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Virtual Teaching among Nursing Students on Depression using Dorothy Johnson's Theory: A Pilot Study

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Abstract
In the challenging realm of nursing education, mental health issues, particularly depression, pose significant threats to students' well-being. In the challenging realm of nursing education, mental health issues, particularly depression, pose significant threats to students' well-being. Despite the growing recognition of mental health challenges among nursing students, there remains a gap in understanding the unique stressors and triggers within the academic environment. Additionally, there is limited research on effective interventions tailored to the specific needs of nursing students combating depression, highlighting the necessity for further exploration and targeted support strategies. Grounded in Dorothy Johnson's Behavioral System Model (BSM) Theory, this study aims to explore the benefits of virtual teaching regarding depression among nursing students. Employing a mixed methods sequential explanatory (QUAN-qual) design, it utilizes the Quick Inventory of Depressive Symptomatology (QIDS-SR) and Brief Resilience Scale (BRS). Participants are divided into virtual teaching and control groups, engaging in Microsoft Teams sessions focused on identifying signs of depression. Quantitatively, this approach did not yield significant increases in academic performance (p-value = 0.545) and the stress-reducing effect of the intervention was also not significant at the .05 alpha level (p-value = 0.695) according to the independent samples t-test. Conversely, qualitative data suggests that virtual teaching has been beneficial among nursing students. Verbal responses from participants highlight themes such as emotion, attachment, emotional support, motivation, nutrition, well-being, and stress management, offering insights into coping mechanisms and support systems utilized by students.
Keywords: depression, awareness, nursing school, virtual teaching, mental health, mixed method
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1. Background

Mental health is of paramount importance, particularly within the demanding milieu of nursing school (Smith, 2008). A nursing degree, often regarded as the second most challenging to attain (Thomas, 2023), poses significant challenges for nursing students throughout their academic journey. The rigorous schedule and demanding coursework lead to high-stress levels among nursing school students. Balancing essential coursework, clinical placements, and personal responsibilities has proved to be overwhelming. Academic stressors, such as exams, papers, research, and group presentations, further exacerbate the pressure, potentially resulting in mental health issues like depression, especially when effective personal and academic life management strategies are lacking (Zhang et al., 2022).

Depression, frequently mistaken for stress, can significantly deteriorate a student's well-being, jeopardizing academic success and potentially leading to academic failure or dropout (Barbayannis et al., 2022). Neglecting to identify and support nursing students at risk of or exhibiting signs of depression exacerbated this problem. These issues were addressed to prevent long-term consequences for nursing students.

This study analyzed the behaviors of nursing students who experienced stress during their academic pursuits and developed strategies which prevented depression during their tenure in nursing school. Specifically, this study determined virtual teaching has recognized signs and symptoms of depression which helped nursing students feel less stressed and prevented depression while in school. Leveraging virtual teaching platforms, students acquired identified signs of depression in their behavior and sought the appropriate help to manage these symptoms.

Drawing upon Dorothy Johnson's Behavioral System Model (BSM) Theory, our research underscored the heightened susceptibility of university students, particularly nursing students, to mental health challenges due to their unique developmental stage, adaptation to a new academic environment, academic and parental expectations, and the intensity of higher education programs (Sönmez et al., 2023).

Stress within the context of pursuing a nursing degree has disrupted critical subsystems, potentially impeding successful adaptation. We applied Johnson's theory in virtual teaching, which enhanced students' psychological well-being, mitigated the risk of depression and stress, and bolstered academic performance by

promoting balance across all subsystems.

1.1 Review of Related Literature

The literature presented here from PubMed was found by the search terms: “virtual teaching,” “mental health,” “nursing students,” and “depression”. The articles contain educational strategies, particularly virtual simulations applied to nurses and nursing students from 2013 to 2023. The search process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines as outlined in Figure 4.

Specifically, meta-analysis was performed by the Researchers in Fall 2023 in a separate unpublished paper. Study effect sizes and publication bias have been estimated. As hypothesized, a meta-analysis synthesizing eight effect sizes from nine studies suggests that virtual intervention is negatively associated with self-reported levels of depression, r = - .880, 95% CI [-0.366, 0.165]; p = .0457. Egger’s regression test suggested no evidence of publication bias, p = .379. By pooled effects of the studies, the overall effect is 0.157 since 95% CI [-0.366, 0.165] does not include the line of no effect, p-value for overall effect < .10, I2 = 88.61 or there is considerable heterogeneity.

Veling et. Al (2021) explored the benefits of virtual reality relaxation in a randomized controlled trial research study. A virtual, self-utilized relaxation tool was developed with the focal point of determining whether a mechanism imposed negative or positive short-term outcomes on the stress and symptoms of individuals with a psychiatric disorder. Regarding the results failing to demonstrate a significant difference, researchers decided to replicate and extend the study's conduct. The p-value for the study was .04. The effect size was 0.865 which resulted in a moderate effect size.

Chen et al. (2021) conducted their study to find out how mindfulness interventions affected nursing students' levels of stress, anxiety, depression, and mindfulness. A meta-analysis of randomized control trials was used, which included 805 nursing students with an effect size of 0.21 which resulted in a small effect size. The p-value is < .001.

Chen et al. (2023) Mobile mindfulness meditation is a mindfulness meditation intervention implemented using mobile devices such as smartphones and apps. It has been used to help manage the mental health of university students. A sample of 958 students was selected for this meta-analysis and the purpose of this study is to assess how well mobile mindfulness mediation works for university students' mental health in terms of stress, anxiety, depression, mindfulness, resilience, and overall well-being. The p-value was < .001. The effect size is 0.19 resulting in a small effect size.

Ozturk et al., (2022) identified that nursing students faced mental health challenges during the transition to distance education amid the pandemic. This randomized controlled trial involving 61 first-year nursing students aimed to assess the impact of online laughter therapy on depression, anxiety, stress, and loneliness. The p-value is > .05. The effect size is 0.88 which resulted in a moderate effect size.

Boumosleh et al., (2017) investigates smartphone addiction symptoms among Lebanese university students, exploring the influence of depression and anxiety while adjusting for various factors. This study examines smartphone addiction symptoms among a sample of 688 Lebanese university students, revealing significant prevalence rates and identifying depression and anxiety as independent positive predictors of smartphone addiction. The p-value for the study was .05. The effect size is 0.94 which resulted in a high effect size.

Thomas, L. (2021) investigated the perception of stress and depression symptoms of nursing students and non-nursing undergraduate students during the COVID-19 pandemic. The study used an anonymous online survey among 2326 undergraduate students. The effect size for the study was 0.10, which resulted in a small effect size. The p-value for the study was .23.

