Research Article

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Effect of Smartphone Addiction, Self-Esteem, and Mental Health on Grit among Nursing Students: A Cross-Sectional Study

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Abstract

Grit is a sense of strength, patience, and persistence which helps students to overcome challenges. It is considered as an indicator of academic success and well-being. However, research on factors associated with grit is limited, especially among nursing students. This cross-sectional study examined the relationship of smartphone addiction, self-esteem, and mental health on grit and grade point average (GPA) among nursing students in Thailand. A total of 989 nursing students completed a paper-based survey measuring smartphone addiction, self-esteem, depression, anxiety, stress, grit, GPA along with demographic items. Grit is negatively related to depression, anxiety, stress, and smartphone addiction (r = -.51, r = -.37, r = -.42, r = -.36, respectively, with $p < 0.001$), but positively associated with self-esteem (r = .56, p <0.001). The GPA was higher among the participants who reported fewer depressive symptoms (r = -.09, $p < 0.001$), higher self-esteem (r = .13, $p < 0.001$), and higher grit (r = .17, p <0.001). Self-esteem, smartphone addiction, and depression are the significant predictors for grit with adjusted R^2 = 0.379, F (5,985) = 121.11, p <0.001. Class level and grit significantly predicted G.P.A with adjusted R^2 = 0.140, F (5,850) = 28.755, p <0.001. Nursing programs as well as mental health professionals may routinely screen for psychological disturbance in nursing students who have potential risks for mental health and smartphone addiction. Health promotion programs to help nursing students manage their physical and mental health while building stronger grit may be the key to nursing students' success.

Keywords: Grit, Mental health, Self-esteem, Smartphone addiction, Nursing student

What was Known

- Mental health problems have become prominent among young adults.
- Nursing students face significant mental health challenges that impact their academic success.

What's New and Next

- Self-esteem, smartphone addiction, and depression are associated with grit and academic success of nursing students.
- Further research is needed to improve mental health and grit among nursing students.

Introduction

Grit, defined as passion and perseverance for long-term goals, is a personality trait that is key to academic success and career achievement.[1] Shih and Maroongroge indicate that grit is expected to become an important metric in medical education.[2] Also, when using Grade Point Average (GPA) as an indicator of academic success, a study conducted in a large university in the U.S. found a significant positive relationship between cumulative GPA and grit.[3] In nursing profession, nurses face significant challenges and exposure to stressful situations throughout their career and require high levels of grit and perseverance to achieve success and avoid burnout.[4] Starting at the beginning of the nursing path, nursing students are challenged to think in a way that will prepare them for clinical practice in a complex environment and all these require them to do multiple academic tasks such as coursework, assignments, and clinical work.[5] There is increasing evidence to support the concept that grit is a driver of career success and avoidance of burnout particularly in the setting of hardship.[6] However, research on factors affected on grit among nursing students has been scarce. Only one study reported that grit level increased with an increase in age, the number of years studied, and academic performance. It also discussed that students who were motivated by television to enter nursing profession and spent more hours watching television had lower grit.[7]

One of the most important features of the growing modern society is the impact of communication tools, especially on the internet and mobile phones, which is undoubtedly affecting young people, especially nursing students. Smartphone addiction is a behavioral addiction to activities such as internet games, social media or gambling that manifests in

symptoms such as not being able to stay away from the smartphone, checking the smartphone frequently, and deterioration of sleep quality due to excessive smartphone use.[8] The effects of smartphone addiction among students can cause academic success, physical health problems, as well as psychological problems including social anxiety, stress, disturbed sleep, and depression.[9, 10] However, none of these studies were conducted among nursing students.

Self-esteem plays a critical role in building mental well-being. Self-esteem is the belief in one's own worth or abilities which may be influenced by emotional states such as triumph, despair, pride, and humiliation.[11] While self-esteem has been explored, the relationship of self-esteem, grit, and academic success is inconsistent. In one recent study, self-esteem was found to be significantly associated with grit.[12] Furthermore, low grit was found to be consistently highly correlated with mental health issues such as stress, depression, and anxiety.[13] Zhang and colleagues found that one component of grit such as consistency of interests was negatively correlated to depression, anxiety, and stress while the perseverance of effort was negatively correlated to depression but not anxiety and stress.[14] A few studies also found a negative correlation between grit and chronic illness in high school and college students.[14, 16]

When conducting literature search on grit, it is found that while grit concept has been promoted as one of academic success indicators, this concept has been understudied especially in nursing student population. And, as the grit concept is fairly new and intertwined with various concepts including smartphone addiction, self-esteem, and mental health issues, the conceptual framework (Figure 1) was created in order to examine the effect of smartphone addiction, self-esteem, and mental health on grit and grade point average (GPA) among nursing students.

