Interrelationships of Key Phenomena in Higher Education During and After the COVID-19 Pandemic: Empirical Findings and Theory Development

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This study investigates the interrelationships of key phenomena including students' well-being, their stress levels and associated coping strategies, as well as university resources in order to comprehensively understand the COVID-19 pandemic's impact on higher education services. The cross-sectional survey data is collected from business students at a large American public university located in the west coast. Empirical findings are reported on students' stress coping strategies and university resources that can be better deployed to promote well-being and reduce stress of university students during and after the COVID-19 pandemic. Based on the empirical findings, this study further develops a theoretical framework that articulates a nomological network of interrelationships of key phenomena in higher education during and after the COVID-19 pandemic. Overall, the current study contributes to emerging literature and adds to the understanding of the COVID-19 pandemic's impact on higher education.

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I. INTRODUCTION

In higher education, students' physical and mental well-being is tremendously important for their academic achievements and lifelong success. The unprecedented COVID-19 pandemic has significantly impacted the well-being and academic lives of university students in many aspects, resulting in higher stress, less coursework satisfaction, and lowered sense of belonging in university communities (Capone et al., 2020). Van de Velde et al. (2020) report that student stress has been largely worsened due to confusion and anxiety regarding ever changing pedagogies

and uncertainty during the pandemic semesters.

It is critical to understand how university students perceive their physical and mental well-being and how they turn to university resources to cope with stresses during the pandemic semesters and the ongoing post-pandemic recovery. Although universities have deployed various resources to address students' needs in those regards, given that it is a new and emerging domain, more research is urgently needed to uncover the dynamics and interrelationships of key phenomena in higher education.

Thus motivated, this study investigates the interrelationships of key phenomena including students' well-being, their stress levels and associated coping strategies, as well as university resources in order to comprehensively understand the COVID-19 pandemic's impact on higher education. This study aims to address the following three questions: (1) *How do university students perceive and evaluate their physical and mental well-being as well as stress levels during the pandemic semesters*? (2) *What coping strategies do students adopt to deal with stresses and the extent to which university resources help improve students' well-being during the pandemic semesters?* And (3) *how the key phenomena are interrelated?*

Following prior research (e.g., Finnerty et al., 2021), we investigate the aforementioned phenomena in the higher education context through the following four steps. First, survey data was collected from business students at a large American public university located in the west coast. Second, based on the descriptive analysis, we identified key factors that have a significant impact on students' well-being; additionally, we explored those highly regarded stress coping strategies and university resources that can imporve students' well-being during and after the COVID-19 pandemic. Third, we

examined the weights and significance of the dimensional indicators of key phenomena using the structural equation modeling (SEM) analysis. Finally, based on findings from the third step, we developed a theoretical model of the impact of the COVID-19 pandemic on higher education. The model articulates a nomological network of interrelationships of the key aforementioned phenomena.

II. METHODOLOGY

2.1. Research Procedure

A cross-sectional field survey is deemed appropriate to investigate aforementioned research questions and phenomena. The field survey was administered among undergraduates at the business school of a large American public university located in the west coast. The data was collected in Fall 2021 when the COVID-19 pandemic was at peak nationwide, the campus was in lockdown, and a majority of courses were delivered online. The survey was distributed through Qualtrics, and the survey link was emailed to the participants and also announced in the course site via Canvas. Following previous research (Tehseen et al., 2017), we adopted the procedural remedies to control the risk of obtaining data with the common method variance (CMV).

2.2. Survey Development

The survey was developed with multi-item scales to capture respondents' perceptions and opinions on four principal constructs – student well-being, stress level, associated stress coping strategy, and university resources. Demographic data, including age, coursework hours, ethnicity, gender, annual household income, school year, student status, and work status, was also

collected. The questionnaires on student well-being and stress copying strategy were primarily adopted from previously validated instruments as detailed below and adapted into the specific university context of this study. The questionnaire included multiple-choice questions (constructed using 7-point Likert scales) and open-ended questions. The questionnaires are reported in Tables A1 to A4 in the appendix.

