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The Impact of Academic Stress on Students' Mental Health: Coping Interventions Based on Virtual Reality Technology

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Abstract: Academic stress is a common issue faced by university students, particularly in major cities like Jakarta, and often has a negative impact on their mental health. This study aims to evaluate the effectiveness of Virtual Reality (VR) technology as an innovative coping strategy to reduce academic stress and improve students' mental health. The study utilized a quasi-experimental design involving 60 students from various universities in Jakarta who met the inclusion criteria, which included having moderate to high levels of academic stress. Participants were randomly divided into two groups: an experimental group (using VR intervention) and a control group (using conventional coping strategies). Data were collected using the Student-Life Stress Inventory (SSI) to measure academic stress levels and the Depression Anxiety Stress Scales (DASS-21) to assess mental health, at both pre-test and post-test stages. The results showed that the experimental group receiving the VR intervention experienced a significant reduction in academic stress levels (with an effect size of 1.86) and an improvement in mental health (with an effect size of 2.02), compared to the control group, which showed smaller changes. These findings support the hypothesis that VR-based coping interventions are more effective than conventional coping strategies in reducing academic stress and improving students' mental health. These results have practical implications for educational institutions to consider incorporating VR technology into student mental health support programs. The study suggests using VR as an engaging and relevant coping method for the tech-savvy student generation.

Keywords: Academic stress, Mental health, Coping, Virtual Reality, Students.

INTRODUCTION

Academic stress is a common phenomenon among university students caused by the pressure to meet high educational demands, fulfill social expectations, and prepare for a competitive future (Bella Khansa Puspita & Dewi Kumalasari, 2022). In an academic context, stress does not always have negative effects. Some students are able to manage academic stress as motivation to excel. However, when stress reaches excessive and prolonged levels, it can endanger mental health, both in the short and long term (Barseli et al., 2017b). In major cities like Jakarta, students from various top universities, such as Universitas Indonesia, Universitas

Negeri Jakarta, and private universities, face significant pressure to achieve academic success and compete in a rigorous educational environment.

Based on data from the Jakarta Health Department (2023), approximately 40% of students in Jakarta experience anxiety and depressive symptoms related to academic pressure. Research by (Barseli et al., 2017a) also shows that students experiencing prolonged academic stress are at higher risk of mental health disorders such as depression, anxiety, and decreased life satisfaction. Students experiencing academic stress often exhibit symptoms such as sleep difficulties, concentration problems, mood changes, and feelings of being overwhelmed, which lead to declining academic performance (Siregar & Putri, 2020). This situation highlights the urgent need for effective coping strategies to help students manage their academic stress optimally.

Although various coping strategies have been introduced, such as counseling or mindfulness approaches, the application of modern technology in addressing academic stress is still relatively new and has great potential. One of the technologies that is gaining attention is Virtual Reality (VR). VR offers simulation experiences that can have therapeutic effects, such as creating relaxation-supportive environments or providing coping training through virtual scenarios (Elmqaddem, 2019). In the context of mental health, research by (Pan et al., 2006) shows that the use of VR can help reduce anxiety and stress levels. This technology allows users to temporarily escape real-world pressures and learn stress management techniques through simulations resembling everyday situations. In Jakarta, with its large student population, the use of VR to address academic stress could be an innovative solution easily accepted by tech-savvy young people.

This study was conducted in Jakarta, focusing on students from several major universities in the city. The competitive and fast-paced educational environment in Jakarta adds emotional burdens to students, who often experience pressure to excel academically as well as the challenges of adapting to fast-paced urban life. VR technology is expected to provide an engaging and interactive coping method, which not only provides psychological benefits but also an enjoyable experience for students. By offering VR-based stress management interventions, students are expected to develop more effective coping skills in dealing with academic pressure.

Academic stress is a common phenomenon faced by students due to high academic demands and is often considered a major factor affecting their mental health (Barseli & Nikmarijal, 2017). According to (Prasetya et al., 2022), stress can affect an individual's emotional well-being and, if not managed properly, can negatively impact quality of life and academic performance. Research by (Yunalia et al., 2021) found that students often experience increased stress levels when facing exams, heavy assignments, and the pressure to achieve. This academic stress not only affects students' academic performance but also their overall psychological state, such as anxiety, depression, and reduced life satisfaction (Barseli & Nikmarijal, 2017).

