

Virtual Relational Agents and the Psychology of Student Well-Being: A Theoretically Grounded Developmental Study of Digital Mental Health Support

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Rapid societal disruption associated with the COVID-19 pandemic intensified psychological distress among university students, revealing both the heightened vulnerability of young adults and the limitations of existing institutional mental health provision. Beyond the practical inadequacy in service availability, a more theoretically significant issue arises concerning whether digitally mediated agents can function as authentic sources of perceived interpersonal and relational support. Drawing on contemporary frameworks in social cognition, self-efficacy theory, and mediated communication, this study investigates the development and preliminary

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evaluation of a virtual relational agent designed to assist students experiencing stress, anxiety, and depressive symptoms. The research was implemented in two sequential phases within a Research and Development design. The first phase involved the conceptualisation and technical construction of a virtual influencer system intended to simulate supportive social interaction while encouraging self-regulatory behaviour and reflective coping strategies. Content validity was assessed by a panel of interdisciplinary experts in mental health and technology, yielding exceptionally strong validity indices (CVI = 0.97–1.00). The second phase examined initial effectiveness using a sample of 30 university students who accessed the intervention through a continuously available web-based platform. Post-intervention results indicated that 86.67% of participants reported significant reductions in self-assessed levels of depression, anxiety, and stress ($p < .01$), alongside generally positive evaluations of the system's perceived psychological usefulness. These findings suggest that digitally embodied agents may extend beyond informational support tools to act as meaningful psychological mediators that enhance perceived support and self-efficacy. Accordingly, such systems may complement conventional mental health services by offering accessible, flexible, and confidential forms of guidance while sustaining users' sense of personal agency. Further investigation is required to determine the durability of observed effects, to examine the experiential and relational dynamics between users and artificial agents, and to address broader philosophical questions regarding technologically mediated care within contemporary understandings of cognition, mental processes, and behaviour.

Keywords: Virtual Relational Agents; Mediated Social Cognition; Student Well-Being; Self-Efficacy; Digital Mental Health; Psychological Support Systems.

Introduction

The COVID-19 pandemic induced substantial societal disruption in Thailand, affecting public health, economic stability, and broader social conditions (Fang et al., 2025). Across population groups, individuals were compelled to modify established lifestyles, and those unable to adapt effectively were more likely to experience psychological strain, including distress, anxiety, stress, and depressive symptoms. University students represent a particularly affected cohort, as they were required to transition rapidly into fully online learning environments. This shift necessitated prolonged daily engagement with digital devices, often for extended periods, which in turn contributed to physical health complaints such as musculoskeletal discomfort and visual fatigue. Compounding these challenges, many students faced infrastructural and financial constraints, including insufficient access to appropriate digital equipment, unstable or absent internet connectivity, and increased household expenditure on data services—factors that disproportionately affected students from lower-income backgrounds and further intensified psychological burden.

Empirical evidence reinforces the severity of this situation. A large-scale survey of adolescents under 20 years old, involving 183,974 participants between 1 January 2020 and 30 September 2021, reported

that 28% experienced high stress levels, 32% were at risk of depression, and 22% were identified as being at risk of suicide. Complementary findings from a survey of approximately 1,000 parents indicated that nearly half observed noticeable deterioration in their children's mental well-being or emerging stress-related symptoms. Similarly, university populations reported elevated anxiety and stress associated with online learning modalities Payne and Leslie (2025), with prolonged exposure contributing cumulatively to depressive symptoms and suicidal ideation. An informal assessment conducted in 2020 among 100 university students in northern Thailand further revealed that 66% reported severe stress, 18% high stress, and 16% moderate stress levels.

In response, the Thai Department of Mental Health has implemented multiple intervention channels, including dissemination of mental health information via media platforms, interactive messaging services, direct consultation with mental health professionals, chat-based support systems, and mobile application services. Between 2019 and 2020, approximately 10,000 adolescents aged 11–19 accessed the national mental health hotline (1323) for counselling related to stress and anxiety. Although these initiatives have contributed to partial mitigation of mental health challenges, the persistent duration of the pandemic has continued to place strain on both service demand and mental health personnel, many of whom have experienced fatigue and occupational burnout due to sustained workload pressures. Consequently, there remains a need for alternative or supplementary interventions capable of reducing psychological burden and preventing escalation into more severe conditions (Puiu et al., 2024).