Student Well-being. Seligman (2011) hypothesized PERMA – Positive Emotion (PE), Engagement (E), Relationships (R), Meaning (M), and Accomplishment (A) – as the building blocks of well-being. Empirical studies (e.g., Bulter & Kern, 2016; Goodman et al., 2017) have confirmed that the PERMA provides comprehensive well-being measures and is appropriate to measure individuals' well-being across various psychosocial domains. Students' feelings towards school-related work, relationships, and goals are key components of mental well-being, and the PERMA's five elements provide cross-examination and comprehensive assessment of student well-being. Thus, we adopt the PERMA to assess student well-being during and after the COVID-19 pandemic. Moreover, because the mandatory social distancing had increased students' feeling of loneliness during the pandemic semesters, we also measured participants' feeling of loneliness in the survey.

Stress Level. We devised the questionnaire with three categories to assess students' stress levels during pandemic semesters: (1) stresses that fit into the well-being measurement and connect to students' school related activities; (2) stresses regarding health concerns and discrimination that are associated with the outbreak of the pandemic; and (3) stresses that are related to general basic needs of life.

Stress Coping Strategy. Following prior research (Folkman & Moskowitz,

2004), we assessed the strategies that university students adopted to deal with stresses during the pandemic semesters and in post-pandemic recovery. Specifically, we adopted the strategy classification that emphasizes avoidance coping, because students had exhibited more avoidance behaviors, such as missing classes and lack of communications during the pandemic semesters.

In addition, consistent with previous research (Chen, 2016; Endler & Parker, 1994; Wu et al., 2020), we focused on examining three stress coping strategies: (1) problem-focused coping (PF Coping) characterized as using informational support and active planning to change stressful situations; (2) active emotion-focused coping that focuses on emotional support and regulates emotions to deal with stressful situations (Baker & Berenbaum, 2007); and (3) avoidance coping that indicates physical or cognitive efforts to disengage from various stressful situations (Moos, 1993).

University Resources. Moreover, we interviewed the university administrators to collect data about university resources and policies, based on which a list of university resources and programs was developed. The questionnaire was then constructed under the PERMA framework.

III. DESCRIPTIVE ANALYSIS

3.1. Respondent Demographics

In this study, a total of 228 valid responses were collected. The response rate was 82.3%. Table 1 summarizes the respondent demographics. As is shown, more than 80% of respondents were third- or fourth-year undergraduates. The division of genders was nearly balanced. About 50% of respondents were between 18-25 years old. The largest portion were Hispanics/Latino (38.6%), followed by Whites (30.3%) and

Asians and Pacific Islanders (18.5%); African Americans were 4.8%. A greater majority lived at home (62.3%), studied full-time (86.4%), did not hold a full-time work (57.0%), and had coursework hours below 20 hours per week (69.8%). Over 50% were with an annual household income below $50,000.

TABLE 1. RESPONDENT DEMOGRAPHICS (N=228)

Measure	Value	Frequency	Percentage
Gender	Male	116	50.9%
	Female	109	47.8%
	Prefer Not to Answer	3	1.3%
Age	18 - 22	78	34.2%
	23 - 25	47	20.6%
	26 - 30	57	25.0%
	30 +	46	20.2%
Ethnicity	White	69	30.3%
	African American	11	4.8%
	Hispanic/Latino	88	38.6%
	Eastern Asian Origin (Asian or Pacific Islander)	30	13.2%
	Prefer Not to Answer	18	7.9%
Student Status	Full-Time	197	86.4%
	Not-Full-Time	31	13.6%
Coursework Hours	Less Than 5 Hours	5	2.2%
	5 – 10 Hours	54	23.7%
	10 – 20 Hours	105	46.1%
	20 – 30 Hours	43	18.9%
	More Than 30 Hours	21	9.2%
Work Hours	1 – 10 Hours	8	3.5%
	10 – 20 Hours	35	15.4%
	20 – 30 Hours	55	24.1%
	More Than 30 Hours	0	0.0%
	Not Applicable	130	57.0%
Living with	Parent(s) and Sibling(s)	142	62.3%
	Friend/Roommate(s)	20	8.8%
	Partner	54	23.7%
	Child(ren)	28	12.3%
	Living Alone	17	7.5%
	Other	7	3.1%
Annual Household Income	Below $30,000	71	31.1%
	$30,000 - $50,000	60	26.3%
	$50,000 - $80,000	41	18.0%
	$80,000 - $100,000	27	11.8%
	Above $100,000	29	19.5%
School Year	Freshmen	17	7.7%
	Sophomore	21	2.2%
	Junior	79	34.6%
	Senior	111	48.7%