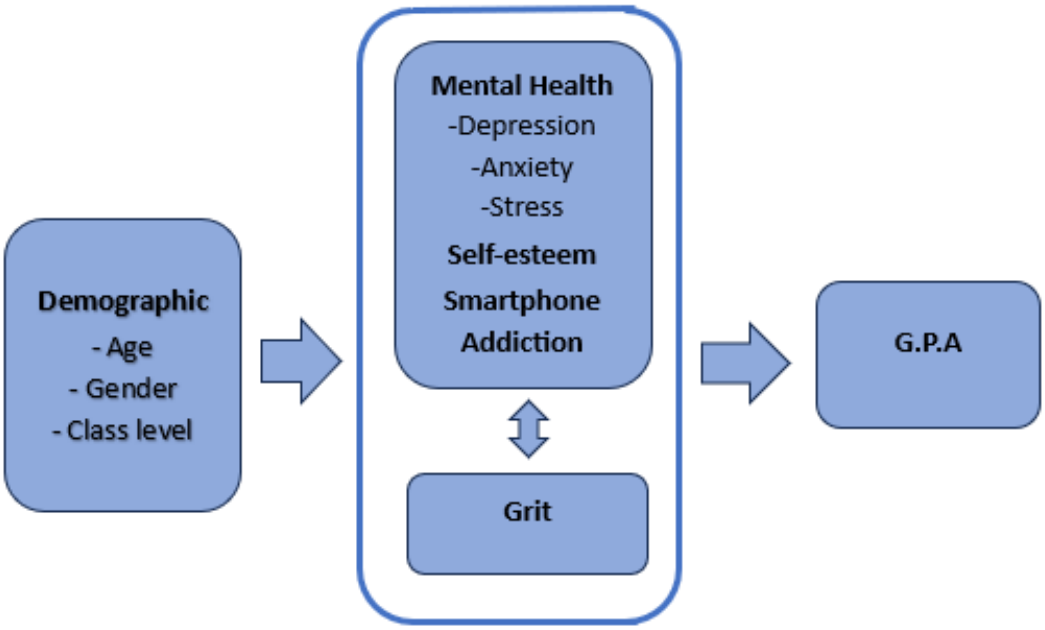

Figure 1 Study's Conceptual Framework

Materials and Methods

1. Study participants and setting

This cross-sectional survey used a non-probability sampling method with a convenience sample of Thai nursing students in one public nursing college and one private university. The participants must be Thai, at least 18 years old, registered in the nursing program in the second semester (period of data collection), able to answer questions, and willing to participate in the study voluntarily. Participants completed the survey on an average of 20 minutes. Once the participants completed the survey, they could enter their email address and phone number if they chose to take part in the random drawing to win one of two cash prizes of 500 baths (~US$15). A total of 996 paper-based surveys were collected with seven surveys unsuitable for analysis due to incomplete data. Thus, data of 989 participants were analyzed in this study.

To ensure a sufficient sample size for multiple regression analyses, G*Power software was used for a priori sample size calculation with the established statistical parameters: a power of 0.9, small effect size 0.15, alpha equals 0.05, and six direct predictors (as shown in the conceptual framework).[17] Since the effect sizes in social science studies are usually smaller than

0.3, the small effect size of 0.15 was used in this calculation.[18] G*Power indicated at least 73 participants are needed.

2. Research instrument

In addition to the demographic information (i.e., gender, age, class level, grade average point), the participants completed the following scales:

Depression, Anxiety, Stress Scale (DASS-21)

DASS-21 has three domains: depression, anxiety, and stress. Each has seven items. The participants were asked to rate their experience on each item over the past week, on a four-point severity scale, ranging from 0 to 3 (0 = never, 1 = occasional, 2 = frequent, 3 = always). The scores were totaled for each domain and then categorized as 'normal', 'mild', 'moderate', 'severe' or 'extremely severe', according to the DASS Manual, with a maximum score of 21 and minimum score of 0.[19] Consistent with a previous study[20], the scale showed internal consistency, for each subscale, depression, anxiety and stress with Cronbach's alpha = 0.81, 0.72, 0.82, respectively.