The integration of technology into mental health support represents one such emerging approach during the COVID-19 period (Charbonnier et al., 2021). Given the constraints of conventional service delivery—particularly limitations related to physical access, travel safety, and social distancing requirements—digital platforms have increasingly been adopted in the form of mental health applications (Villacis et al., 2021). However, many existing applications offer limited user engagement, often functioning as static interfaces that translate informational content into mobile text formats and provide generalised recommendations, which may reduce sustained user interaction. More recently, chatbot-based artificial intelligence systems have been introduced to facilitate text-driven interaction. Nevertheless, these systems may not accommodate user preferences for more naturalistic communication modalities, as some individuals find text input inconvenient and instead prefer spoken interaction, as reflected in the rising utilisation of hotline services. In this context, “virtual influencer” systems have been proposed as an alternative technological form that extends beyond conventional chatbots by

simulating more human-like conversational presence. Such systems may enhance perceived relational engagement, operate continuously without fatigue, and provide confidential support environments that promote user comfort and psychological safety.

Prior research has demonstrated that virtual influencer technologies can be applied in mental health contexts for symptom detection, screening, and predictive assessment. For instance, studies have shown that such systems can identify depressive indicators through analysis of facial expressions, body language, and emotional cues (Chaudhry et al., 2024; Shin et al., 2021). Additional evidence suggests their utility in diagnostic prediction and even in supporting treatment-related decision processes, including medication selection (Kim & Park, 2021). These capabilities indicate significant potential for broader societal application, particularly among adolescents who are already familiar with influencer-based digital environments. From this perspective, virtual influencer systems may enable users to engage in preliminary self-assessment of psychological symptoms, thereby reducing risk escalation and supporting early intervention. They may also contribute to cost reduction while improving accessibility to mental health resources. Accordingly, this study aims to develop a "virtual influencer" programme designed to support students experiencing anxiety, stress, or depressive symptoms. The research is structured into two phases: Phase 1 focuses on the design and development of the virtual influencer system for mental health support, while Phase 2 evaluates its effectiveness in addressing student psychological well-being.

Research Objective

1. To develop the "virtual influencer" program, which will help students with health problems.
2. To test the effectiveness of the "virtual influencer" program in assisting students with mental health problems.

Literature Review

Concepts Related to Mental Health Problems

Stress refers to the physiological and psychological response of the body and mind to internal or external demands that challenge an individual's capacity to maintain equilibrium. When adaptation becomes insufficient, stress may present through somatic, cognitive, or behavioural manifestations, originating from physiological, psychological, or social determinants. Effective stress management typically involves emotional regulation, problem-solving strategies, and cognitive reframing techniques (Azaditalab et al., 2025). Anxiety is commonly characterised by

heightened psychological arousal, feelings of apprehension, and persistent concern regarding anticipated future events. It may produce both physical and psychological effects. Management approaches for anxiety generally include relaxation-based interventions aimed at regulating emotional responses and training cognitive control mechanisms. Depression is defined by enduring low mood accompanied by disruptions across emotional, cognitive, behavioural, and physiological domains. If left unaddressed, it may develop into major depressive disorder. Its aetiology is multifactorial, involving both biological predispositions and psychosocial stressors. Therapeutic approaches typically focus on enhancing emotional regulation, restructuring maladaptive thought patterns, and rebuilding a sense of purpose and meaning in life (García-Pérez et al., 2025).

Virtual Influencer Theory and Principles

A virtual influencer refers to a digitally constructed agent developed through Computer-Generated Imagery (CGI), designed to replicate human-like appearance, facial expressions, and interactive behaviours. Such systems are capable of continuous operation without physiological limitations such as fatigue or illness. When integrated with voice recognition and cognitive processing architectures, they enable users to communicate emotional states and receive contextually appropriate mental health guidance through simulated interpersonal interaction (Schouten et al., 2020; Topol, 2019). Voice recognition technology functions by converting spoken language into textual form through the analysis of acoustic signals and their alignment with computational language models. Within the scope of this study, this technology is employed to identify and extract mental health-related keywords from users’ verbal input (Miner et al., 2017), as illustrated in Figure 1.