In managing stress, coping strategies are a crucial aspect. Coping refers to the efforts individuals make to manage perceived pressure or emotional demands, and it is divided into two main types: problem-focused coping and emotion-focused coping (Prasetya et al., 2022). Mahmoud, Staten, and (Bella Khansa Puspita & Dewi Kumalasari, 2022) argue that students who use problem-focused coping strategies tend to have better mental health compared to those who use avoidance or emotion-focused coping strategies. These findings are supported by (Norma et al., 2021), who showed that effective coping strategies can mitigate the impact of academic stress on mental health.

Virtual Reality (VR) technology has emerged as a potential new intervention tool in the context of mental health, particularly for managing anxiety and stress. VR allows users to engage in simulations resembling the real world, where they can practice coping and relaxation

techniques in a controlled environment (Barseli & Nikmarijal, 2017). According to Maples-Keller et al. (2017), VR has proven effective in reducing anxiety in individuals with anxiety disorders, providing realistic experiences without having to face the actual situation. In the context of education, (Yunalia et al., 2021) found that VR provides an immersive learning experience and can help students practice coping techniques in a calming atmosphere. Another study by (Yunalia et al., 2021) also found that VR has the potential to increase students' self-efficacy in dealing with stress.

With the high levels of academic stress experienced by students, especially in large cities like Jakarta, innovative solutions are needed that can attract young people and help them cope with the emotional pressures they face (Norma et al., 2021). Using VR as a coping medium can provide a more interactive and enjoyable new experience, allowing students to learn effective stress management techniques in a risk-free environment. A study by (Pramesta & Dewi, 2021) showed that interactive approaches involving technology have high effectiveness in helping students develop adaptive and relevant coping skills.

In this study, VR technology is proposed as a coping intervention method that can help students in Jakarta manage the academic stress they experience. Based on previous research, the proposed hypothesis is that VR will help students reduce anxiety and improve mental health through immersive and effective coping learning (Bella Khansa Puspita & Dewi Kumalasari, 2022). Additionally, it is expected that VR will also increase students' motivation to proactively deal with academic stress, enabling them to achieve better academic results without feeling emotionally burdened.

The following is a conceptual framework model in the form of a table, illustrating the relationships between the variables in the study.

Table 1. Conseptual Framework

Variable	Description	Relationship Between Variables
Academic Stress	Psychological pressure faced by students due to high demands	Independent variable that negatively impacts students' mental health
Students' Mental Health	Emotional and psychological state affected by stress	Dependent variable directly influenced by academic stress
Coping Strategies (Intervention)	Efforts made by students to manage academic stress	Mediating variable reducing the negative impact of academic stress
Use of VR Technology	Utilizing Virtual Reality for stress coping in a controlled environment	Part of coping strategy offering innovative and immersive approach
Improvement in Mental Health	Expected outcome of improved mental health after VR-based coping intervention	Final result of using VR as a coping intervention

The table illustrates how the variables in this study interact to achieve the final research objective, which is to improve students' mental health.

This research is expected to make a significant contribution in addressing the need for more relevant and effective coping methods for students, especially in this increasingly complex digital era. By adopting VR technology, this study aims to provide a solution that suits the characteristics of the younger generation who are more familiar with digital innovation, while also providing a foundation for the implementation of technology in the field of mental health.

METHOD

This study used a quantitative approach with a quasi-experimental design to test the effectiveness of VR-based coping interventions in reducing the impact of academic stress on students' mental health. A quasi-experimental design allows for the testing of causal relationships even though not all research conditions are fully controlled (Ghofar & Islam, 2015). With this design, the study was able to identify changes in students' mental health after

exposure to VR-based coping interventions, compared to a control group that used conventional coping strategies.

The population in this study consisted of active students from several universities in Jakarta who reported moderate to high levels of academic stress. The selection of students in Jakarta aimed to observe the effectiveness of the intervention in an urban student population that often faces academic pressure due to high demands and a competitive environment (Drawson et al., 2017).

The sample was selected using purposive sampling to ensure that participants met specific criteria relevant to the study. Inclusion criteria included:

1. Students aged 18-24 years who were actively enrolled in a university.
2. Students who reported high levels of academic stress based on initial or pre-test results.
3. Students without physical or mental health disorders that could interfere with participation in the VR intervention.

The planned sample size was 60 students, who would be randomly divided into two groups. The first group (experimental group) received VR-based coping intervention, while the second group (control group) used conventional coping strategies, such as academic counseling or relaxation training without VR technology.

