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Research Paper

Impact of Artificial Intelligence Chatbots on Student Well-being and Mental Health: A Systematic Review

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Abstract

Students in schools and colleges face some challenges, including rigorous academic schedules, academic work load, standardized tests, and assignments deadline, which can contribute to significant stress and mental health risks. Thus, numerous studies have been conducted to control stress between students, such as self-guided stress management programs. This paper reviews several studies published between 2019 and 2023 exploring the impacts of deploying state-of-the-art artificial intelligence chatbots which are used to boost and manage psychological disorders and mental health symptoms such as anxiety, depression, fear, and worry between prospective and current undergraduate students. This study outlines the key phases of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). It begins with screening (115) articles and subsequently includes (13) articles for intensive review, which all focus on psychological disorders and mental health conditions that can be influenced by the conversational agents and chatbots. However, the results revealed that anxiety and depression are the main psychological disorders that can be influenced by conversational agents and chatbots. Moreover, this review revealed multiple cases of universities and schools, emphasizing the implementation of chatbots for both learning and advising functions. The Systematic Literature Review (SLR) in this study is constrained to the specific databases, and the search keywords were limited to the article title fields only; which excluded the abstracts. This could have caused some missing relevant studies. In future work, other essential databases will be included, such as Scopus and WoS. In addition, we will include more information about the technique and the complexities of using the chatbot as it may have a significant impact on student behaviors and emotions.

Keywords: *Artificial Intelligence; Chatbot; Mental Health; Student; Systematic Review; Well-Being*

INTRODUCTION

The World Health Organization (WHO) describes mental health as an essential aspect of a collection of individual ability as a human being to think, interact all together, earn a living as well as enjoy life. Moreover, the WHO clarifies that mental health is a kind of well-being where individuals recognize their own abilities that effectively manage the normal stresses of life and can work productively to maintain connections within their community (World Health Organization, 2023). The definition revealed the importance of individuals, including the students, to cope successfully with the stresses. According to the American Psychological Association (APA), the primary stress symptoms among high school students are characterized by feeling anger, and the adoption of negative mechanisms are the main stress symptom among high school students (American Psychological Association, 2023).

According to the National College Health Assessment, 75% of students experience moderate to severe psychological distress (National College Health Assessment, American College Health Association, 2021). High school students and college students experience various types of factors that cause stress and anxiety (Chelvarayan et al., 2023). For example, freshman students might face some difficulties in coping with a new university life and need to adapt to a new language and culture (Mofatteh, 2021). Consequently, students who are from small towns and admitted into a public national university with a large class size might need more support compared to other students. Moreover, other researches revealed that medical students face mental distress, which is more related to academic pressure (Azim & Baig, 2019). In fact, prospective undergraduate students who are basically high school students face many challenges in terms of academic workload, standardized admission tests as well as the university applications deadline, which can

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eventually cause students to experience stress and be at risk of mental health issues (De Nieva et al., 2020). Thus, numerous studies have been conducted to control stress between students, such as self-guided stress management programs (Amanvermez et al., 2020; Credo et al., 2023; Bocar & Rachmawati, 2023; Rahmatullah et al., 2023).

Interestingly, several authors used traditional technology as well as artificial intelligence models to control and examine the stress with students (Woodward et al. 2020; Lattie et al., 2019; Assayed et al., 2023a). Though, this study aims to explore and review the impacts of deploying the state-of-the-art artificial intelligence chatbots that are used to boost and manage psychological disorders and mental health symptoms such as anxiety, depression, fear, and worry between prospective and current undergraduate students. Therefore, two research questions will be formulated in this article:

RQ1: How can chatbots improve mental health among prospective and current undergraduate students?
RQ2: What are the different ways colleges and universities utilize chatbots and what impact do these implementations have on the psychological well-being of students?

Chatbots for Prospective Students

The AI chatbot is known as a machine learning chatbot that handles more complex problems. It is essentially a computer program that uses various functions and algorithms from natural language processing (NLP) and artificial intelligence (AI) algorithms. Luo et al. (2019) defined the AI chatbot as a computer program that imitates human conversations through text chat or voice. Moreover, Haristiani (2019) considered the chatbot as one of the advanced technologies utilized in various kinds of academic and educational platforms. It is being increasingly adopted into different aspects of students' lives, ranging from middle and secondary schools to university admission processes and orientations. For example, prospective undergraduate students need to be advised and guided effectively before starting their classes at universities (Ruga, 2024). Though, high school counselors have an essential role in decreasing students' stress levels by clarifying to them the required documents for universities application as well as providing students the recommendation letters and transcripts (Paolini, 2019). Assayed et al. (2024) developed a machine learning chatbot named HSchatbot to help students equally in high schools categorize their enquiries based on the types of questions they ask. Due to the high volume of annual applications received by universities within a limited timeframe, as a result, admission offices face an overwhelming number of enquiries from candidate students. Consequently, having a cost-effective chatbot that can handle responses efficiently will significantly reduce the load on the officers. Moreover, El Hefny et al. (2021) introduced a chatbot named Jooka for supporting prospective students applying to the German University in Cairo.