Smartphone Addiction Scale-Short Version (SAS-SV)

The Smartphone Addiction Scale-Short Version (SAS-SV) is a self-reported scale used to differentiate smartphone addiction. It consists of 10 items with a six-point Likert scale (1 = strongly disagree to 6 = strongly agree). The scale includes questions to help determine whether someone is said to be experiencing smartphone addiction, namely the daily-life disturbance, withdrawal, cyberspace-oriented relationship, overuse, and tolerance. Scoring is calculated by adding all the scores for the 10 items. The highest possible score is 60, and the lowest possible score is 10. The interpretation of the results of the questionnaire is based on male or female respondent. For male, score of 31 or higher indicates smartphone addiction. For female, score of 33 or higher indicates smartphone addiction. Consistent with a previous study[21], the scale showed a good internal consistency, with Cronbach's alpha = 0.87.

Rosenberg Self-Esteem Scale (RSE)

The self-esteem scale is a 10-item self-report measure of global self-esteem.[22] The participants were asked to answer on a four-point Likert scale (1 = strongly disagree to 4 = strongly agree). Reverse scoring was calculated for the negative statements: 2, 5, 6, 8, and 9. Similar to a previous study[23], the scale showed a good internal consistency with Cronbach's alpha = 0.82.

Grit

Short Grit Scale (Grit-S) Thai version contains eight items assessing a respondent's perseverance of effort.[24] The participants were asked to answer on a five-point Likert scale (1 = not like me at all to 5 = very much like me). Reverse scoring was done for statements: 1, 3, 5, and 6. The Grit Scale showed moderate degree of internal consistency with Cronbach's alpha = 0.69 in a recent Thai student sample.[25] For this study, the scale showed a fair internal consistency, with Cronbach's alpha = 0.66.

3. Data Collection Procedure

The data collection process is described as followed: 1) Permission was obtained to collect data from each college/university campus; 2) The researchers trained the data collection team how to distribute the paper-based survey, obtain informed consent, and provide basic assistance to participants; 3) Participants completed the anonymous survey on an average of 20 minutes; 4) Results of all responses and information are anonymous and used only for research and educational purposes.

4. Statistical analysis

SPSS software version 27 was used for data analyses. Descriptive statistics were used to describe demographic characteristics. To compare the grit score between the two groups (i.e., gender, age groups), independent samples t-test was used. One-way ANOVA was used to analyze the difference in the total scores of grit between the three and more groups including class level, mental health (depression, anxiety, and stress), self-esteem, and smartphone addiction. Pearson correlation coefficients were used to explore relationships among demographic variables, mental health, self-esteem, grit, and GPA. Spearman's rho test was used to examine the associations of class level, grit, and GPA. After identifying the correlated variables, multiple regression analysis was used to test the predictability of mental health, self-esteem, and smartphone on the grit among nursing students. For GPA, hierarchical multiple regression analysis was used to control covariates (age and class level) with depression, self-esteem, and grit entered as the potential predictors. The assumptions of the multiple regression analyses were checked including normality, homoscedasticity, and multicollinearity.

Results

Among 989 participants, the majority of the participants were female (93.6%). The average age was 20.48 (*SD* = 2.01). According to DASS manual [17], 14% of the participants were categorized in the moderate to extremely severe depression levels. Approximately, a third (37.4%) were categorized in the moderate to extremely severe anxiety levels while 14.7% were categorized in the moderate to extremely severe stress level. The smartphone addiction is at 28.6%. On the positive side, most reported having average to high self-esteem (97.6%).

For the bivariate analysis of demographic variables, grit mean values were the lowest for extremely severe depression ($p < 0.001$), extremely severe anxiety ($p < 0.001$), severe stress ($p < 0.001$), low self-esteem ($p < 0.001$), and smartphone addiction ($p < 0.001$). GPAs were highest for class level 1 (freshman students) ($p < 0.001$), age less than 20 years old ($p < 0.001$), normal depressive symptoms ($p < 0.05$), and high self-esteem ($p < 0.05$). See Table 1.