Santangelo et al. (2019) measured the prevalence and investigated the socio-demographic correlations of depressive symptoms among the nursing student population at the University of Palermo to concentrate on mental and behavioral disorders by developing strategies to improve quality of life and prevent diseases. The population size consisted of 493 students and the average age of participants was 21.88 years. The study showed that the risk of having depressive symptomatology is significantly associated with being in the second year of study (aOR 1.94), the third year of study (aOR 1.92), and having a perceived low health status (aOR 3.08). For this study, the results were expressed as adjusted odds ratio (aOR) with 95 per cent confidence intervals instead of the use of a p-value.

This literature review sheds light on the promising role of virtual teaching in enhancing the mental well-being and academic resilience of nursing students. By leveraging theoretical frameworks and empirical evidence, the findings underscore the importance of tailored interventions and proactive monitoring in addressing mental health challenges among students in nursing education.

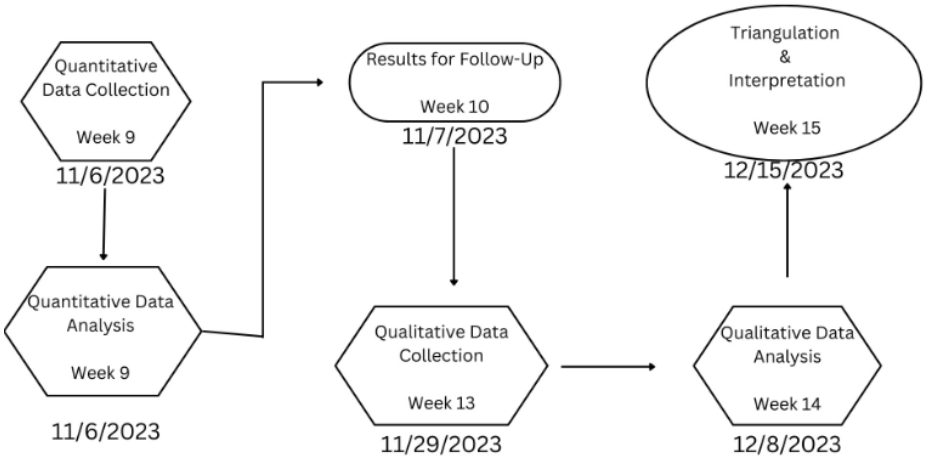
2. Methods

2.1 Research Design

A mixed methods sequential explanatory (**QUAN-qual**) design was adopted for data collection before and after

virtual teaching on Microsoft Teams with nursing students from Generic Bachelor of Science (GBS) Program at Helene Fuld College of Nursing (HFCN).

Figure 1. Conceptual model in the study



2.2 Participants

Participants for this study were selected through a convenience sampling approach, following approval from the school's research ethics committee. All participants were Associate of Applied Science (AAS) and GBS students actively enrolled at HFCN. In line with statistical power calculations available at https://clincalc.com/stats/samplesize.aspx, a sample size of thirty-four (34) participants out of (175) students under the (a) AAS and GBS Program was required, (b) could comprehend and write English, and (c) were willing to participate.

2.3 Data-Gathering Procedure

The selected participants were divided into two equal groups: virtual teaching group and control group. Both groups were assessed for their mental health regarding depression and level of resilience.

Phase 1: Both groups answered the online questionnaire at https://docs.google.com/forms/d/1J2zmxDsdI3xLP2VE50hXeexS986CKM28k0lDeQT57bk/viewform?edit_requested=true which consisted of demographical information, QIDS-SR 16, and BRS.

Phase 2: Virtual teaching group received virtual education on three learning activities encompassing the seven subsystems: (1) Attachment; (2) Achievement; (3) Aggressive; (4) Dependence; (5) Sexual; (6) Ingestive; and (7) Eliminative. Session duration is fifteen (15) minutes via Microsoft Teams. Virtual education is centered to recognize signs and symptoms of depression while in nursing school and provided strategies to manage these symptoms related to each subsystem.

Phase 3: At one-week post intervention, participants from both groups completed a posttest using the same questionnaires provided in Phase 1 which evaluated changes in knowledge and behavior regarding depression signs and symptoms and level of resilience. Additionally, participants who scored high on the depressive scale received a follow-up call a week later to assess whether they sought assistance for their behavior or be provided resources to do so.

2.4 Questionnaires

The research utilized 3 questionnaires.

2.4.1 The Quick Inventory of Depressive Symptomatology (Self Report) or QIDS

The QIDS-SR was developed to reduce the time needed to appraise depressive symptom severity. This specific tool was ideal for our study for accuracy, validity, reliability (by Cronbach's alpha at 0.86), and timeliness. (Rush, 2003; Brown, 2008).

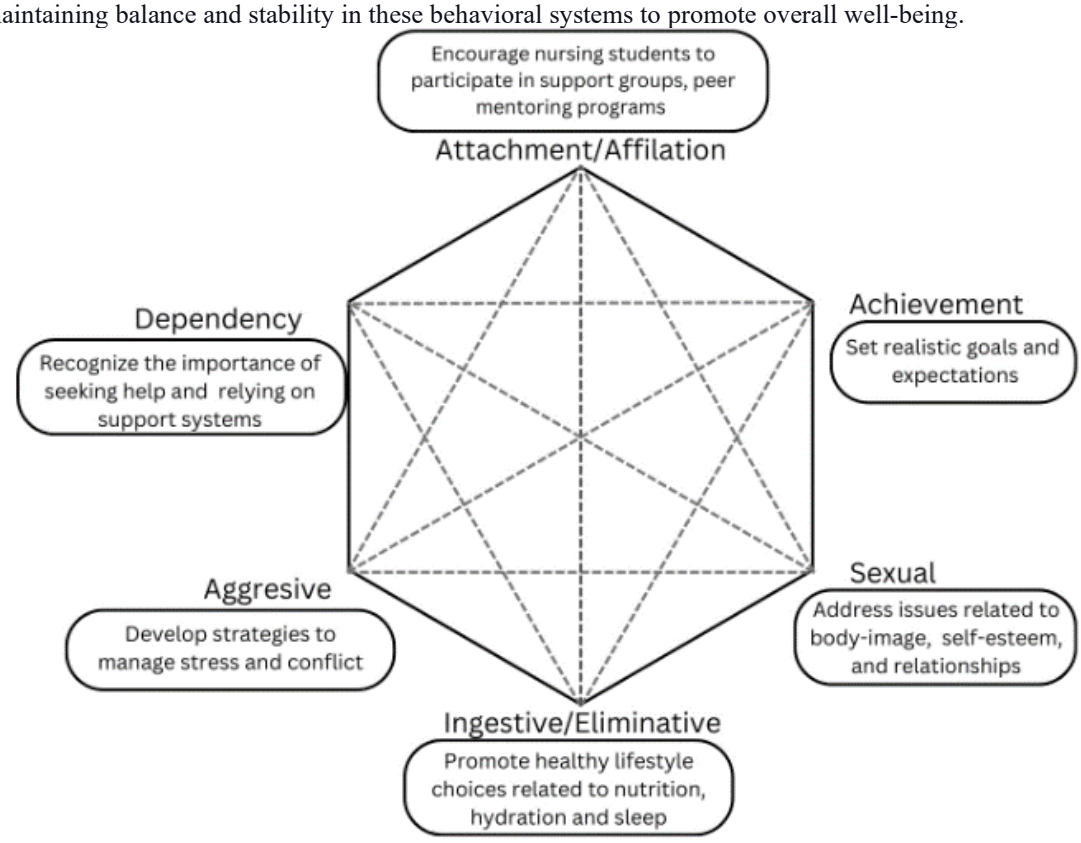
2.4.2 The Brief Resilience Scale (BRS)