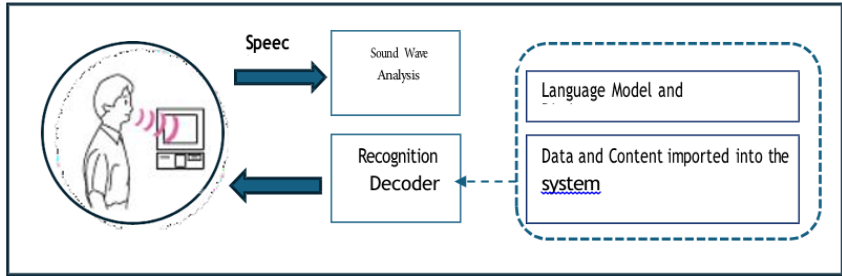


Figure 1: The Mechanism of the Voice Recognition System

Methods

This study adopted a Research and Development (R&D) framework to design, develop, and evaluate a virtual influencer programme intended to

support university students experiencing stress, anxiety, and depression. The investigation was conducted in two sequential phases. Phase 1 involved the development of the programme architecture alongside the construction of a structured conversational database. Phase 2 focused on evaluating the effectiveness of the developed system. The study population comprised university students aged between 17 and 25 years who were able to read and comprehend Thai. Two participant groups were involved: 30 students who contributed mental health-related input data for system development, and a further 30 volunteer participants with internet access who were identified as experiencing varying levels of stress, anxiety, or depression and were recruited for the effectiveness evaluation phase.

Development

The research was implemented in two distinct phases. Phase 1 focused on the design and development of the virtual influencer system. This included, first, the construction of a simulated conversational database derived from an extensive literature review and recorded counselling interactions with student volunteers experiencing stress, anxiety, and depression. These materials were approved by the relevant ethics committee and subsequently validated by three mental health experts to ensure content accuracy and appropriateness. Second, system development was undertaken, incorporating conversation flow design and full system implementation based on the Software Development Life Cycle (SDLC). This stage also included integration of voice recognition functionality and the development of key system modules, namely a DASS-21-based screening component, guidance and response mechanisms, an evaluation subsystem, a mental health monitoring dashboard, and user group management functions, as illustrated in Figure 2. System readiness was further examined through pilot testing involving both users and technology specialists.

Phase 2 assessed the effectiveness of the developed programme. Eligible student participants were recruited through self-assessment screening procedures, followed by the acquisition of informed consent. Participants were then granted flexible access to the virtual influencer system, which provided counselling interactions through selected avatar interfaces. After system use, participants completed post-intervention emotional reassessment and provided feedback. The collected data were subsequently verified, processed, and subjected to analysis.

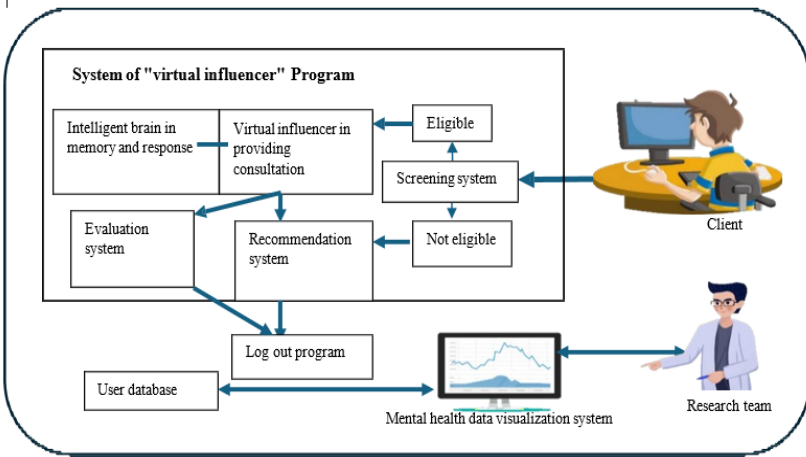


Figure 2: The System Structure of the "Virtual Influencer" to Assist Mental Health
Source: Authors Own Elaboration

Research Instruments

The virtual influencer programme was developed through an integrative process combining an extensive literature review with primary data collected from consenting student volunteers. This material was used to construct therapeutic dialogue scripts intended to support mental health intervention. Content validity was assessed by three mental health experts, yielding an overall Content Validity Index (CVI) of 0.97. Domain-specific validity scores were 1.00 for stress-related content and 0.96 for both anxiety and depression components. Following expert review and revision, the system underwent technical implementation and was subsequently evaluated by three technology specialists, who confirmed full system content validity (CVI = 1.00).