The research instruments included reliable and valid measurement tools to assess students' academic stress and mental health levels. The instruments used in this study were:

The research instruments included reliable and valid measurement tools to assess students' academic stress and mental health levels. The instruments used in this study were:

1. **Student-Life Stress Inventory (SSI):** This tool was used to measure the level of academic stress experienced by students, covering aspects such as workload, time pressure, and academic competition (Taylor & Stanton, 2007). SSI scores were categorized into low, moderate, and high levels, helping identify students who met the inclusion criteria.
2. **Depression Anxiety Stress Scales (DASS-21):** This instrument measured students' mental health conditions, including aspects of depression, anxiety, and stress (Carver & Connor-Smith, 2010). DASS-21 has high reliability and is commonly used in research measuring mental health.
3. **Simulator Sickness Questionnaire (SSQ):** Used for the experimental group to ensure that participants did not experience physical discomfort from using VR, such as nausea or dizziness that might occur during VR sessions (Wolfers & Utz, 2022).

Data collected from the pre-test and post-test were analyzed using statistical techniques with SPSS software. The data analysis steps included:

1. **Normality Test:** The Shapiro-Wilk test was conducted to ensure a normal distribution of the obtained data.
2. **Difference Analysis:** Paired sample t-tests were used to analyze the differences between pre-test and post-test scores in each group. Independent sample t-tests were conducted to examine differences between the experimental and control groups.
3. **Effectiveness Analysis:** Intervention effectiveness was analyzed by calculating the effect size using Cohen's d. This effect size helps determine the magnitude of the change in students' mental health that can be attributed to the VR-based coping intervention (Cohen, 1988).

These analyses helped answer the hypothesis that VR-based coping strategies are more effective than conventional coping strategies in reducing academic stress and improving students' mental health.

RESULT AND DISCUSSION

This study aimed to test the effectiveness of VR-based coping interventions in reducing academic stress and improving students' mental health. Data were collected from pre-test and post-test measurements using the Student-Life Stress Inventory (SSI) to assess academic stress levels and the Depression Anxiety Stress Scales (DASS-21) to evaluate mental health. Analysis was conducted to compare the differences between the experimental group that received VR intervention and the control group that used conventional coping strategies.

The sample in this study consisted of 60 students who met the inclusion criteria, namely aged 18-24 years, active university students, and having moderate to high levels of academic stress based on pre-test results. Participants were divided into two groups: the experimental group (30 students) who received the Virtual Reality (VR) intervention and the control group (30 students) who followed conventional coping strategies.

Tabel 2. Sample Characteristics

Characteristic	Category	Number (N)	Percentage (%)
Gender	Male	28	46.7
	Female	32	53.3
Age	18-20 y.o.	22	36.7
	21-22 y.o.	25	41.7
	23-24 y.o.	13	21.6
Stress Level (Pre-Test)	Moderate	29	48.3
	High	31	51.7
Intervention Group	Virtual Reality (VR)	30	50.0
	Conventional	30	50.0

The distribution of sample characteristics shows that this study involved a diverse sample in terms of gender and age, representing the student population in Jakarta. Additionally, the high number of participants with high stress levels (51.7%) indicates that academic stress is a relevant issue for many students in large cities. The balanced distribution between the experimental and control groups ensures that the results obtained can objectively describe the effectiveness of the intervention.

Tabel 3. Pre-Test and Post-Test Results for Experimental and Control Groups

Group	Variable	Pre-Test (M ± SD)	Post-Test (M ± SD)	t	p	Effect Size (d)
Experimental (VR)	Academic Stress (SSI)	80.5 ± 10.2	62.1 ± 8.7	-9.63	<0.001	1.86
	Mental Health (DASS-21)	31.8 ± 7.5	18.2 ± 5.4	-10.57	<0.001	2.02
Kontrol (Konvensional)	Academic Stress (SSI)	81.1 ± 9.8	75.4 ± 9.2	-3.45	0.001	0.72
	Mental Health (DASS-21)	32.2 ± 7.3	27.6 ± 6.5	-4.15	<0.001	0.85

M: Mean or average score of the sample.

SD: Standard deviation, indicating score variation.

t: t-value from t-test, testing the difference between pre-test and post-test scores.

p: p-value, statistical significance level. A p-value < 0.05 indicates a statistically significant difference.