Chatbots for Current Undergraduate Students

Since undergraduate students come to universities from different social and geographic backgrounds, they need effective advising to ensure their success and graduation on time. Bilquise et al. (2022) developed a bilingual chatbot that supports both English and Arabic in order to assist current students in following the academic plan and subsequently succeeding in courses. On the other hand, the conversation agents play an essential role in the teaching and advising process. For example, learning foreign languages (Ahn, 2022; Kohnke et al., 2023, Assayed et al., 2023b) or assisting undergraduate students with other topics such as health sciences and medicine courses (Sallam et al., 2023). Despite the fact that university students are vulnerable to different kinds of stresses due to college work, social relationships, homesickness, and education funding (Trappey et al., 2022), the majority of authors concentrated on the function of chatbots in education and learning without covering the potential psychological impacts (Lin & Ye, 2023; Kasthuri & Balaji, 2021).

The Systematic Literature Review (SLR) in this paper exposes the readers in deploying different aspects of AI chatbot solutions that can support students in improving their mental health for their well-being and academic success. This study is organized as follows: First, the literature review will be presented. Subsequently, the PRISMA approach will be explained in the methodology

section. This will be followed by the findings and discussion, and finally, the limitations and future work.

LITERATURE REVIEW

A diverse range of empirical studies have been dedicated to studying the mental health and well-being of students (Hernández-Torrano et al., 2020). In contrast, several studies have investigated the use of state-of-the-art chatbots in education and learning (Pérez et al., 2020, Cunningham-Nelson et al., 2019, Wollny et al., 2021, Smutny & Schreiberova, 2020). However, few researchers have studied the impacts of chatbots on students' wellbeing and mental health from different perspectives. For instance, Fredes et al. (2022) conducted a literature review on the role of virtual assistants in supporting academic stress for students in high schools. Another review had been conducted by Kapoor and Goel (2022) to study several conversational AI chatbots that provided help to general patients who complained from different mental health issues, though, this review is not emphasized on students. Nevertheless, Lattie et al. (2019) reviewed the literature on using digital mental health interventions specifically targeting college students; however, this study did not focus on chatbots; instead, it focused on some websites and general apps. Therefore, this paper seeks to bridge these gaps by reviewing the state-of-the-art chatbots that are deployed particularly in high schools and universities to improve the well-being and mental health of students.

RESEARCH METHOD

As mentioned in the introduction section, the WHO describes the mental health part of well-being in different aspects of actions; consequently, several authors have used these terms interchangeably. On the other hand, chatbots have become ubiquitous in different aspects of life. Researchers have also used different terminologies, such as "dialog system" or "conversational agent" (McTear, 2020; Mazumder & Liu, 2022) to describe these chatbots. In simple words, the chatbot is defined as software that can simulate human conversations by using text chat or voice commands (Ayanouz et al., 2020). Nevertheless, the search criteria process has considered all these terminologies in retrieving the related articles from particular databases. However, the methodology in this study covers all processes in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach along with the resources and databases that are adopted in this study.

Approach

This study adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). First, it finds all retrieved articles, then the included and excluded process is implemented, and next the eligible articles are specified for further analysis.

Search Criteria

The search is implemented using Boolean operators (AND, OR). The criteria include three categories, as shown in Table 1. The first statement is coded by A and includes synonyms terms of chatbots such as "ChatGPT", and "conversational AI", and both terms are separated by the operator "OR". The second statement is coded by B and describes the students' emotions as follows: well-being or "mental health" or depression OR anxiety. The final search statement is coded by C and is related to education and advising and is defined as "education" or "university" or "school" or "student". Afterward, all sentences are joined together by the operator "AND". Yet, the authors in this study implemented the search criteria to retrieve journals published within the timeframe 2019-2023.