The BRS was developed by Smith et. al (2008). The purpose of it is to assess one's ability to bounce back and recover from stressors while promoting resistance and perseverance. Similar to the QIDS-SR, the BRS is a reliable measuring tool with a Cronbach's alpha at 0.71 and has psychometric characteristics that come together as a unitary construct. Adoption of this research instrument is ideal for this study because it goes with Dorothy Johnson's framework, in which her seven subsystems are presented as a unitary construct.

2.4.3 Nursing School Stress and Well-being Questionnaire
The researchers created a comprehensive questionnaire to assess shifts in knowledge and behavioral patterns related to signs and symptoms of depression, and the individual's resilience level.

2.5. Ethical Considerations
This research was approved and cleared by the Helene Fuld College of Nursing Review Board.

2.6. Data Analysis
Jamovi 2.3.28 was used to analyze the data. Frequency and percentage were used to treat the descriptive data, as detailed in Table 1. An independent samples *t*-test was employed to compare the control and experimental groups regarding virtual teaching. Confirmatory Factor Analysis (CFA) tested the hypothesis on whether virtual teaching aids in recognizing signs and symptoms of depression among nursing students. Qualitative data supporting the research were derived from a QDA. Additionally, the efficacy of short virtual education sessions was assessed from pre-questionnaire and post-questionnaire stages. This analysis gauged the impact of interventions on participants' comprehension and management of depression-related issues in the nursing school context. A conceptual model (Figure 1) underscored the significance of maintaining equilibrium in behavioral systems for nursing students' well-being and improved outcomes.
Figure 2. Dorothy Johnson's Behavioral System Model, addressing seven key subsystems. It offers interventions for maintaining balance and stability in these behavioral systems to promote overall well-being.



3. Results
Table 1 presents the demographic characteristics of the participants. The study initially required 34 participants; however, attrition led to fewer respondents. The ultimate sample size comprised 27 participants. This group exclusively consisted of nursing students enrolled in the GBS Program, representing 100% of the final sample. The participants, aged 18 to 64 years, were predominantly single, with 44.4% (12 out of 27) falling into this category. Additionally, a majority of 70.4% (19 out of 27) identified as belonging to the African American group.

Table 1
Characteristics of Nursing Student Participants (n = 27)

Demographical Factors	***n***	**%**
Nursing Programs		
Associate degree	00	00.0
Generic Bachelors' degree	27	100.0
RN to Bachelors' degree	00	00.0
Age (Years)		
18 – 24	03	11.1
25 – 34	12	44.4
35 – 44	09	33.3
45 – 54	02	7.4
≥ 55	01	3.7
Gender		
Male	6	22.2
Female	21	77.8
Other	00	00.0
Prefer not to say	00	00.0
Marital Status		
Single (never married)	12	44.4
Married	08	28.6
Domestic Partnership	03	11.1
Divorced	04	14.8
Ethnicity		
White	00	00.0
Hispanic or Latino	02	7.4
Black or African American	19	70.4
American Indian or Alaskan Native	00	00.0
Prefer not to say	01	3.7
Native Hawaiian or Pacific Islander	00	00.0
Other	05	18.5

In Table 2, only 22 items were selected with 3 subscales instead: "BRS" (6 items) described efforts to avoid stressful situation; "QID-RS" (10 items) described efforts to deal with the stressful situation; and "Emotional Intelligence" (6 items) described efforts to keep a positive attitude despite stressful situation. These were rated by participants (n =27) on a 5-point Likert-type scale: 1 = Never; 2 = Almost Never; 3 = Sometimes; 4 = Fairly Often; and 5 = Very Often. Scores were determined by the mean of items per subscale. Also, the items were referenced from Ahmad, Alzayyat, and Al-Gamal (2018). Scores were in the following interpretations: 0-1.66, **Low**; 1.67-3.33, **Moderate**; and 3.34-5.00, **High**.

We performed CFA to assess construct validity (Nguyen et al., 2022) of the subscales in the CBA with an assumption that the factors are correlated based on literature (Kenig, 2022). The tested model has three dimensions. Although Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) test usually appears in exploratory factor analysis or EFA, these were included in this CFA (1) to find out if items correlate to each other if found statistically. Moreover, Bartlett's test of sphericity and KMO results has been the basis for further analysis (Sadtyadi, 2018) like CFA.

The CFA model for the questionnaire was thought of as a single-order, multidimensional model (Bikos, 2022). Each of the 22 items loaded onto one of the 3 factors. Unstandardized factor loadings ranged between .535 and .67 on Latent Factor 1/Subscale: "BRS" between .21 and .906 on Latent Factor 2/Subscale: "**QIDS**" and between .223 and .88 on Latent Factor 3/Subscale: "Emotional Intelligence". Except items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13, factor loadings were above the .50 threshold (Liao, Huang, & Wang, 2022). Alternatively, a loading factor value of > .30 will still be a good item (Faradillah & Adlina, 2021) such as items 6, 14, and 15. These indicate that the degree of item relationships to their specific factor were adequate (Bean, 2021).

The fit indices suggest that the confirmatory factor analysis (CFA) model may not adequately fit the data. The Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values are both below the recommended cutoffs

of .95 and .90, respectively, indicating poor model fit in terms of incremental fit. Additionally, the Root Mean Square Error of Approximation (RMSEA) value of .140, along with its confidence interval [.111, .168], exceeds the acceptable range of .05 to .08, further indicating inadequate fit in terms of absolute fit. Moreover, the Standard Root Mean Square Residual (SRMR) value of .126 is above the recommended threshold of <.08, indicating poor model fit in terms of model parsimony. Overall, these findings suggest that the CFA model may not accurately represent the underlying structure of the data.