The Depression Anxiety Stress Scale (DASS-21), adapted into the Thai language Oei et al. (2013), was employed as the primary screening instrument for assessing levels of depression, anxiety, and stress. The instrument comprises 21 items distributed across three subscales, with responses rated on a four-point scale from 0 to 3, where higher scores indicate greater symptom severity. In addition, a User Feedback Questionnaire was developed to assess participants' experiences with the virtual influencer programme. Content validity of this instrument was confirmed by three experts (CVI = 1.00). The questionnaire consists of 13 items rated on a five-point Likert scale, demonstrating acceptable internal reliability ($\alpha = 0.84$), and also includes an open-ended section designed to capture qualitative user feedback.

Ethical Considerations

The study received approval and an exemption from the University Human Research Ethics Committee (COE: 159/2022), based on its classification as minimal-risk research. The initial list of volunteers was compiled from publicly available recruitment announcements, with no collection of personally identifiable information. For the second group of volunteers, all data were fully anonymised and securely stored within encrypted databases, accessible exclusively to the principal investigator. To ensure confidentiality, all results are presented in aggregated form, preventing the identification of individual participants.

Data Analysis

Pre- and post-intervention mental health outcomes were analysed using a paired-sample t-test to determine statistically significant differences. Descriptive analyses, including mean values and standard deviations, were computed for the user feedback measures. In addition, qualitative responses provided by participants were systematically coded, categorised, and subjected to thematic analysis to identify recurring patterns and interpretive themes.

Results

Development of the "Virtual Influencer" Program to Assist Students with Mental Health Problems

The study led to the development of a web-based virtual influencer system aimed at supporting university students experiencing stress, anxiety, and depression. The program is accessible independently via a website for 24 hours and allows users to engage for an unlimited duration (<https://virtualInfluencer-01.web.app/>). Illustrative examples of the system interface and functionality are presented in Figures 3–16.