Table 1. Search categories and criteria.

code	Search Category	Criteria
A	Chatbot	(chatbot OR ChatGpt OR Conversational AI)
B	Emotion	(well-being OR "mental health" OR depression OR anxiety)
C	Education	(student OR education OR school OR university)
	Formula=	"A "AND "B" AND "C" allintitle:(chatbot OR ChatGpt OR Conversational AI) AND (student OR education OR school OR university) AND (wellbeing OR "mental health" OR depression OR anxiety)

Since this study covered AI technology, education, and emotions, we conducted searches across different databases that included journals and references that targeted multiple domains such as technology, education, and health sciences. Table 2. Presents the main resources used in this systematic review.

Table 2. The databases and resources used in this article

Resources and Database
EBSCO
WorldCat.org
Taylor and Francis Journals
Academic Search Complete
Computers & Applied Sciences Complete
ScienceDirect
ProQuest Central
ABI/INFORM Global
Electronic Books
SAGE Journals
ERIC
Google Scholar

As illustrated in Figure 1, the PRISMA chart starts by identifying the databases as well as the search criteria, then screening the articles that are mentioned within five years. After that, the authors apply the inclusion and exclusion criteria in order to review only the eligible articles.

Identification

In this study, the authors initiated the processes of identifying multiple databases, as described in Table 1, to ensure a comprehensive literature search. According to the research questions, the following search keywords are formulated by using Boolean operators, which are then implemented in the search title as follows:

allintitle:(chatbot OR ChatGPT) AND (student OR education OR school OR university) AND (wellbeing OR "mental health" OR depression OR anxiety).