Item correlations were interpreted in the following: above .5, strong; .3 to .5 moderate; and 0 to .3, weak (Turney, 2022; Swan, 2023). So, items with a correlation coefficient > .3 per subscale were identified. These were found between item 6 and item 3; item 6 and item 4; item 14 and item 2; item 14 and item 6; item 15 and item 3; item 15 and item 14.

Significant factor correlations were found between “To adopt different strategies to solve problems,” and “To quarrel with others and lose temper,” ““To adopt different strategies to solve problems,” and “To expect miracles so one does not have to face difficulties,” and “To cry, feel moody, sad and helpless.” And “To avoid teacher”, “To cry, feel moody, sad and helpless.” And quarrel with others and lose temper.”, “To cry, feel moody, sad and helpless” and “To adopt different strategies to solve problems,” and “To cry, feel moody, sad and helpless during the COVID-19 outbreak.” and “To quarrel with others and lose temper.” The responses were collectively provided by all participants in the experimental group and sourced from the "Nursing School Stress and Well-being Questionnaire Phase 2.

Table 2

Confirmatory Factor Analysis

Subscale	Factor Loading	CR	AVE
BRS		.739	.364
1. To avoid duties during clinical practice.	.535		
2. To avoid teachers.	.678		
3. To quarrel with others and lose temper.	.584		
4. To expect miracles so one does not have to face difficulties	.670		
5. To expect others to solve the problem.	.538		
QIDS		.847	.555
6. To adopt different strategies to solve problems.	.214		
7. To set up objectives to solve problems.	.789		
8. To make plans, list priorities, and solve stressful events.	.906		
9. To have confidence in performing as well as senior schoolmates.	.810		
10. To adopt different strategies to solve problems.	.794		
Factor 5 (Emotional Intelligence)		.659	.457
11. To keep a positive attitude in dealing with life events.	.888		
12. To see things objectively.	.814		
13. To have confidence in overcoming difficulties.	.882		
14. To cry, feel moody, sad and helpless.	- .223		
15. To cry, feel moody, sad and helpless during the COVID-19 outbreak.	- .067		

Note. Composite Reliability, CR; Average Variance Extracted, AVE

The composite reliability (CR) of each latent variable and the average variance extracted (AVE) were calculated using an Excel spreadsheet (accessible at https://www.analysisinn.com/post/how-to-calculate-average-variance-extracted-and-composite-reliability/). CR assessed the internal consistency of indicators within a single domain while AVE measured the amount of variance in the indicators explained by each domain compared with the variance explained by measurement error (Verdugo-Alonso et al., 2017). CR of BRS (.739) and QUID (.847) were reliable based on the cutoff ≥ .70 (Cheung et al., 2023) except Factor 5 = .659.

AVE for first-order factors should exceed .50 (50%) to show convergent validity (Cheung et al., 2023; Nguyen et al., 2022). The AVE was higher than 50% in QUID (.555). On the other hand, BRS (.364) and Factor 5 (.457) did not meet the cutoff.

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On the other hand, the correlation coefficient between subscales should not exceed the square root of the

AVE (Dragan & Topolšek, 2014) to conclude discriminant validity. Square root of each AVE for BRS, QIDS, and Factor 5 (Emotional Intelligence) were .603, .745, and .676.

Table 3

Item ratings of BRS, QIDS, and Emotional Intelligence (n = 27)

Subscale		Mean		*SD*	Interpretation	Cronbach's α	McDonald's ω
BRS							
1.	I tend to bounce back quickly after hard times.	2.22	±	0.909	Moderate	.857	.874
2.	I have a hard time making it through stressful events.	2.88	±	0.927	Moderate	.850	.870
3.	It does not take me long to recover from a stressful event.	3.66	±	0.825	High	.862	.879
4.	It is hard for me to snap back when something bad happens.	2.63	±	0.888	Moderate	.848	.868
5.	I usually come through difficult times with little trouble.	2.85	±	1.014	Moderate	.866	.879
6.	I tend to take a long time to get over setbacks in my life.	2.59	±	1.183	Moderate	.857	.874
QIDS							
7.	Falling Asleep	2.59	±	1.161	Moderate	.850	.869
8.	Sleep During the Night	2.93	±	1.034	Moderate	.854	.872
9.	Waking Up Too Early	2.00	±	1.025	Moderate	.847	.867
10.	Sleeping Too Much	1.20	±	.558	Low	.858	.876
11.	Feeling Sad	1.71	±	.750	Moderate	.847	.864
12.	Decreased Appetite	1.46	±	0.636	Low	.849	.866
13.	Increased Appetite	1.56	±	0.776	Low	.858	.875
14.	Decreased Weight (Within the Last Two Weeks)	1.44	±	0.673	Low	.853	.869
15.	Increased Weight (Within the Last Two Weeks)	1.59	±	0.974	Low	.860	.877
Emotional Intelligence							
16.	Concentration/ Decision Making	1.90	±	0.800	Moderate	.845	.862
17.	Perception of myself	1.49	±	0.840	Low	.850	.867
18.	Thoughts of my own death or suicide	1.15	±	0.422	Low	.857	.873
19.	General interest	1.71	±	0.873	Moderate	.848	.866
20.	Energy level	1.83	±	0.863	Moderate	.849	.867
21.	Feeling slowed down	1.41	±	0.67	Low	.852	.868
22.	Feeling restless	1.56	±	0.673	Low	.844	.859
	Overall	**2.02**	**±**	**0.432**	Moderate	**.859**	**.875**

Nursing students had low "BRS" (*M* = 1.50) in the following items: "I tend to bounce back quickly after

hard times" (Q1) (*M* = 2.22); "I have a hard time making it through stressful events" (Q2) (*M* = 2.88); "It does not take me long to recover from a stressful event" (Q3) (*M* = 3.66); "It is hard for me to snap back when something bad happens" (Q4) (*M* = 2.63); "I usually come through difficult times with little trouble" (Q5) (*M* = 2.85); "I tend to take a long time to get over set-backs in my life" (Q6) (*M* = 2.59).