Table 1 Demographic Data and Classification of Depression, Anxiety, Stress, Self-esteem, Smartphone Addiction and bivariate analysis with Grit and G.P.A. of Participants (n = 989)

Variables	*Number*	(%)	Grit Mean (±SD)	t/F (p-value)	G.P.A.	t/F (p-value)
Gender						
Female	926	93.6	3.49 (0.51)	.470	3.12 (0.37)	-.725
Male	63	6.4	3.46 (0.55)	(.638)	3.16 (0.37)	(.478)
Class level						
1 (Freshman)	282	28.5	3.53 (0.52)	1.930	3.49 (0.40)	59.472
2 (Sophomore)	274	27.7	3.43 (0.52)	(.123)	3.07 (0.34)	(<.001)
3 (Junior)	188	19.0	3.47 (0.51)		3.01 (0.31)	
4 (Senior)	245	24.8	3.51 (0.50)		3.12 (0.37)	
Age (Mean ±SD)	**20.48±2.01**					
≤20	565	57.1	3.48 (0.52)	-.506	3.19 (0.40)	6.290
>20	424	42.9	3.50 (0.50)	(.613)	3.04 (0.30)	(<.001)
Depression (Mean ±SD)	**6.72±6.13**					
Normal	705	71.4	3.62 (0.47)	61.68	3.15 (0.37)	2.958
Mild depression	141	14.3	3.31 (0.43)	(<.001)	3.04 (0.32)	(.019)
Moderate depression	111	11.2	3.02 (0.45)		3.10 (0.40)	
Severe depression	22	2.2	2.91 (0.44)		3.05 (0.28)	
Extremely severe depression	9	0.9	2.88 (0.51)		2.97 (0.37)	
	8.10±6.47					

Variables	*Number*	(%)	Grit Mean (±SD)	t/F (*p*-value)	G.P.A.	t/F (*p*-value)
Anxiety (Mean ±SD)						
Normal	509	51.6	3.64 (0.49)	30.94	3.13 (0.35)	0.447
Mild	109	11.0	3.47 (0.52)	(<.001)	3.11 (0.40)	(.775)
Moderate	226	22.9	3.37 (0.50)		3.12 (0.40)	
Severe	81	8.2	3.25 (0.46)		3.15 (0.38)	
Extremely Severe	62	6.3	3.09 (0.50)		3.07 (0.36)	
Stress (Mean ±SD)	**10.90±7.64**					
Normal	712	72.1	3.60 (0.48)	35.47	3.13 (0.37)	0.437
Mild	131	13.3	3.24 (0.46)	(<.001)	3.12 (0.34)	(.782)
Moderate	92	9.3	3.26 (0.49)		3.10 (0.42)	
Severe	50	5.1	3.01 (0.50)		3.06 (0.28)	
Extremely Severe	3	0.3	3.33 (0.36)		3.10 (0.47)	
Self-esteem (Mean ±SD)	**31.53±4.35**					
Low (<23)	23	2.3	2.86 (0.28)	152.22	3.05 (0.30)	4.148
Average (23-32)	532	53.8	3.29 (0.45)	(<.001)	3.09 (0.37)	(.016)
High (>32)	433	43.8	3.76 (0.46)		3.16 (0.36)	
Smartphone addiction (Mean ±SD)	**27.36±9.45**					
Not addicted	706	71.4	3.58 (0.51)	8.794	3.14 (0.36)	1.737
Addicted	283	28.6	3.27 (0.47)	(<.001)	3.09 (0.38)	(.089)

The zero-order correlations ranged from 0.012 – 0.879 (Table 2). Results suggested that significant negative correlations, grit increased when depressive symptoms decreased (r = -.51, p < 0.001), anxiety decreased (r = -.37, p < 0.001), stress (r = -.42, p < 0.001), smartphone addiction decreased (r = -.36, p < 0.001). However, grit increased when self-esteem increased (r = .56, p < 0.001). In addition, the significant correlations suggested that the GPA was higher among the participants who were younger, in a lower-class level, and reported fewer depressive symptoms (r = -.21, r = -.31 and r = -.09, respectively with p < 0.001). On the other hand, the participants with higher GPA reported higher self-esteem (r = .13, p < 0.001) and higher grit (r = .17, p < 0.001). The participants who had higher depressive symptoms reported higher anxiety (r = .68, p < 0.001), stress (r = .76, p < 0.001), and smartphone addiction (r = .36, p < 0.001) but had lower self-esteem (r = -.60, p < 0.001). Participants who had higher anxiety reported higher stress (r = .75, p < 0.001) and smartphone addiction (r = .36, p < 0.001) but had lower self-esteem (r = -.40, p < 0.001). Participants who had higher stress reported higher smartphone addiction (r = .38, p < 0.001) but had lower self-esteem (r = -.49, p < 0.001). Participants who had higher smartphone addiction reported lower self-esteem (r = -.32, p < 0.001).