Start using the program: Figures 3-10

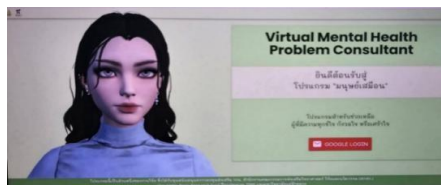


Figure 3: Home Page



Figure 4: Select Avatars

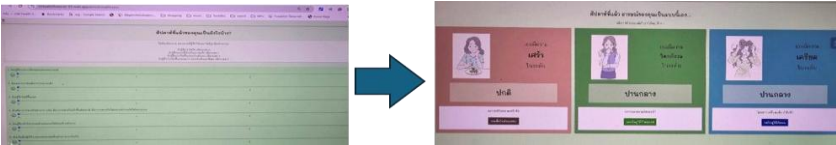


Figure 5: Screening Emotion

Figure 6: Present the Result of Emotion



Figure 7: Recommendation for Caring Mental Health



Figure 8: Consent to Join the Program



Figure 9: Instructions for Using the Program



Figure10: Start Using the Program
Source: Authors Own Elaboration



After using the Program: Figures 11-14



Figure11: Research Team

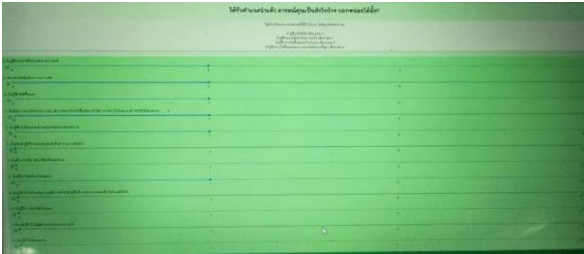


Figure12: Evaluate Emotion After Using the Program



Figure 13: Compare Pre-Post Score of Emotion



Figure 14: The End of Program Page
Source: Authors Own Elaboration

For Research Team: Figures 15-16



Figure 15: Present the Number of Users

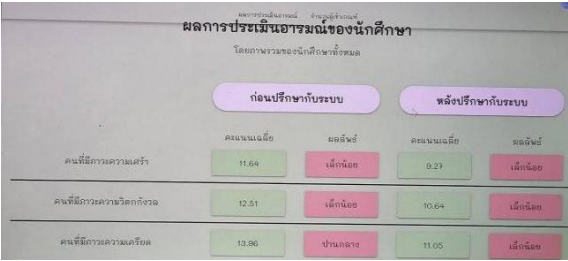


Figure 16: Mean Score of User Emotion
Source: Authors Own Elaboration

Figures 3–16 present the main functional components of the virtual influencer programme. These include pre- and post-intervention emotional screening interfaces for depression, anxiety, and stress (Figures 5 and 12), as well as modules that deliver mental health guidance and support (Figure 7). The figures also depict informational interfaces outlining study details and programme usage instructions (Figures 9 and 10), alongside user interaction screens illustrating engagement between users and the system (Figure 10). In addition, the visual outputs include emotional assessment result displays (Figure 13), and administrative dashboards designed for the research team, which present aggregated user statistics and mean emotional score trends (Figures 15 and 16).

Testing the Effectiveness of the "Virtual Influencer" Program to Assist Students with Mental Health Problems

A total of 55 students reporting symptoms of stress, anxiety, and depression initially engaged with the programme; however, only 30 participants completed the intervention in accordance with the study protocol and were included in the final analysis. The majority of participants opted for a female avatar (80%), with a mean age of 20.1 years, and 66.67% were first-year university students. Post-intervention findings showed that 86.67% of participants reported reductions in at least one of the measured psychological domains (stress, anxiety, or depression), while 63.33% demonstrated improvement across all three domains (Table 1).

Table 1

The Number of Participants with Changes in their Levels of Depression, Anxiety, or Stress After using the "Virtual Influencer" Program (n = 30)

	No Change in Score Level	Score Level Decreased in One Type	Score Level Decreased in Two Out of Three Types	Score Level Decreased in all Three Types
After using the Program	4 (13.33%)	4 (13.33%)	3 (10.00%)	19 (63.33%)

Comparative analysis of pre- and post-intervention measurements indicated statistically significant decreases in levels of depression, anxiety, and stress after participants used the virtual influencer programme (Tables 2 and 3).

Table 2

Average Pre-Post Scores of Depressions, Anxiety, and Stress of using the "Virtual Influencer" Program (n = 30)

Variable	Assessment	Average Score (Mean) and Standard Deviation (SD)
Depression	Pre-Score	13.90 (3.968)
	Post-Score	9.23 (5.283) ***
Anxiety	Pre-Score	14.00 (4.009)
	Post-Score	10.37 (5.282) ***
Stress	Pre-Score	15.23 (3.794)
	Post-Score	11.03 (5.327) ***

*** p < .001

Table 3

Comparison of the Pre-Post Average Scores of Depressions, Anxiety, and Stress of using the "Virtual Influencer" Program (n = 30)

Comparison of the Post Mean	Std. Deviation	t	Sig. (2-Tailed)
Depression 4.667	4.589	5.570	.000
Anxiety 3.633	4.351	4.574	.000
Stress 4.200	4.589	5.013	.000

*** p < .001

User Feedback on the Virtual Influencer Program

Participant feedback indicated a generally high level of satisfaction with the virtual influencer programme across most assessed dimensions. The highest mean rating reached 4.53 out of 5, whereas the lowest mean score was recorded for the item assessing participants' willingness to recommend the programme to others (Table 4).