In terms of "QID-RS," they scored high (*M* = 3.41) in the following items: "Falling Asleep" (Q7) (*M* = 2.59); "Sleep During the Night" (Q8) (*M* = 2.93); "Waking Up Too Early" (Q9) (*M* = 2.00); "Sleeping Too Much" (Q10) (*M* = 1.20; "Feeling Sad" (Q11) (*M* = 1.71); "Decreased Appetite" (Q12) (*M* = 1.46); "Increased Appetite" (Q13) (*M* = 1.56); "Decreased Weight (Within the Last Two Weeks)" (Q14) (*M* = 1.44); "Increased Weight (Within the Last Two Weeks)" (Q15) (*M* = 1.59); and "Concentration/Decision Making" (Q16) (*M* = 1.90).

Lastly, students had [high] "Emotional Intelligence" (*M* = 3.74) in the following items: "View of Myself" (Q17) (*M* = 1.49); "Thoughts of Death or Suicide" (Q18) (*M* = 1.15); "General Interest" (Q19) (*M* = 1.71); "Energy Level" (Q20) (*M* = 1.83); "Feeling slowed down" (Q21) (*M* = 1.41); and "Feeling restless" (Q22) *(M* = 1.56*)*. Altogether, the results amounted to a moderate score (*M* = 4.00).

In Table 3, Cronbach's alpha (α) and McDonald's omega (ω) were calculated for the scale reliability. The interpretation of Cronbach's α was referenced from Arof, Ismail, and Saleh (2018) as follows: > .90, Excellent; .80 to .89, Good; .70 to .79, Acceptable; .60 to .69, Questionable; .50 to .59, Poor; and < .59, Unacceptable. The range of inter-item correlations must be between .15 and .85 while the average inter-item correlation must be between .15 and .50 (Paulsen & BrckaLorenz, 2017).

By McDonald's ω, ≥ .70 is recommended (McNeish, 2018). However, for small samples (e.g., ≤ 200), a cutoff of ≥ .65 can be used (Nájera Catalán, 2019). In spite ω coefficient (i.e., based on estimates of uniqueness from factor analysis) has been known better than α coefficient (i.e., based on correlation between items) as a measure of internal consistency (Trizano-Hermosilla & Alvarado, 2016; Stensen & Lydersen, 2022), use of the latter continues (Raykov & Marcoulides, 2019).

The "BRS" subscale consisted of 6 items (α = .832; ω = .837), the "QIDS" subscale consisted of 10 items (α = .785; ω = .836), and the "Emotional Intelligence" subscale consisted of 5 items (α = .726; ω = .788). The overall item reliability statistics consisted of 22 items (α = .828; ω = .848). Reliability was excellent. No items were ≤ .59. Overall, the range of item-rest correlations was between .285 and .629, and the average item-rest correlation was between .208 and .306 did meet the recommended criteria. By ω coefficients, the questionnaire had excellent reliability.

This study examined the effectiveness of a short virtual education on depression and assessed the effects of the participant's understanding and management of depression-related issues in nursing school. A total of 28 students were randomly assigned to either the experimental group (n = 13) or the control group (n = 13). The experimental group received virtual education on three learning activities encompassing Dorothy Johnson's Behavioral System Model Theory seven subsystems: (1) Attachment; (2) Achievement; (3) Aggressive; (4) Dependence; (5) Sexual; (6) Ingestive; and (7) Eliminative, while the control group received no intervention.

The median test score for the experimental pretest is 2.14 with an interquartile range *(IQR)* of 0.545 and the experimental posttest median is 1.88 with an *IQR* 0.719. The median test score for the control group pretest is 2.02 with an *IQR* 0.659 and the control group posttest median 2.01 with an *IQR* 0.513. An independent *t*-test was conducted to compare the two groups. The *t*-statistics for the pretest is - 0.0159, with df = 23 (*p* = .987), and the *t*-statistics for the posttest is 0.4338, with df = 29 (*p* = .668).

The effect size for the difference between the groups was calculated using Cohen's d, resulting in a value of - 0.005 which is considered a small effect size for the pretest, and a value of 0.140 which is also a small effect size for the posttest.

Table 4 shows there is no significant difference between the median test scores of the experimental group and the control group. These findings suggest that the virtual education on depression and the assessments of the effects of the participant's understanding and management of depression-related issues in the context of nursing school didn't improve test performances with a small effect size.

If the data follows a normal sample distribution, the Student's *t*-test is applied; otherwise, the group outcome comparison is determined using the Mann-Whitney U test. In cases where there is unequal variance, indicating a violation of homogeneity, the Welch's *t*-test is required. Shapiro–Wilk test of normality is not significant for the pretest (*p* = 0.585) and posttest (*p* = 0.769), indicating that the sample distribution is normal and the Levene's test of equality of variances is not significant for the pretest (*p* = 0.475) and posttest (*p* = 0.956), indicating that variances are equal between groups.