Following the statistical procedure outlined in Simmering et al. (2015) and Tehseen et al. (2017), we conducted the post hoc tests for estimation of the common method variance

(CMV) and concluded that it was not a concern of the study.

3.2. Findings of Descriptive Analysis

We calculated the mean and standard deviation of responses to assess the significance of each measure on the four principal constructs: student well-being, stress level, stress coping strategy, and university resources. The estimates for each survey question are reported in the appendix. We summarize below the key findings of the descriptive analysis to answer the first and second research questions of this study.

Student well-being. The descriptive analysis in Table A1 shows that university students felt moderately satisfied (with mean values falling between 4 and 5) with their overall physical and mental well-being. It is important to note that all measurements are on a 7-point Likert scale. In particular, they did not report feelings of loneliness during the pandemic semesters; and they held positive emotion towards school-related work and activities. However, having experienced high level of stress related to school activities, students reported that they remained actively engaged in schoolwork and activities, finding them meaningful. Moreover, students expressed satisfaction in their relationships with peers and professors; had confidence in the support they received from the university; reported being able to handle school responsibilities; and noted progress toward their school-related goals.

Stress level. As shown in Table A2, students' stress levels range from _moderately stressful_ (with mean values between 4 and 5) to _very stressful_ (with mean values between 5 and 6) across most measures, including school-related work and activities such as classes and graduation, concerns related to the contagion of COVID-19, and basic life necessities (e.g., paying bills). Three stress categories - relationship with peers,

relationship with professors, and maintaining a normal interest in everyday activities - were rated lower than the neutral value of 4, indicating that students experienced less stress in these particular areas.

Stress coping strategy. The descriptive analysis in Table A3 further shows that students adopted all of the three stress coping strategies. Among them, the problem-focused coping strategy is the most adopted and the avoidance coping one the least.

University resources. Overall, students indicated that university resources were moderately helpful in enhancing their well-being and academic success, with mean values of almost all measures falling between 4 and 5, as shown in Tables A4-1 and A4-2. However, when students were asked to specify which university resources they would utilize, they mentioned only a limited number of categories. This may be due to the campus lockdown, a situation that has significantly restricted access to university resources.

IV. STRUCTURAL EQUATION MODELING ANALYSIS

The structural equation modeling (SEM) analysis was performed to validate the principal constructs and to assess their structural relationships. The enhanced variance-based partial least squares path modeling was used to perform the SEM analysis (Benitez et al., 2020; Ringle et al., 2015).

4.1. Accessing the Reflective and Formative Measurement Models

We first validated psychometric properties of both reflective and formative measurement models that encompass the four principal constructs. The principal constructs are conceptualized and operationalized at the second formative conceptual order, each with

several dimensional indicators at the first reflective order, as shown in Figure 1.