Table 2 *Correlation matrix of Grit with other variables (n= 989)*

Variables	1	2	3	4	5	6	7	8	9
1. Age	1								
2. Class level †	.879**	1							
3. Depression	-.054	-.079*	1						
4. Anxiety	-.106**	-.139**	.677**	1					
5. Stress	-.081*	-.124**	.764**	.753**	1				
6. Self-esteem	.025	.041	-.604**	-.403**	-.485**	1			
7. Smartphone addiction	-.122**	-.128**	.364**	.361**	.381**	-.320**	1		
8. Grit	.027	-.016	**-.513****	**-.369****	**-.417****	**.558****	**-.357****	1	
9. Grade Point Average (GPA)	**-.206****	**-.311****	**-.090****	-.012	-.049	**.133****	-.061	**.169****	1

†Spearman's rho test, * p < 0.05, ** p < 0.001

Multiple regression analysis was performed to test the model predicting grit (Table 3). The proposed variables including significant mental health determinants (depression, anxiety, and stress), smartphone addiction, and self-esteem were entered. The overall model predicting grit was supported, $F\ (5,985)$ = 121.11, p < 0.001, with three variables significantly predicted grit (depression, self-esteem, and smartphone addiction). The adjusted R^2 value was 0.379 indicating that 37.9% of the variance in grit was explained by this model. In this model, self-esteem was the most powerful variable contributing to grit (β = 0.37, p < 0.001), followed by depression (β = -0.23, p < 0.001) and smartphone addiction (β = -0.16, p < 0.001).

Table 3 *Multiple regression analysis summary for Depression, Anxiety, Stress, Self-esteem, and Smartphone Addiction predicting grit (n = 989)*

	Unstandardized Coefficients		Standardized Coefficients
Variables	B	Std. Error	β
Depression	-.019	.004	-.230**
Anxiety	-.001	.003	-.014
Stress	.000	.003	.007
Self esteem	.043	.004	.368**
Smartphone addiction	-.009	.002	-.156**
Constant	2.485	.140	

Note: R = .618, R^2 adj. = 0.379, $F\ (5,985)$ = 121.11, **p < 0.001

Hierarchical multiple regression analysis was performed to test the model predicting GPA by controlling for age and class level (Table 4). When age and class level were entered in Step 1, class level significantly predicted GPA, $F\ (2,853)$ = 51.94, p < 0.001, adjusted R^2 = 0.11. When adding depression, self-esteem, and grit in Step 2, the overall model predicting GPA was supported, $F\ (5,850)$ = 28.755, p < 0.001, with two variables significantly predicted GPA (class level and grit). The adjusted R^2 value was 0.140 indicating that 14.0% of the variance in GPA was explained by this model.

Table 4 *Hierarchical Multiple Regression Analysis Summary for Depression and Self-esteem, Controlling Age and Class Level, Predicting G.P.A. (n = 855)*

Variables	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	β	R^2	ΔR^2
Step 1				0.106	0.109
Age	.004	.008	.020		
Class level	-.114	.014	-.342**		
Constant	3.333	.143			
Step 2				0.140	0.036
Age	.002	.008	.012		
Class level	-.115	.014	-.346**		
Depression	.000	.003	-.006		
Self-esteem	.006	.004	.077		
Grit	.096	.028	.133**		
Constant	2.834	.192			

Model 1: $R = .329$, R^2 adj. = 0.106, $F(2,853) = 51.942$, $^{**}p < 0.001$

Model 2: $R = .380$, R^2 adj. = 0.140, $F(5,850) = 28.755$, $^{**}p < 0.001$

Discussion

This study reports the associations of grit with both negative and protective factors including mental health issues (depression, anxiety, and stress), smartphone addiction, and self-esteem. This study found that increasing levels of grit negatively correlated with depression, anxiety, and stress. Specifically, the participants categorized in the extremely severe depression and extremely severe anxiety groups had the lowest mean scores of grit. Using a multiple regression analysis, the study found that depressive symptoms significantly predicted grit. This is congruent with the previous study among nursing students in Korea which found negative correlation between depression and grit (r = -.379, p < .001).[26] Musumari and colleagues also found that grit is negatively correlated with scores on measures of depression and anxiety.[25]