Table 4

Average Scores of Opinions on Using the "Virtual Influencer" Program to Assist Student with Mental Health Problem (n = 30)

No	Topic	Mean (SD)	Interpretation
1	This program that meets user needs	4.50 (.572)	High
2	This program responds to diverse situations and contexts	4.10 (.607)	High
3	System usage activities are appropriate and interesting	4.17 (.874)	High
4	This program keeps users interested, enjoyable, and easy to use	4.27 (.828)	High
5	Users feel relaxed when using this program	4.13 (.776)	High
6	This program responds effectively	3.73 (1.202)	High
7	This program displays appropriately on the devices used	3.67 (1.028)	High
8	This program ensures data confidentiality	4.23 (.728)	High

9	This program meets users' practical application needs	4.40 (.814)	High
10	Users can participate well in program activities	4.20 (.714)	High
11	Users see the benefits of this program	4.47 (.776)	High
12	Users will think of this program again when encountering stress/anxiety/depression	4.47 (.629)	High
13	Users would recommend this program to others	4.53 (.571)	Very High

Qualitative Feedback on the Virtual Influencer Program

Participants responses were categorized into positive feedback, negative feedback, and suggestions for improvement.

Positive Feedback: Participants reported that the program was easy to use and accessible with clear voice communication. It functioned effectively as a mental health support tool, providing guidance, emotional relief, stress and anxiety management strategies, and opportunities for reflective thinking. Several users described the system as a safe space to express concerns when support from other people was not readily available.

Negative Feedback: Some participants reported issues related to system stability and responsiveness, including delayed replies, repetitive interactions, and occasional system freezing. These issues were consistent with lower ratings in stability and responsiveness. Participants also noted usability limitations, particularly device compatibility problems, as the system did not function properly on certain platforms such as iOS. In some cases, users also experienced difficulty exiting the application.

Suggestions for Improvement: Participants recommended further development to improve compatibility across iOS, Android, and tablet devices. They also suggested enhancing system stability, improving response speed, and enabling more natural voice-based interaction. Additionally, participants proposed adding clearer navigation controls, including recovery or reset buttons to address situations where the system becomes unresponsive.

The study explored the effectiveness of a virtual relational agent designed to support university students experiencing mental health challenges exacerbated by the COVID-19 pandemic. The research was grounded in the observation that cases of student mental health difficulties increased substantially during this period, with elevated levels of stress, anxiety, and depression associated with online learning demands and broader lifestyle disruptions. Methodologically, the study employed a Research and Development (R&D) framework consisting of two main phases: the conceptual and technical development of the virtual agent, followed by preliminary effectiveness testing. In the first phase, an interdisciplinary team designed a virtual influencer system intended to simulate supportive human interaction. The design was informed by social

cognition theory, self-efficacy theory, and mediated interaction frameworks, emphasising the importance of human-like engagement in digital environments. Content validity testing produced high indices ranging from 0.97 to 1.00, indicating strong appropriateness and relevance for mental health application.

The second phase involved preliminary effectiveness testing with a sample of 30 university students. Participants interacted with the virtual relational agent via a continuously accessible web-based platform designed to provide consistent support. Results were encouraging, with 86.67% of users reporting significant reductions in self-reported depression, anxiety, and stress levels, with statistical significance ($p < .01$), supporting the programme's effectiveness. In addition to quantitative outcomes, qualitative feedback indicated that participants perceived the system as psychologically supportive, suggesting that it functioned not only as an informational tool but also as a perceived mediator of emotional support and self-efficacy enhancement. These findings suggest that digitally embodied agents may serve as a valuable complement to conventional mental health services, offering flexible, accessible, and confidential support while promoting user autonomy in managing mental health needs. In the context of increasing demand and workforce strain among mental health professionals during the pandemic, such systems may help reduce service burden while expanding access to early intervention and coping resources (Bahreini et al., 2024).

Further research is required to examine the long-term sustainability of observed effects, particularly whether improvements in mental health outcomes persist over time. In addition, deeper investigation into the phenomenology of user-agent interaction is necessary to better understand how perceived relational support develops within digital environments. The philosophical implications of technologically mediated care also warrant further exploration, particularly in relation to evolving conceptions of cognition, behaviour, and relational experience in increasingly digital contexts. Overall, this study contributes to the growing body of research on the integration of digital technologies into mental health interventions. While it highlights the potential of virtual relational agents to enhance student well-being and resilience, it also underscores the importance of careful implementation and continuous refinement. Future development should prioritise responsiveness to user experience, ensuring that such systems remain supportive, adaptive, and ethically grounded within rapidly evolving digital mental health landscapes.