Figure 1 presents the weight coefficient of each dimensional indicator of the principal constructs. The findings validated that all the dimensional indicators are significant for their corresponding principal constructs. The estimates of both reflective and formative measurement models are omitted here due to space constraints and will be provided upon request.
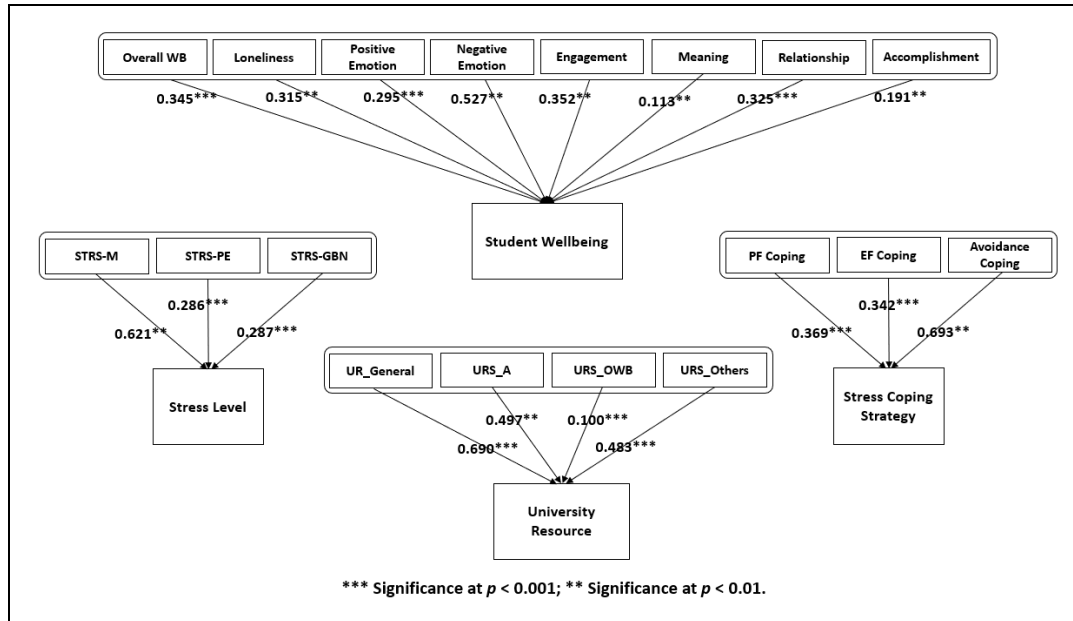

FIGURE 1. WEIGHT COEFFICIENTS OF DIMENSIONAL INDICATORS

4.2. Assessment and Findings of Structural Relationships

We next assessed structural relationships of the principal constructs to gain a comprehensive understanding of interrelationships of key phenomena. This will answer our third research question. As shown in Figure 2, the major findings are as follows: (1) Stress level is negatively significantly associated with student well-being ($\beta = -0.599$; $p < 0.01$); stress level explains 35.9% of the variance in student well-being ($R^2 = 0.359$). (2) Stress level is positively significantly associated with stress coping strategy ($\beta = 0.206$; $p < 0.001$); stress level explains 16.4% of the variance in coping strategy ($R^2 = 0.164$). (3) Stress level is positively significantly associated with university resources ($\beta = 0.191$; $p < 0.001$).

(4) Student well-being is negatively significantly associated with university resources ($\beta = -0.231$; $p < 0.01$). (5) Stress coping strategy is positively significantly associated with university resources ($\beta = 0.187$; $p < 0.001$). (6) Student well-being, stress level, and stress coping strategy jointly explain 32.2% of the variance in university resource ($R^2 = 0.322$). And (7) both constructs – student well-being and stress level – serve as a mediator mediating the relationship between stress level and university resources.