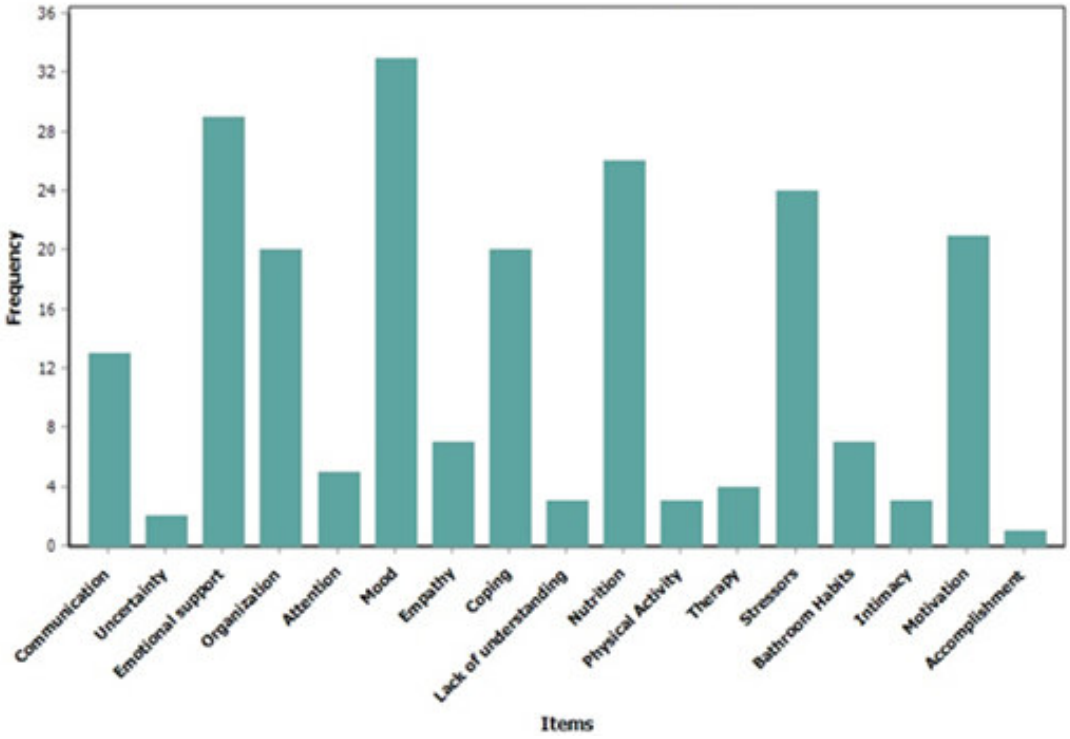
Table 4
Independent Samples T-Test

	Statistic	df	*p*	*Sig. (≤ .05)*		Effect Size
Pretest Average						
Student's t	-0.611	39	.545	not significant	Cohen's d	-0.205
Welch's t	-0.57	20	.575	not significant	Cohen's d	-0.198
Mann-Whitney U	162		.585	not significant	Rank biserial correlation	0.110
Post Test Average						
Student's t	0.395	39	.695	not significant	Cohen's d	0.132
Welch's t	0.436	30.3	.666	not significant	Cohen's d	0.139
Mann-Whitney U	171		.769	not significant	Rank biserial correlation	0.060

Note. H_a $\mu_{Control} \neq \mu_{Experiment}$

Qualitative Data

Figure 3. QDA Miner Bar Graph illustrating the frequency of code distribution
Figure 3. Distribution of themes



Qualitative Phase

The qualitative phase of our study revealed several key themes regarding nursing students' experiences, each supported by corresponding verbal responses. Emotion emerges as a central theme, as expressed by participants feeling heightened stress and pressure toward the end of their program (P1). Attachment to support systems, whether through speaking with someone or seeking emotional support from friends, is highlighted (P2, P3, P4, P8). Motivation plays a significant role, with participants drawing on their reasons for pursuing nursing and support networks to stay motivated (P4).

Nutrition emerges as a concern, with participants admitting to sacrificing healthy eating habits due to time constraints (P5). Well-being is a recurring theme, evidenced by activities to relax and manage stress, seeking help from counselors (P6, P7), and engaging in social interactions to enhance mood (P9). Stressors related to balancing school, work, and family responsibilities are also evident (P10). Finally, empathy is emphasized as a crucial support aspect, suggesting active listening and empathetic communication as effective strategies for assisting peers (P11).

These themes collectively highlight nursing students' multifaceted challenges and the importance of emotional support, motivation, and self-care in navigating their educational journey.

Verbal Responses in Question 1: (P1) "Now I feel like we're getting closer to the end and the stress is a little bit more harder, there's more expectation and you're literally down to the wire it towards the end." This response correlates with our theme of emotion.

Verbal Responses in Question 2: (P2) "Yes, I think that's true. And it also put me at ease when speaking to someone and I don't know how I feel." This response correlates with our theme of attachment.

Verbal Responses in Question 3: (P3) "Because nursing school In general, it's difficult and sometimes you do need a little extra support because there is instances where I feel like ohh I'm giving up or like you reach hardships where you're going to fail. So I like seeing my friends, friends emotional support." This response correlates with our theme of emotional support.

Verbal Responses in Question 4: (P4) "I also I remember the reasons why I am in nursing school and that helps to motivate me in addition to my support group at school, I have a group of friends that you know I'm able to talk to and who are there to encourage me." This response correlates with our theme of Motivation.

Verbal Responses in Question 5: (P5) "Yeah, I'm often too tired to you know cook, it takes at least an hour or two to make a decent healthy meal. Sometimes, if I'm too busy or too tired I don't want to spend time doing that so I I'd rather go for a quick meal somewhere even though I know it's not healthy I'd rather do that sometimes." This response correlates with our theme of nutrition.

Verbal Responses in Question 6: (P9) "And when I do have time, we definitely go, like, we'll go to the movies, we'll go to the park, we'll go to the parking lot, OK." This response correlates with our theme of well-being.

Verbal Responses in Question 7: (P7) "I seek out help from the school counselor to help me navigate stressors and how to relieve them." This response correlates with our theme of well-being.

Verbal Responses in Question 8: (P8) "Yes, seeking support from my colleagues helps me to, I guess, vent and let out whatever I'm feeling." This response correlates with our theme of emotional support.

Verbal Responses in Question 9: (P9) "No. From like when I'm in school like compared to when I'm not in school, yes, no, no changes really. I'm actually more active down like socially than before because I'm usually quiet. But when I'm in school, you know, you know, I interact a little bit more." This response correlates with our theme of mood.

Verbal Responses in Question 10: (P10) "I sometimes I reach out to them when like I'm going to lie in school sometimes. You know, there's just a. Lot of work. And then I have you. Know I'm going to school full time and I work full time. And then you know, it's a lot when I come home. And I have. To you know. Has a lot. To do with my son. And then I gotta study. And then I'm gonna give the family time. And I still gotta find time. Commercials to study. Comes home and find time for me." This response correlates with our theme of stressors.

Verbal Responses in Question 11: (P11) "The best thing is just to listen to them, really, to instead of like trying to find a a rebuttal or find a way to like calm the situation. The best thing is just sit, stand there, let them know that you're listening to them and try to communicate with them more. Empathetically you use empathy instead of sympathy." This response correlates with our theme of empathy.

4. Discussion

Given that the composite reliability (CR) of Factor 5 (.659) was less than .70 and the average variance extracted (AVE) of BRS (.364) and Factor 5 (.457) was less than .50 according to the confirmatory factor analysis (CFA) results, a thorough review of the measurement model is warranted to replicate this study and ensure alignment with theoretical constructs. Potential actions to address this include item removal, utilization of modification indices, exploration of alternative models, and consideration of additional data collection. Cross-validation and expert review can further validate and refine the measurement model.

By applying Dorothy Johnson's Behavioral System Model (BSM) Theory, our study targeted stress-related behaviors and depression prevention through individual interventions and behavioral monitoring. Virtual teaching facilitated the development of time management skills, offered flexibility, and supported self-paced learning, aligning with findings from McKenzie and Murray (2010).

The qualitative outcomes underscore the possible transformative benefit of integrating virtual teaching within Johnson's theoretical framework to promote academic performance while mitigating stress and depression. The study indicates that such interventions can be optimized as mental health support in nursing schools, laying the groundwork for future research on effective strategies to address challenges faced by students in the demanding field of nursing.