This study found that smartphone addiction significantly predicted grit. Since grit is closely tied to perseverance and self-control, it is theorized that grittier individuals are better able to delay gratification and cope adaptively and are thus less likely to rely on maladaptive coping

strategies like smartphone addiction.[27] Individuals who showed the least proneness to smartphone addiction was characterized profile by higher levels of self-control, grit, and mindfulness.[28] Conceptually, it is also possible that chronic smartphone addiction may also lower self-control, in its specification of consistent goals and interest which may lower level of perseverance and passion to accomplish long term goals.[1] Furthermore, this study suggested that when smartphone addiction increased, depression symptoms, anxiety and stress increased. Consistent with previous studies, smartphone addictions can lead to psychological disturbance including depression, anxiety, and stress and may reduce self-esteem.[29, 31] Smartphone addiction can also make it difficult for college students to concentrate in class, leading to a decrease in their academic performance and life happiness. Furthermore, serious smartphone addiction can lead to social anxiety.[32, 34]

When facing difficulties, strong self-esteem helps people to persist for longer and adjust better in society.[22] This study found that self-esteem was the most powerful predictor of grit, consistent with another study which found that grit was significantly correlated with self-perception and positive personality attributes.[34]

When examining GPA as the outcome, this study found that GPA was positively correlated to student age, class level, self-esteem, and grit while it was negatively related to depression. A previous study reported a similar finding that depression was negatively correlated with academic achievement (r = -.230, p = .026).[26] Congruent with another study stating that symptoms of depression, decreased self-esteem might further hinder a student's academic performance.[35] In addition, the study result showed GPA could be predicted by class level (β = -.35, $p < 0.001$) and grit (β = 0.13, $p < 0.001$). In the first year of nursing college, nursing students mostly take fundamental courses. As the nursing students advance to the next academic years, they may be challenged by the clinical rotation which may impact their GPA.

For grit, similar to previous studies[26, 36] this study found found the significant positive correlation between academic achievement and grit. Helping students to become grittier may increase the chance of student's academic and professional success in the long term.

This is the first study examining the relationship of mental health, smartphone addiction, self-esteem, grit, and GPA among nursing students in Thailand. There are limitations to this current research. First, the study uses a convenience sample, so the generalizability is limited. The study also uses a self-reported survey. The Grit Scale is relatively transparent and maybe

vulnerable to social desirability bias, particularly in nursing students. Additionally, the study design is cross-sectional, which limits the directionality of the findings. In a longitudinal design, there would be more opportunities to explore how self-esteem, grit, smartphone addiction, depression, anxiety, and stress interact over time. Furthermore, experimental research is needed to extend the findings of this study into practice and study the efficacy of counselling interventions that simultaneously focus on increasing self-esteem and reducing smartphone addiction, depression, and anxiety to improve grit among nursing students.

Conclusion

In conclusion, mental health, grit, self-esteem, and smartphone addiction issues are complexed and interweaved requiring more research to expand the understanding of these areas. The present findings have implications for nursing programs as well as mental health professionals to routinely screen for psychological disturbance in nursing students who have potential risks for mental health and smartphone addiction. As GPA may be influenced by mental health, self-esteem, and grit, health promotion programs to help nursing students manage their physical and mental health while building stronger grit may be a key to the nursing student success. Nursing colleges may offer extracurricular activities focusing on mental health and grit enhancement such as stress and self-care management workshops, how to become “grittier” training, and social support groups. Nursing college may also adopt a peer counseling program so students may be readily to properly recognize and help other students who are in need.

Ethical Approval Statement

Main Approval was obtained for this project from the institutional Review Board for the Protection of Human Subjects of California State University, Long Beach, U.S.A. (reference# 23-149). The participants were informed of their right to decline or withdraw from this study at any time and for any reason. Written consent forms were obtained from participants prior to data collection. The study was performed in accordance with the Declaration of Helsinki.

Author Contributions

SH co-designed the study, analyzed data and wrote the manuscript. PS co-designed the study, collected data, and reviewed the manuscript. NR co-designed the study and revised the manuscript. PR co-designed the study, obtained IRB approval, and edited the manuscript. All authors read and approved the manuscript prior to submission for publication.

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Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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