The R^2 values suggest the acceptable level of the explanatory power of the structural model; the f^2 values indicate the medium to large effect sizes of the structural relationships. Additionally, the respondent demographics were treated as control variables controlling for effects on the
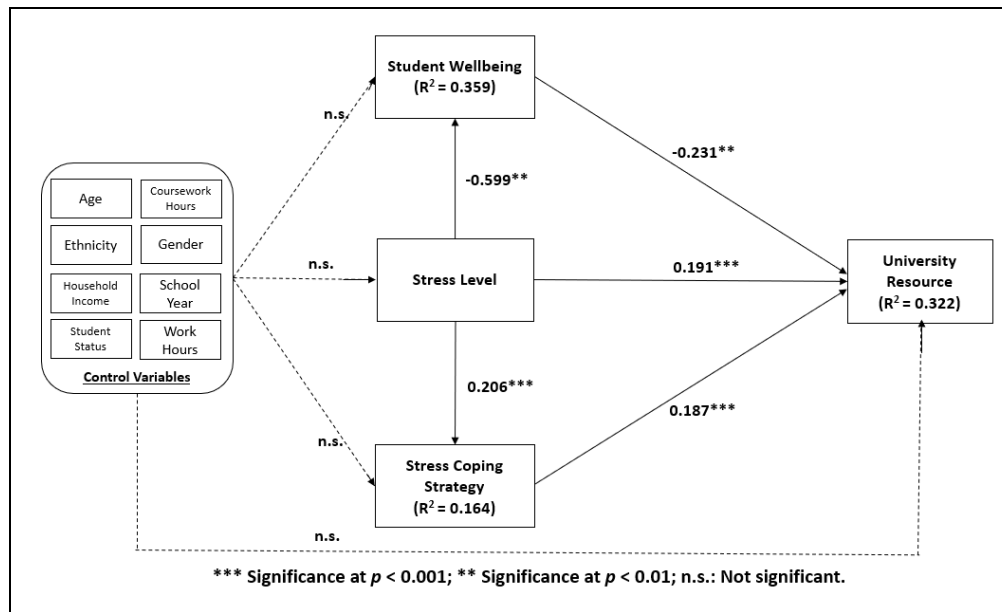
principal constructs – none was found significant.

FIGURE 2. SEM ESTIMATES OF STRUCTURAL RELATIONSHIPS

V. THEORY DEVELOPING

Based on the above empirical findings, this study develops a theoretical framework to comprehensively understand the interrelationships of key phenomena in higher education during and after the COVID-19 pandemic. The theoretical framework is articulated in both process and variance models, as shown in Figure 3.

- The process model of the framework recognizes the COVID-19 pandemic's impacts on university students as a dynamic process that involves four interdependent phenomena – student well-being, stress levels and associated coping strategy, as well as university resources. The model provides an explanation of the temporal progression of how student stress is formed during the pandemic at various levels and how levels of stresses affect student well-being,

coping strategies, and the deployment of university resources in higher education.

- The variance model interprets the impacts of the COVID-19 pandemic in terms of existence, manner, and magnitude of causal relationships of the key phenomena. It explains and predicts whether a higher level of student stress leads to a lower level of student well-being (*Proposition 1*) and/or a higher likelihood of taking stress coping strategies and/or seeking university resources for support (*Propositions 2 and 3*); whether a higher level of student well-being and stress coping strategy jointly or individually causes a lower (of higher) level of university resource deployment, in what manner, to what degree (*Propositions 4 and 5*); or whether any category of student demographics induces