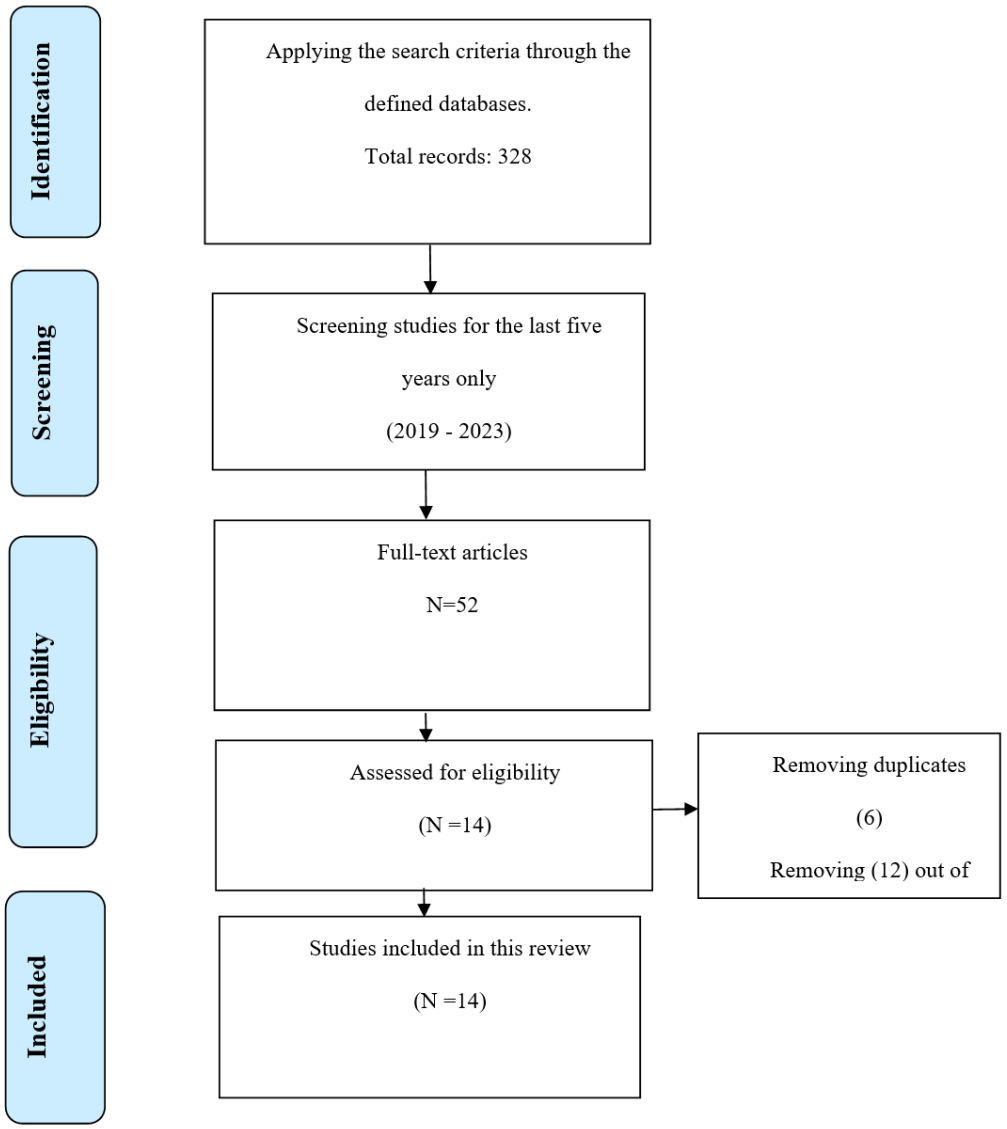

Figure 1. PRISMA as demonstrating the processes of the systematic review in this study.

As a result, Table 3 displays the results of the records and articles that were retrieved from the databases.

Table 3. The number of retrieved articles from the search databases.

Resources and Database	Number of records
EBSCO	200
WorldCat.org	74
Taylor and Francis Journals	0
Academic Search Complete	0
Computers & Applied Sciences Complete	0
ScienceDirect	3
ProQuest Central	34
ABI/INFORM Global	9
Electronic Books	0
SAGE Journals	4

Resources and Database	Number of records
ERIC	1
Google Scholar	3
Total	328

Screening and Eligibility

The generated records are limited to a specific timeframe (2019- 2023), with a total number of (n=115), afterward, we limited the list to the full-text records, with a total number is (n=52).

Excluded Strategy

Due to the use of multiple databases in this search criteria, numerous articles were duplicated across different databases; accordingly, the authors excluded (6) duplicated articles. Furthermore, (12) articles are removed because they concentrated mainly on educational chatbots without considering the students' emotions. Another (20) records are excluded from the review because some of the bibliographies of these articles are not complete as some main information is missing such as the publisher's name, author's names, etc.

Included Strategy

The total number of selected articles in this systematic review (n=14), these articles are all about using the chatbot or ChatGPT in educational fields focusing on exploring their impacts on students' emotions.

FINDINGS AND DISCUSSION

Table 4 provides a detailed summary of the articles included in this study. The table encompasses key characteristics of each article, including the article name, psychological disorder, author, methodology, utilizing chatbots, technology, and result.

Table 4. The included studies in the systematic review

Article Name	Psychological disorder	Author	Methodology	Utilizing Chatbots	Technology	Results
Cognitive network science reveals bias in GPT-3, ChatGPT, and GPT-4 mirroring math anxiety in high-school students.	Anxiety	Abramski et al. (2023)	Theoretical Research-Behavioral forma mentis network	Learning in schools	GPT3, ChatGPT, GPT-4	Compared to ChatGPT and GPT-3, they provided more negative associations and less positive associations for STEM subjects like math and physics.
Chatbot's Complementary Motivation Support in Developing Study Plan of E-Learning English Lecture	Intrinsic motivation and enjoyment	Ryong et al. (2023)	Qualitative Study	English Learning in schools (e-learning)	Chatbot	Discovering the moderation effects for the learning motivation type.
A Study of Student's Subjective Well-Being Through Chatbot in Higher Education	Wellbeing (Life satisfaction)	Agarwal and Linh (2021)	Qualitative Study	Counseling in colleges and universities	Chatbot	It is recommended within the colleges and universities for the well-being of their students.
ChatGPT in education: A discourse analysis of worries and concerns on social media.	Anxiety/worries	Li et al. (2023)	NLP + Empirical Study	Education-twitter (X) users	ChatGPT/BERT	The analysis indicates that Twitter/Xusers have an overall positive attitude toward the use of ChatGPT in education.
Chatbot-Human Interaction and Its Effects on EFL Students' L2 Speaking Performance and Anxiety	Anxiety	Çakmak (2022)	Quantitative with an Open-ended questionnaire	Teaching Speaking language courses at a university	ChatBot	Negative attitudes toward the chatbot interaction. Students informed facing difficulties in being understood exactly, with higher anxiety in L2 speaking
Artificial Intelligence–Based Chatbot for Anxiety and Depression in University Students	Depression and anxiety	Klos et al. (2021)	A pilot randomized controlled trial	University students	ChatBot (TESS) for Mental Health	The initial results show evidence for Tess's usability in the Argentinian population