The nursing students' verbal responses offer insights into various themes relevant to nursing education and well-being. The first response reflects the emotional strain experienced towards the end of academic pursuits, aligning with the theme of emotion. Subsequent responses highlight the importance of attachment, emotional support, and motivation in navigating challenges faced during nursing school. Additionally, concerns about

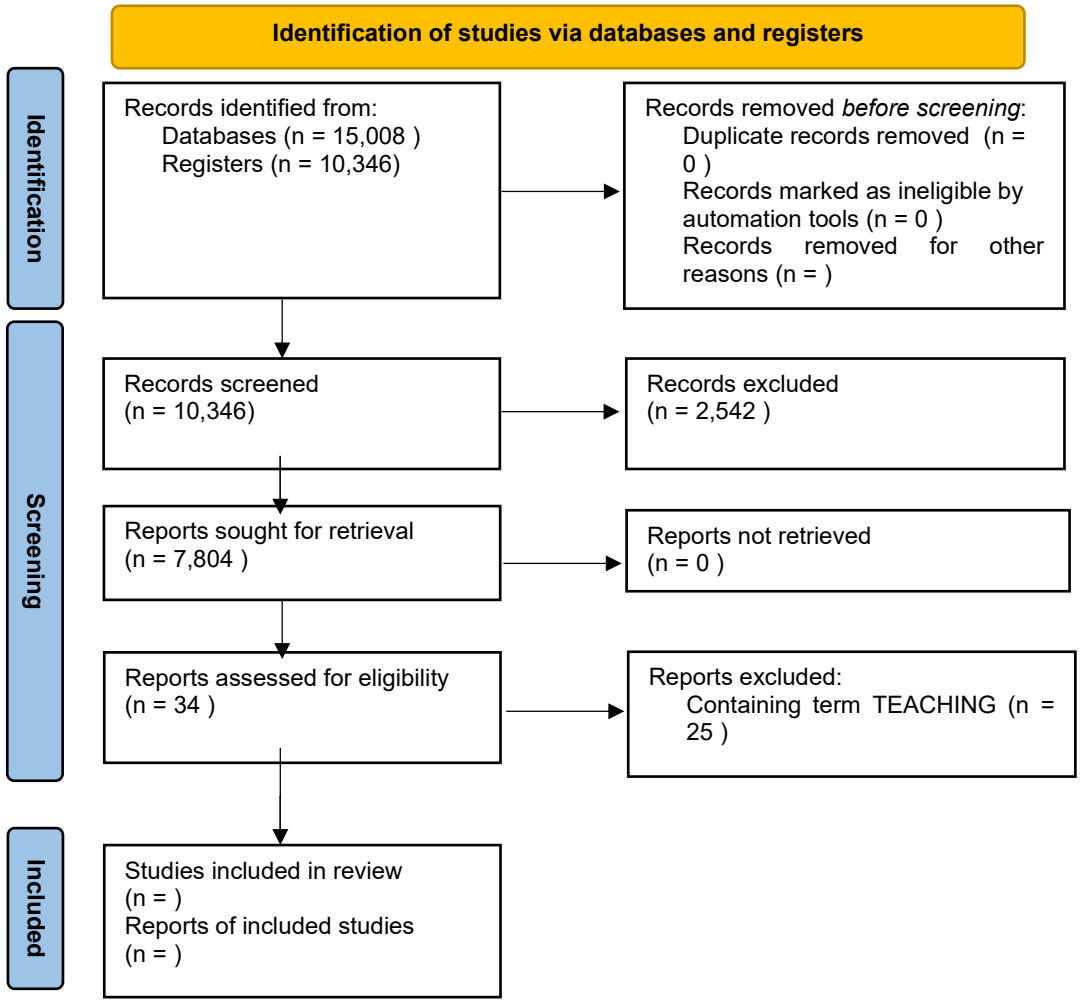
nutrition, well-being, and stress management emerge, underscoring the multifaceted nature of student experiences. Notably, seeking support from counselors and colleagues, engaging in leisure activities for well-being, and utilizing empathetic communication strategies are identified as coping mechanisms. These themes collectively contribute to a deeper understanding of the complex interplay between academic demands, personal well-being, and support systems in the context of nursing education.

In summary, this study sheds light on the promising role of virtual teaching in bolstering the mental well-being and academic resilience of nursing students. By leveraging theoretical frameworks and empirical data, the findings highlight the importance of tailored interventions and proactive monitoring in mitigating stress and depression among students. Furthermore, the study underscores the broader potential of virtual teaching to revolutionize education, offering flexibility and empowerment to learners across diverse settings.

5. Conclusion

This study contributes to our understanding of mental health challenges, particularly depression, among nursing students in the demanding environment of nursing school. Employing Dorothy Johnson's Behavioral System Model (BSM) Theory as a guiding framework, the study targeted stress-related behaviors and implemented virtual teaching interventions to prevent depression. The impact of virtual teaching on mental well-being and academic resilience qualitatively underscores the transformative potential of such interventions within nursing education, with implications extending to broader educational contexts. By emphasizing the importance of maintaining behavioral equilibrium for students' well-being and academic success, this study provides valuable insights that can guide the development of effective strategies to support students in challenging academic environments.

Figure 4. PRISMA Model (Page et al., 2021)



References

1. Ahmad, M. M., Alzayyat, A., & Al-Gamal, E. (2018). Coping behavior inventory: Psychometric properties with Arab universities' students. *Journal of Nursing Measurement, 26*(1).

https://www.researchgate.net/profile/Muayyad-Ahmad-3/publication/323935568_Coping_Behavior_Inventory_Psychometric_Properties_With_Arab_Universities'_Students/links/5b1eeacd0f7e9b0e373dd124/Coping-Behavior-Inventory-Psychometric-Properties-With-Arab-Universities-Students.pdf