changes in any section(s) of the co-
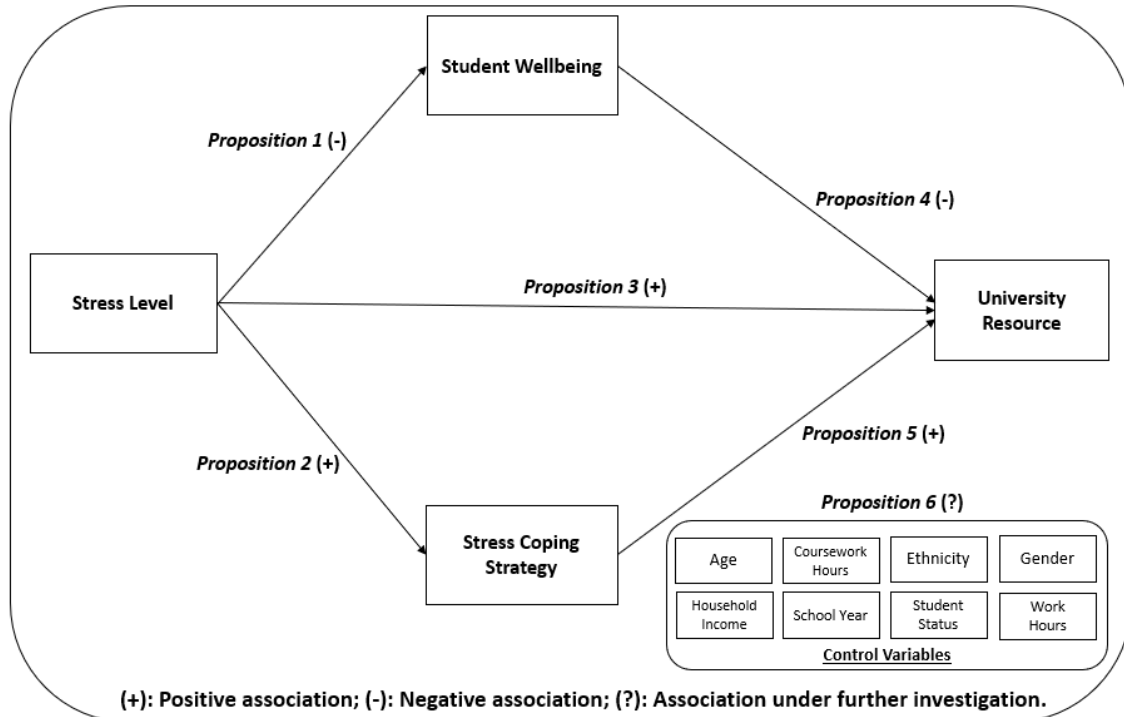variances (*Proposition 6*).

FIGURE 3. THEORETICAL FRAMEWORK OF THE COVID-19 PANDEMIC IMPACT

VI. DISCUSSION

6.1. Theoretical Implications

The impact of the COVID-19 pandemic on higher education is a new stream of research. In this regard, the descriptive analysis of this study provides university students' perspectives of physical and mental well-being, stress levels and associated coping strategies, as well as deployment of university resources. The findings are firsthand and context-specific on how university students "perceive it, describe it, feel about it, judge it, remember it, and make sense of it" from a phenomenological perspective (Patton, 2002). Our findings add a significant empirical value to the emerging stream of literature and provide answers to our first and second research questions.

Moreover, the SEM analysis of this study validates key phenomena and identifies their interrelationships to comprehensively understand the COVID-19 pandemic's impact on higher education. To that end, the study develops a theoretical framework that encompasses a nomological network of interrelationships and mechanism of key phenomena in higher education. With both of the process and variance models, the framework explains how the key phenomena are interrelated and provides theoretical answers to our third research question. The framework extends the SEM findings from the descriptive analysis and explores the multi-dimensional measures among key phenomena. The empirical findings and theoretical framework provide a comprehensive view of the COVID-19 impact and ultimately inform a cumulative body of knowledge of the literature.

6.2. Practical Implications

Our findings contribute to the general higher education administration, operations and policy making in several ways. First, the survey can be customized to address specific dynamics of the key phenomena in various higher education contexts. Second, the empirical findings and theoretical development provide insights on how to deploy university resources to improve student well-being and reduce stress levels during the pandemic semesters and post-pandemic recovery. For example, the study suggests universities should increase visibility and accessibility of supporting resources as they are found to be effective in improving student well-being, but students are not well aware of the resources. Finally, the study provides specific guidelines for better developing curricular and extracurricular activities. For example, faculty should concentrate more on relationship building with students to improve their well-being in the virtual learning modality where face-to-face interactions were missing.