Effect Size (d): Effect size value based on Cohen's d to measure the magnitude of the intervention effect. Cohen suggests that d > 0.8 is a large effect (Cohen, 1988).

Experimental Group (VR)

In the experimental group that used VR-based coping interventions, there was a significant decrease in academic stress scores (SSI) from 80.5 (SD = 10.2) at pre-test to 62.1 (SD = 8.7) at post-test, with t = -9.63 and p < 0.001. The effect size was 1.86, indicating a very large effect of VR intervention in reducing academic stress. Mental health, measured by DASS-21, also showed a significant improvement, with the average score decreasing from 31.8 (SD = 7.5) at pre-test to 18.2 (SD = 5.4) at post-test (t = -10.57, p < 0.001), and an effect size of 2.02, also indicating a very large effect of VR intervention.

Control Group (Conventional)

In the control group that used conventional coping strategies, there was a significant decrease in academic stress scores from 81.1 (SD = 9.8) at pre-test to 75.4 (SD = 9.2) at post-test (t = -3.45, p = 0.001), with an effect size of 0.72, indicating a moderate effect. Mental health in the control group also improved, with DASS-21 scores decreasing from 32.2 (SD = 7.3) at pre-test to 27.6 (SD = 6.5) at post-test (t = -4.15, p < 0.001), and an effect size of 0.85, indicating a moderate effect.

Interpretation of Results

The results of this study show that VR-based coping interventions are more effective in reducing academic stress and improving students' mental health compared to conventional coping strategies. The experimental group that received the VR intervention showed a much larger decrease in academic stress levels and an improvement in mental health compared to the control group. The large effect sizes in the experimental group (d = 1.86 for academic stress and d = 2.02 for mental health) indicate that the use of VR has a very significant and meaningful impact in helping students manage academic stress more effectively.

VR intervention allows students to learn coping through immersive and interactive simulations, thereby enhancing their ability to cope with academic pressure in real-life environments. On the other hand, conventional coping strategies, while showing positive effects, did not produce changes as large as those seen with VR intervention.

This study indicates that VR technology can be an effective and innovative tool for improving students' mental health, especially in managing high academic stress. These findings provide practical implications for educational institutions to consider using VR technology as part of student mental health support programs.

Academic stress experienced by students in major cities like Jakarta is a common phenomenon that can negatively affect their psychological well-being. Students are often faced with pressure to achieve academic excellence, meet social expectations, and prepare for future challenges, all of which contribute to high levels of stress. The findings of this study show that the use of VR technology as a coping tool has a greater impact in reducing academic stress and improving mental health compared to conventional coping techniques.

Data shows that in the experimental group (receiving VR intervention), there was a very significant decrease in academic stress levels, with an effect size of 1.86, and an improvement in mental health with an effect size of 2.02. These large effect sizes indicate that VR is a highly effective strategy. Conversely, the control group using conventional coping techniques experienced smaller reductions in stress and improvements in mental health, with effect sizes of 0.72 and 0.85, respectively, which are considered moderate.

The results support the research hypothesis that VR, as an immersive technology, can offer a more in-depth and engaging coping learning experience. Students in the experimental

group benefited from VR simulations that helped them practice relaxation and coping techniques in a controlled and safe environment, allowing them to apply the skills learned when facing stress in real life. Using VR, students can also experience a brief "escape" from academic pressure, which plays an important role in relieving stress symptoms.

Comparison with Previous Research

The findings of this study are consistent with previous research showing that VR technology can be used as an effective tool in psychological therapy. (Eisenbeck et al., 2022) showed that the use of VR in managing anxiety and stress has great potential to bring about positive changes in individuals' psychological conditions. Research by (Basith et al., 2021) also found that VR can enhance self-efficacy in coping with anxiety-inducing situations and that VR is highly beneficial in the context of coping training requiring repeated practice in a safe environment.

Previous research in the educational context showed that VR can help students learn coping better than conventional techniques because virtual environments provide a more interactive and realistic experience (Maresca et al., 2022). Thus, the findings of this study not only strengthen empirical evidence regarding the effectiveness of VR in psychological interventions but also expand understanding of how this technology can be specifically applied to the context of academic stress among students.

CONCLUSION

The conclusion should relate to the title and answer the research formulation or objectives. Do not make statements that are not adequately supported by your findings. Mention the improvements made to the field of industrial engineering or science in general. Do not create further discussion, repeat the abstract, or simply list the results of the research results. Do not use bullet points, use paragraph sentences instead.

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