Article Name	Psychological disorder	Author	Methodology	Utilizing Chatbots	Technology	Results
			(Quantitative study)			
Using AI chatbots to provide self-help depression interventions for university students: a randomized trial of effectiveness.	Depression and Anxiety	Liu et al. (2022)	Quantitative study	University students	Chatbot therapy	The results revealed that self-help depression intervention delivered via chatbot demonstrated superiority over minimal bibliotherapy in reducing depression and anxiety levels.
Effects of Incorporating an Expert Decision-making Mechanism into Chatbots on Students' Achievement, Enjoyment, and Anxiety	Anxiety and enjoyment	Hsu et al. (2023)	A quantitative study (A quasi-experiment)	Students Learning	IBM Watson/EDM (Expert System)	The experimental results showed that the expert decision-making-based chatbot is more effective than the conventional chatbot in reducing students' learning anxiety while increasing their enjoyment during the learning.
Raising awareness of smartphone overuse among university students: a persuasive approach using digital well-being Chatbots	Wellbeing	Abreu (2022)	Experiment + Empirical study (Anova + qualitative study with collecting student's feedback)	University students learning	Dialogflow - API	Students believed it is essential to have a conversational chatbot on their smartphones, in terms of helping them become more aware of usage times.
A Chatbot to promote Student's Mental Health through Emotion Recognition	Mental Health/depression and stress	Dhanasekar et al. (2021)	Experiment	Students' guidance and advising at the university	DialogFlow and (NLP)	Developing a chatbot to help students with mental health issues
Investigating the Acceptability and Perceived Effectiveness of a Chatbot in Helping Students Assess Their Well-being	Lifestyle habits and well-being (mental Health)	Sia et al. (2021)	Quantitative study (4-point Likert scale)	High school student's performance	A Chatbot named "Abot"	A positive improvement in student's well-being
VHope: An empathetic virtual hope chatbot using a neural conversational model for student's mental well-being	Well-being state throughout the conversation	Beredo (2022)	Experiment	As student therapist	A generative Model	Experts have observed that it could adapt and correct the well-being labels during the conversations.
Investigating Students' Use of a Mental Health Chatbot to Alleviate Academic Stress	Anxiety and Mental health (Stress)	De Nieva et al. (2020)	Quantitative (Survey)	Senior high school students	Chatbot (Woebot)	The participants have valued Woebot's stories while they also faced some difficulties in some cases when the chatbot generated unsuitable responses.
A Test Platform for Managing School Stress Using a Virtual Reality Group Chatbot Counseling System	Mental health problems among students (e.g., anxiety or depression)	Lin et al. (2021)	Experiment and quantitative analysis for the evaluation	Chatbot counseling system (college students)	An immersive virtual reality chatbot	The application provides a test for future clinical trials to evaluate and enhance the automated virtual reality chatbot as a counseling system.

This SLR revealed several research approaches that are used to study the psychological impacts of educational chatbots on students. Of these, 54% of these reviews were conducted by using quantitative methods and mainly they used the survey design followed by 23% of those who used an experiment method by developing a chatbot and 15% who used both methods, and only 8% of these reviews conducted by using a qualitative method shown in Table 5.

Table 5. The research approaches that are adopted in the systematic review

Research Design	Percentage
Quantitative Study	54%
Experiment	23%
Experimental + Empirical study	15%
Qualitative Study	8%

Taxonomy

The taxonomy of this review is classified into three primary categories; according to Cooper (1988), the taxonomy could be classified from different perspectives including the goal, coverage, audience, and the focus of the research. Therefore, the first taxonomy of the selected articles is classified as the goal of the chatbot in the academic institution, the second category is the psychological disorders or mental health that are affected by using the chatbot, and the third category is assigned to the domain that the authors adopted in their research. Figure 2 shows the taxonomy of this study.