The results of this research also contribute to improving strategies, decision-making, and process operations in higher education Operations Management (OM). First, OM is a discipline that features numerous quantitative courses with a high failure/withdrawal rate. OM researchers could utilize the theoretical framework developed in this paper to gather discipline-specific data, ultimately enhance student success and retention in OM by identifying stress factors related to the discipline and implementing targeted interventions. Second, the traditional teacher-directed approach remains the predominant teaching style among OM educators. However, this research highlights the significance of building strong relationships with students to enhance their well-being and academic outcomes. This result underscores the strategic importance for universities to allocate additional pedagogical resources to promote more student-centered approach to OM teaching. Furthermore, this result also demonstrates the necessity for OM educators to provide more student-centered instructional choices within the classroom.

VII.   CONCLUDING REMARKS

We conclude the study with limitations that should be addressed in future research. The samples in this study are a group of undergraduate students of the business school of a public university located in America's west coast. While we collected data on participants' perceptions and opinions, due to the potential effect of CMV, we caution about the generalizability of our findings. Future research may include more demographic variables and more representative samples and data from different regions and academic disciplines. Future research may also extend the theoretical framework through the collection of heterogeneous data across various types of higher education institutions.

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APPENDIX: Survey Questionnaire and Descriptive Analysis of Data

TABLE A1. STUDENT WELL-BEING

Category	Questionnaire	Mean	STD
Overall Well-being (OWB)	How would you rank your overall physical and mental well-being (OWB1)?	4.19	1.51
	Compared to others of your same age and sex, how is your physical and mental well-being (OWB2)?	4.44	1.49
	How satisfied are you about your current physical and mental well-being (OWB3)?	4.44	1.69
Loneliness	How lonely do you feel at school (LON)?	4.13	1.78
Positive Emotion (PE)	How often do you feel satisfied about school-related work and/or activities (PE1)?	4.87	1.19
	How often do you feel positive about school-related work and/or activities (PE2)?	4.75	1.15
	To what extent do you feel satisfied about your overall experience at school (PE3)?	4.67	1.40
Negative Emotion (NE)	How often do you feel stressed with school-related work and/or activities (NE1)?	5.57	1.29
	How often do you have withdrawal feelings regarding school-related work and/or activities (NE2)?	4.16	1.36
	How often do you feel dissatisfied with school-related work and/or activities (NE3)?	4.14	1.34
Engagement (E)	How often do you become absorbed in what you are doing for school-related work and/or activities (E1)?	5.31	1.27
	How often do you lose track of time while doing school-related work and/or activities (E2)?	4.65	1.45
	To what extent do you feel interested in your school-related work and/or activities (E3)?	4.72	1.47
Meaning (M)	To what extent do you feel your school-related work and activities purposeful and meaningful (M1)?	4.82	1.48
	In general, to what extent do you feel that your school-related work and activities are valuable (M2)?	4.75	1.52
	To what extent do you generally feel that you have a sense of direction in your school-related work and activities (M3)?	4.69	1.45
Relationship (R)	To what extent do you feel you receive help and support from the university for your well-being and academic success (R1)?	4.40	1.55
	How satisfied are you with your peer relationships (R2)?	4.27	1.61
	How satisfied are you with relationships with your professor (R3)?	4.30	1.62
Accomplishment (A)	How often do you feel you are making progress towards accomplishing your school-related goals (A1)?	5.47	1.21
	How often do you achieve the important school-related goals you have set for yourself (A2)?	5.42	1.12
	How often are you able to handle your school-related responsibilities (A3)?	5.46	1.04