Discussion

The Virtual Influencer Program: Development and Efficiency Testing: The Virtual Influencer program was developed in two phases. The first

phase involved development, and the second phase focused on efficiency testing. The conversation database was constructed through an extensive literature review combined with experiential inputs from individuals experiencing stress, anxiety, and depression. This database was validated by mental health experts, yielding a Content Validity Index (CVI) of 0.97, while both the Virtual Influencer system and its voice recognition component were validated by technology experts with a CVI of 1.0. These results confirmed the adequacy and functional reliability of both content and system performance. The programme comprises five core functions: 1) user guide, which provides essential navigation instructions; 2) assessment module for evaluating stress, anxiety, and depression levels; 3) health advice function offering recommendations for improvement; 4) privacy feature allowing users to select identities to ensure a secure and comfortable experience; and 5) post-consultation assessment, which evaluates users' emotional state after interaction.

The Efficiency of the Virtual Influencer Program: Efficiency testing involved thirty participants and demonstrated a statistically significant reduction in depression, anxiety, and stress levels in 86.67% of users ($p < 0.01$). These findings are consistent with prior studies indicating that mental health applications, chatbot-based interventions, and digital therapeutic programmes are effective in reducing psychological distress (Jornkokgoud & Sariwat, 2021; Samoh et al., 2022; Schueller et al., 2017; Torous et al., 2018). Systematic reviews further support the effectiveness of internet-based and web-based interventions for student populations (Harith et al., 2022). Nevertheless, while digital mental health tools demonstrate measurable benefits, they cannot fully substitute direct intervention by qualified health professionals. Chatbots and similar systems are best positioned to provide initial support, psychoeducation, and self-management strategies, particularly in contexts where professional resources are limited, whereas severe cases should be referred for specialised clinical care (Denecke et al., 2021; Vaidyam et al., 2019).

User Opinions on the Virtual Influencer Program: Participants generally expressed positive perceptions of the programme, particularly highlighting its effectiveness in reducing stress, anxiety, and depression, as well as its provision of practical and applicable coping strategies. These outcomes are consistent with previous research reporting high user satisfaction and accessibility in chatbot-based and online mental health interventions (Denecke et al., 2021; Harith et al., 2022; Jornkokgoud & Sariwat, 2021; Rachyla et al., 2018; Samoh et al., 2022; Vaidyam et al., 2019). However, participants also identified areas requiring improvement, particularly system stability, responsiveness, usability, and cross-platform accessibility across mobile operating systems such as iOS and Android, in

order to enhance overall functionality and user experience. The COVID-19 pandemic has played a critical role in shaping the psychological well-being of university students, thereby increasing the demand for innovative support mechanisms. As conventional mental health services become increasingly burdened, the integration of technology—particularly virtual relational agents—has been proposed as a viable strategy for addressing student mental health challenges. This study examines the impact of such digital interventions on student well-being and explores the interdependence of multiple determinants influencing mental health outcomes. Student involvement in the design and evaluation of mental health interventions in higher education has been identified as essential for ensuring relevance and effectiveness, as noted by (Cleverley et al., 2026). Engaging students in participatory development processes fosters a sense of ownership and enhances alignment between system design and lived experience, thereby increasing acceptance and sustained utilisation of digital tools.

Family context also plays a significant role in shaping university students' mental health outcomes. Jameel et al. (2026) highlight that the relationship between social media addiction and psychological distress, including depression and anxiety, can be moderated by supportive family environments. In an increasingly digital academic landscape, the role of family support becomes even more salient. Accordingly, virtual relational agents should not only provide immediate psychological assistance but also encourage users to maintain meaningful connections with their families and support networks. By reinforcing communication within the family unit, such systems may contribute to more sustainable mental health outcomes and reduce feelings of isolation during periods of stress. Additionally, designing agents that facilitate reflective sharing of experiences with family members may enhance interpersonal communication and promote a more supportive home environment. Academic pressures further contribute to student psychological distress. Multisari et al. (2022) note that final-year academic requirements generate significant stress and anxiety among students. In this context, virtual relational agents may offer targeted support by providing structured guidance, time management strategies, self-care reminders, and tailored content addressing academic workload challenges, particularly those related to final project completion. Moreover, Jadrić et al. (2025) emphasises that perceived institutional quality significantly influences student satisfaction and psychological well-being. The implementation of virtual agents may therefore be interpreted as an extension of institutional support, potentially improving students' perceptions of their educational environment and strengthening the

integration between academic systems and mental health support structures.