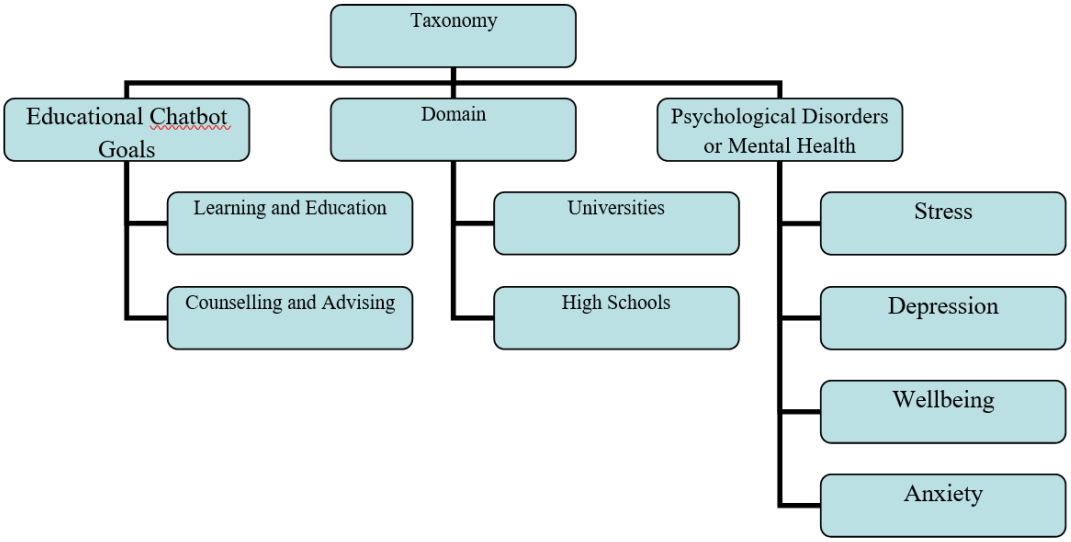

Figure 2. The literature taxonomy of this study.

Chatbots' Impact on Psychological Disorders

This section answered particularly to the question:

RQ1: How can chatbots improve mental health among prospective and current undergraduate students?

The authors of this review highlighted anxiety and depression as the main psychological disorders that can be influenced by conversational agents and chatbots. As (62%) of the articles focused on studying the impacts of anxiety and depression. Hsu et al. (2023) conducted a quantitative study to examine the impact of educational chatbots on university students' anxiety; the result shows that the expert decision-making-based chatbot (EDM-chatbot) is more effective than the conventional chatbot in terms of promoting students' learning achievement with reducing their learning anxiety and increasing the enjoyment in learning since the EDM is built based on decision tree and accordingly the conversations between learners are more streamlined based on expert knowledge and students can reply by using their own words rather than selecting defined options. De Nieva et al. (2020) investigated the impact of a mental health chatbot called Woebot on improving the students' stress among high school students. Woebot is an AI-powered chatbot that uses the principles of cognitive behavioral therapy, and 25 high school students who are engaged with this chatbot are investigated to reduce their stress from the academic workload. Moreover, Lin et al. (2021) developed a chatbot as a counseling system for supporting students in particular mental health problems such as anxiety and depression. Other authors applied the behavioral

forma mentis networks (BFMNs) as a method of investigation (Abramski et al.,2023) to study the correlation between anxiety and using the ChatGPT in learning STEM sciences in schools

Chatbots: Counseling, Advising, and Learning

The authors in this study explore multiple cases of universities and schools, with the focus on the implementation of chatbots for both educational and advising functions. Accordingly, the following research question is discussed in this section:

RQ2: What are the different ways colleges and universities utilize chatbots and what impact do these implementations have on the psychological well-being of students?

In general, this review revealed the importance of chatbots in both counseling and advising students (Agarwal & Linh, 2021; Beredo, 2022; Lin et al., 2021; Dhanasekar et al., 2021) as well as in learning and teaching courses (Abramski et al., 2023; Çakmak, 2022; Hsu et al., 2023; Abreu, 2022). Despite the important role of improving the wellbeing of high school students, few studies have focused on studying the impact of deploying chatbots on their learning and advising, particularly at this stage of learning. This study shows (23%) of the included articles adopted the data from high school students, whereas, (70%) focused on university students.

CONCLUSIONS

This review examines the main psychological disorders and mental health conditions that can be influenced by the conversational agents and chatbots implemented within educational institutions such as schools and universities. The results revealed that anxiety and depression are the main psychological disorders that can be influenced by conversational agents and chatbots. However, the review explores multiple cases of universities and schools, emphasizing the implementation of chatbots for both learning and advising functions. Although several studies have examined the impact of motivations and engagements in learning with chatbots (Kuhail et al., 2023), only a limited number have focused on the state-of-the-art of chatbots in addressing academic stress and other psychological disorders among high school students.

LIMITATION & FURTHER RESEARCH

This systematic literature review is constrained to specific databases and does not include other important search databases such as Scopus and Web of Science. Another limitation of this study is that the search keywords were limited to the article title fields only; which not included the abstracts. This could have caused some missing relevant studies. In future work, other essential databases such as Scopus and WoS will be included. Moreover, in future, we will include more information about the technique and the complexities of using the chatbot as it may have a significant impact on student behaviors and emotions.

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