TABLE A2. STRESS LEVEL

Category	What degree of stress do you have related to the following area (1 = No stress at all; 7 = Extremely stressful)?	Mean	STD
Accomplishment (STRS-A)	Do well in on campus classes (STRS-A1).	5.01	1.60
	Do well in on-line classes (STRS-A2).	4.06	2.01
	Graduate on time as planned (STRS-A3).	5.10	1.96
	Find proper jobs and/or internships (STRS-A4).	5.31	1.85
Meaning (STRS-M)	Find meaning and purposes in what you do at school (STRS-M1).	4.05	1.70
	Find meaning and purposes in your life (STRS-M2).	4.49	2.02
Positive emotion (STRS-PE)	Stay satisfied with school-related work and activities (STRS-PE1).	4.24	1.67
	Stay satisfied with daily life activities (STRS-PE2).	4.08	1.81
COVID-19 (STRS-COV)	Contagion of COVID-19 on campus (STRS-COV1).	4.50	2.29
	Contagion of COVID-19 in general (STRS-COV2).	4.47	2.21
General basic (STRS-GBN)	Paying bills; Safe place to sleep; Have enough to eat (STRS-GBN1).	4.26	2.21
	Commuting to campus (STRS-GBN3).	4.33	2.25
Relationships (STRS-R)	Connect or reconnect with school peers (STRS-R1)	3.91	1.75
	Connect or reconnect with professors (STRS-R2)	3.84	1.69
	Connect with industry professionals in the job field (STRS-R3).	4.84	1.70
Engagement (STRS-E)	Lost interest or feel disengaged to school-related work and activities (STRS-E1).	4.24	1.84
	Lost interest or feel disengaged to daily life activities (STRS-E2).	3.89	1.86

TABLE A3. STRESS COPING STRATEGY

Category	How likely do you use the following strategies to cope with your stress (1 = Extremely unlikely; 7 = Extremely likely)?	Mean	STD
Problem-focused coping (PF)	Take actions to try to make the situation better (PF1).	5.09	1.07
	Try to see it in a different light, to make it seem more positive (PF2).	5.48	1.26
	Concentrate my efforts on doing something about the situation I'm in (PF3).	5.72	0.93
Active emotion-focused coping (EF)	Say things to let my unpleasant feelings escape (EF1).	4.88	1.53
	Get emotional support from others (EF2).	4.62	1.75
Avoidance coping (AC)	Turn to other activities to take mind off things (AC1).	5.28	1.55
	Try to ignore stressful situations (AC2).	4.41	1.83
	Try to think about it less (AC3).	4.33	1.80

TABLE A4-1. UNIVERSITY RESOURCES (UR-General)

Category	To what extent do you feel the university resources would enhance your well-being and academic success (1 = No at all; 7 = Completely)?	Mean	STD
Positive emotions (URG-PE-Others)	Resources to reduce stress in general as well as that related to COVID-19.	4.19	1.87
Overall Well-being (URG-OWB)	Resources to enhance exercise, relaxation, nutrition, and well-being.	4.45	1.80
Accomplishment (URG-A)	Resources to enhance learning and future job prospects.	4.93	1.64
Meaning (URG-M-Others)	Resources to enhance mindfulness and serenity.	4.39	1.79
Relationship (URG-R-Others)	Resources to interact with peers, professors, and industry professionals.	4.63	1.69
Engagement (URG-E-Others)	Resources to engage you in organized activities, such as sports events, concerts, art events, outdoor hikes, trips and adventures.	4.46	1.75

TABLE A4-2. UNIVERSITY RESOURCES (UR-Specific)

Category	How likely will you use the following university resources to enhance your well-being and academic success (1 = Extremely unlikely; 7 = Extremely likely)?	Mean	STD
Accomplishment (URS-A)	**Academic advisement (AA)**	5.48	1.73
	Ask-a-tech walk in center (WALK)	4.08	1.93
	Career fairs (FAIRS)	4.88	1.74
	Computer labs (LABS)	4.19	2.11
	Learning resource center (LRC)	4.42	2.05
Overall Well-being (URS-OWB)	**Student Recreation Center (SRC).**	4.47	1.99
	Oasis2: Nutrition counseling, massages, acupuncture, nap pods.	4.36	1.98
Meaning (URS-M)	**Oasis1: M**indfulness workshops (MWS).	4.21	2.02
Relationship (URS-R)	**Faculty office hours (FACULTY).**	4.84	1.71
Others (URS-Others)	**Public safety: University police and parking (SAFETY).**	4.06	2.11