2. Bean, J. (2021, October 13). Using R in social work research. The Ohio State University. https://bookdown.org/bean_jerry/bookdown_r_for_social_workers/confirmatory-factor-analysis.html
3. Bikos, L. H. (2022, September 12). Recentering psych stats: Psychometrics. https://lhbikos.github.io/ReC_Psychometrics/CFA1st.html
4. Boumosleh, J. M., & Jaalouk, D. (2017a). Depression, anxiety, and smartphone addiction in university students- A cross sectional study. *PLOS ONE*, *12*(8), e0182239. https://doi.org/10.1371/journal.pone.0182239
5. Brown, E. S., Murray, M., Carmody, T. J., Kennard, B. D., Hughes, C. W., Khan, D. A., & Rush, A. J. (2008). The Quick Inventory of Depressive Symptomatology-Self-report: A psychometric evaluation in patients with asthma and major depressive disorder. *Annals of Allergy, Asthma & Immunology, 100*(5), 433-438. https://doi.org/10.1016/S1081-1206(10)60467-X
6. Chen, B., Yang, T., Xiao, L., Xu, C., & Zhu, C. (2023). Effects of Mobile mindfulness Meditation on the mental Health of university Students: Systematic review and Meta-analysis. *Journal of Medical Internet Research*, *25*, e39128. https://doi.org/10.2196/39128
7. Chen, X., Zhang, B., Jin, S.-X., Quan, Y.-X., Zhang, X.-W., & Cui, X.-S. (2021). The effects of mindfulness-based interventions on nursing students: A meta-analysis. *Nurse Education Today*, *98*, 104718. https://doi.org/10.1016/j.nedt.2020.104718
8. Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., & Wang, L. C. (2023). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia Pacific Journal of Management*, 1-39. https://doi.org/10.1007/s10490-023-09871-y
9. Dragan, D., & Topolšek, D. (2014, June). Introduction to structural equation modeling: Review, methodology and practical applications. In The International Conference on Logistics & Sustainable Transport (Vol. 6, pp. 19-21). https://www.researchgate.net/profile/Dejan-Dragan-2/publication/267810858_Introduction_to_Structural_Equation_Modeling_Review_Methodology_and_Practical_Applications/links/545acf900cf25c508c319c8b/Introduction-to-Structural-Equation-Modeling-Review-Methodology-and-Practical-Applications.pdf
10. Li, N., Huang, J., & Feng, Y. (2020). Construction and confirmatory factor analysis of the core cognitive ability index system of ship C^2 system operators. *Plos One, 15*(8), e0237339. https://doi.org/10.1371/journal.pone.0237339
11. Liao, H. C., Huang, C. Y., & Wang, Y. H. (2022). Development and psychometric testing of a scale measuring caring behaviors for healthcare students and providers. *Medical Education Online*, *27*(1), 2066496. https://doi.org/10.1080/10872981.2022.2066496
12. McKenzie, K & Murray, A 2010, 'E-learning benefits nurse education and helps shape students' professional identity', Nursing Times, vol. 106, no. 5, pp. 17-9. http://www.nursingtimes.net/e-learning-benefits-nurseeducation-and-helps-shape-students-professional-identity/5011215.article
13. McNeish, D. (2018). Thanks coefficient alpha, we'll take it from here. *Psychological Methods, 23*(3), 412. https://rameliaz.github.io/files/kuliah/matrikulasi-mapsi/mcneish.pdf
14. Nájera Catalán, H. E. (2019). Reliability, population classification and weighting in multidimensional poverty measurement: A Monte Carlo study. *Social Indicators Research, 142*(3), 887-910. https://doi.org/10.1007/s11205-018-1950-z
15. Ozturk, F. O., & Tekkas-Kerman, K. (2022). The effect of online laughter therapy on depression, anxiety, stress, and loneliness among nursing students during the Covid-19 pandemic. *Archives of psychiatric nursing*, *41*, 271–276. https://doi.org/10.1016/j.apnu.2022.09.006
16. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., & Chou, R. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. International Journal of Surgery, 88, 105906. https://doi.org/10.1016/j.ijsu.2021.105906; http://prisma-statement.org/documents/PRISMA_2020_flow_diagram_new_SRs_v1.docx
17. Paulsen, J. & BrckaLorenz, A. (2017). Internal consistency. FSSE Psychometric Portfolio. https://scholarworks.iu.edu/dspace/handle/2022/24498
18. Raykov, T., & Marcoulides, G. A. (2019). Thanks coefficient alpha, we still need you!. *Educational and Psychological Measurement, 79*(1), 200-210. https://journals.sagepub.com/doi/pdf/10.1177/0013164417725127
19. Rush, A. J., Trivedi, M. H., Ibrahim, H. M., Carmody, T. J., Arnow, B., Klein, D. N., Markowitz, J. C., Ninan, P. T., Kornstein, S., Manber, R. and Thase, M. E., 2003. The 16-Item Quick Inventory of Depressive

Symptomatology (QIDS), clinician rating (QIDS-C), and self-report (QIDS-SR): A psychometric evaluation in patients with chronic major depression. *Biological Psychiatry, 54*(5), 573-583. https://doi.org/10.1016/S0006-3223(02)01866-8

20. Sadtyadi, H. (2018). Performance assessment and the factors inhibiting the performance of Buddhist education teachers in the teaching duties. *Research and Evaluation in Education, 4*(2), 136-143. http://dx.doi.org/10.21831/reid.v4i2.21940
21. Santangelo, O. E., Provenzano, S., Giordano, D., Alagna, E., Armetta, F., Gliubizzi, C., Terranova, A., D'Anna, G., Barresi, D., Grigis, D., Genovese, C., Squeri, R., & Firenze, A. (2019). Nursing students and depressive symptomatology: An observational study in university of palermo. *Mental Illness*, *11*(2), 25–31. https://doi.org/10.1108/mij-10-2019-0006
22. Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine, 15*,194-200. https://www.researchgate.net/publication/23164897_The_Brief_Resilience_Scale_Assessing_the_Ability_to_Bounce_Back
23. Stensen, K., & Lydersen, S. (2022, August 29). Internal consistency: from alpha to omega?. *Tidsskr Nor Legeforen*. https://doi.org/10.4045/tidsskr.22.0112
24. Thomas, L. M. (2022). Stress and depression in undergraduate students during the COVID-19 pandemic: Nursing students compared to undergraduate students in non-nursing majors. *Journal of Professional Nursing*, *38*, 89–96. https://doi.org/10.1016/j.profnurs.2021.11.013
25. Trizano-Hermosilla, I., & Alvarado, J. M. (2016). Best alternatives to Cronbach's alpha reliability in realistic conditions: Congeneric and asymmetrical measurements. *Frontiers in Psychology, 7*, 769. https://doi.org/10.3389/fpsyg.2016.00769
26. Veling, W., Lestestuiver, B., Jongma, M., Hoenders, R., & Van Driel, C. (2021). Virtual reality relaxation for patients with a psychiatric disorder: Crossover Randomized Controlled trial. *Journal of Medical Internet Research*, *23*(1), e17233. https://doi.org/10.2196/17233
27. Verdugo-Alonso, M. A., Henao-Lema, C. P., Córdoba-Andrade, L., & Arias González, V. B. (2017). Dimensionality and internal structure of the Colombian version of the INICO-FEAPS quality of life scale. *Journal of Intellectual Disability Research, 61*(12), 1094-1103. https://www.researchgate.net/publication/320326481_Dimensionality_and_internal_structure_of_the_Colombian_version_of_the_INICO-FEAPS_quality_of_life_scale