. https://healthtimes.co.zw/2021/09/13/rise-in-suicides-among- zim-male-tertiary-students-exposes-need-for-peer-to-peer-counseling-in-zim-universities-and-colleges/

Klos, M. C., Escoredo, M., Joerin, A., Lemos, V. N., Rauws, M., & Bunge, E. L., Artificial intelligence⇓based chatbot for anxiety and depression in university students: Pilot randomized controlled trial. *JMIR Formative Research,* 5(8). 2021. https://doi.org/10.2196/20678

Koulouri, T., MacRedie, R. D., & Olakitan, D., Chatbots to Support Young Adults' Mental Health: An Exploratory Study of Acceptability. ACM Transactions on Interactive Intelligent Systems, 12(2). 2022. https://doi.org/10.1145/3485874

Liu, H., Peng, H., Song, X., Xu, C., & Zhang, M., Using AI chatbots to provide self-help depression interventions for university students: A randomized trial of effectiveness. Internet Interventions, 27, 100495. 2022 https://doi.org/10.1016/j.invent.2022.100495

Maguraushe, K., da Veiga, A., & Martins, N., A personal information privacy perceptions model for university students. *Information Security Journal: A Global Perspective*, *33*(4), 394–424. 2024. https://doi.org/10.1080/19393555.2024.2329554

Mutunhu, B, Dube, S., Ncube, N., & Sibanda, S., Cyber Security Awareness and Education Framework for Zimbabwe Universities: A Case of National University of Science and Technology. *Proceedings of the International Conference on Industrial Engineering and Operations Management Nsukka, Nigeria*, 5–7. 2022. https://ieomsociety.org/proceedings/2022nigeria/111.pdf

Mutunhu, Belinda, Dube, S., Dube, S. P., & Mpofu, S., A Framework for Transitioning to Virtual Classes During Life-Threatening Pandemics Like COVID-19. *European Conference on E-Learning*, *21*(1), 279–287. 2022. https://doi.org/10.34190/ecel.21.1.900

Ndlovu, B., Migioni, Z. T., Dube, S., & Nyoni, P., Betr Selektr: A University Program Recommender System Utilising Personality Type and Academic Results. *The Barcelona Conference on Education 2023: Official Conference Proceedings*, *November 2023*, 701–715. 2023. https://doi.org/10.22492/issn.2435-9467.2023.55

Ncube, Tapiwa, A., Suicide and Mental Health. The Chronicle. 2023. https://doi.org/10.5040/9781509932733.ch-004

Nelekar, S., Abdulrahman, A., Gupta, M., & Richards, D. , Effectiveness of embodied conversational agents for managing academic stress at an Indian University (ARU) during COVID-19. *British Journal of Educational Technology,* 53(3), 491–511. 2022. https://doi.org/10.1111/bjet.13174

Nyambara, T., SUICIDES a trend at Nust? Campus Moments. 2019. https://campusmoments.wordpress.com/2019/04/09/suicides-at-nust-a-trend/

Nyashanu, M., Nuwematsiko, R., Nyashanu, W., & Jidong, D. E., Lived experiences of stressors and problems of higher education students on teacher education course in the eastern highlands of Zimbabwe, 2019. *Pan African Medical Journal*, *36*(289), 1–11.2020. https://doi.org/10.11604/pamj.2020.36.289.21481

Saunders, M., & Bristow, A. , *2023 Research Methods for Business Students Preface and Chapter 4* (Issue February).

Tagarot, S., All The Feels: Building a Chatbot to Assist Students Struggling with Depression. *Computer Science Honors Theses*.2022.

Zhu, Y., Wang, R., & Pu, C. , "I am chatbot, your virtual mental health adviser." What drives citizens' satisfaction and continuance intention toward mental health chatbots during the COVID-19 pandemic? An empirical study in China. *Digital Health*, *8*. 2022. https://doi.org/10.1177/20552076221090031

Biographies

Tapiwa Tauro is a Department of Informatics and Analytics student at the National University of Science and Technology. He is a Digital Forensics Examiner certified in Paraben Corporations DSMO, P2CO, MFT, and FFT. He has gained a combined experience in ICT Systems Administration, and Digital Forensics. His research interests are in the fields of Artificial Intelligence, Data Science and Analysis, and Positive Psychology (Mental Health).

Sibusisiwe Dube is a professor, senior lecturer, and projects coordinator in the Department of Informatics and Analytics at the National University of Science and Technology. She holds a Ph.D. in Information Systems from the University of Cape Town, South Africa, a Master of Science degree in Computer Science from the National University of Science and Technology in Bulawayo, Zimbabwe, and a Bachelor of Science Honors degree in Information Systems from Midlands State University, Zimbabwe. Her research interests encompass Information and Communication Technology for Development (ICT4D), the Digital divide, ICT in education, and the paradox of the second-order digital divide in highly literate country's higher education institutions. Sibusisiwe has received research awards, including the NUST RIO grants in 2014 and 2016, as well as conference travel funding from UCT in 2016.

Belinda Ndlovu is currently pursuing a Ph.D. in Information Systems at the University of South Africa. Additionally, she works as a lecturer and project coordinator for postgraduate students at the National University of Science and Technology in the Department of Informatics and Analytics. She possesses a Master of Science degree in Information Systems, a Bachelor of Science Honors Degree in Computer Science, and a Graduate Diploma in Higher Education. Her research interests encompass Health Informatics, Machine Learning, Fourth Industrial Revolution Technologies, and ICT4D (Information and Communication Technology for Development).

Fungai Jacqueline Kiwa is a highly skilled and versatile professional in the field of Information and Communication Technology (ICT) with expertise in Artificial Intelligence, creative IoT framework designing, and intensive programming skills. Dr. Fungai Jacqueline Kiwa holds a Doctor of Philosophy Degree in Cultural Heritage and Information Technology from Chinhoyi University of Technology, complemented by a Post Graduate Diploma in Higher Education. She holds a Master of Science degree in Information Systems, a Bachelor of Technology (Honors) degree in Computing and Information Technology and an Advanced Diploma in Computing and Information Technology. With a wealth of academic achievements, Dr. Kiwa has authored 20 publications, encompassing articles, conferences, book chapters, thesis, and dissertations.