Beyond academic stressors, socioeconomic factors also significantly shape student mental health outcomes. Hossain et al. (2023) highlight the multidimensional nature of student well-being, demonstrating that emotional, social, and academic domains are deeply interconnected. Socioeconomic disparities may intensify psychological vulnerability, particularly among students from lower-income backgrounds during crisis periods such as the COVID-19 pandemic. Consequently, virtual relational agents must be designed with inclusivity in mind, ensuring accessibility across diverse socioeconomic contexts. Incorporating language localisation, personalised content delivery, and resource referral systems—such as financial aid guidance—can improve equity in access to digital mental health support. Self-efficacy is another critical determinant of psychological well-being, particularly among adolescents and young adults. Raimondi et al. (2025) emphasise that higher levels of self-efficacy can mitigate negative mental health outcomes, underscoring the importance of fostering self-regulation and reflective coping mechanisms through virtual relational agents.

Beyond emotional support, such systems can strengthen users' belief in their capacity to manage academic and personal challenges. Features such as goal setting, progress tracking, and positive reinforcement may significantly enhance self-efficacy, thereby contributing to improved resilience and overall mental health outcomes (Kjell et al., 2021). Finally, further investigation is required to assess the long-term effectiveness of digital mental health interventions. Although early findings regarding virtual relational agents are promising, their sustained impact over time remains insufficiently understood. Longitudinal and cross-cultural studies are needed to evaluate adaptability and durability across diverse educational contexts. In addition, deeper exploration of user-agent interaction phenomenology is necessary to understand how perceived support and self-efficacy evolve through sustained engagement with digital systems. Overall, virtual relational agents represent a promising innovation in mental health support for university students, particularly in the context of COVID-19-related challenges. Through participatory design, attention to contextual factors such as family support, socioeconomic conditions, and self-efficacy, these systems can be refined to better address the complex and evolving needs of student populations.

Limitations and Suggestions

The Virtual Influencer program is constrained by several technical and functional limitations, including system instability and delayed responsiveness, limited keyword recognition capacity, intermittent

internet-related disruptions, and non-natural conversational output. In addition, the system currently lacks compatibility with iOS devices and demonstrates comparatively lower performance on Android platforms than on desktop environments. For future development, it is recommended that system stability and response efficiency be enhanced, alongside expansion of keyword recognition capabilities and improvement of natural language processing to support more fluent and human-like interaction. The conversational design should also be refined to increase coherence and usability. Furthermore, the programme should be optimised for multi-platform accessibility, particularly through the introduction of full iOS support and performance enhancement for Android devices. Appropriate technical strategies should also be implemented to mitigate the impact of internet connectivity disruptions. Finally, continuous usability evaluation and systematic incorporation of user feedback are strongly recommended to further improve the effectiveness of the programme in mental health support and preventive applications.

Conclusion

This study underscores the significant potential of virtual relational agents as an emerging modality for supporting the mental well-being of university students, particularly within the context of heightened psychological challenges associated with the COVID-19 crisis. The findings indicate that such digital agents may contribute to reductions in depression, anxiety, and stress by providing an accessible and user-friendly platform for mental health support. Grounded in principles of social cognition and self-efficacy, these systems facilitate a form of human-like interaction that may enhance perceived relational support and assist students in managing their psychological states more effectively. The results further suggest that while traditional mental health services remain essential, technology-based interventions can serve as a complementary approach by addressing gaps in accessibility and service availability. Positive user feedback regarding psychological benefits also reflects the increasing acceptance and perceived usefulness of digital tools in mental health care. However, as this study represents an initial step in exploring digitally mediated relational support, further research is required. Future investigations should examine the long-term sustainability of observed effects, the complexity of user-agent interaction dynamics, and the ethical considerations surrounding technologically mediated care. A deeper understanding of these dimensions will be essential for refining system design, improving effectiveness, and addressing emerging challenges. Overall, the integration of virtual relational agents into mental health support frameworks presents a

promising direction for enhancing student resilience and well-being. As mental health care continues to evolve, the development of flexible, accessible, and user-centred digital interventions is likely to play an increasingly important role in supporting future generations.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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