

Work in Progress: Proposing Items for an Engineering Undergraduate Subjective Wellbeing Questionnaire (EUSWQ)

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Abstract

Background

Mental Health and Wellbeing (MHW) research in engineering undergraduate education contexts is in its infancy. Further, to this date, no quantitative questionnaire items have been specifically constructed and validated to measure the potentially unique aspects of MHW of engineering students. In this present study, the conceptual framework for an Engineering Undergraduate Subjective Wellbeing Questionnaire (EUSWQ) will be proposed. This proposed questionnaire will include 35 items that correspond to 7-factors or latent variables including faculty support, learning experiences, support environment, financial support, task organization, engineering practice opportunities, and task orientation.

Design/Method

In the fall semester of 2021 at a Western land grant institution, 8 semi-structured interviews of undergraduate engineering students were conducted to inform the development of an MHW questionnaire that could be specifically used with engineering undergraduate students. After conducting a thematic analysis of the students' interviews, 7 factors or themes emerged that may capture the unique aspects of MHW in undergraduate engineering students. Next, these 7 factors were used to develop open-ended items for an online survey that was sent to all undergraduate students at the university. Survey data (N = 105) was collected in the Spring of 2022. Thematic analysis will be conducted on open-ended responses.

Results

Thematic analysis of the 8 student interviews resulted in identifying 7 factors that contributed to the subjective wellbeing of undergraduate engineering students. These factors included faculty support, learning experiences, financial support, task organization, support environment, engineering practice opportunities, and task orientation formed the analytical framework. These 7 factors will be the conceptual framework for the EUSWQ. Thirty-five items, 5 corresponding to each factor in the 7-factor framework will be identified through the analysis of the data acquired through anonymous responses (N = 105) to the 7 open-ended questions and will be proposed for validation in the paper draft.

Conclusion

The 7-factor conceptual framework and corresponding items proposed in EUSWQ will be the results of rigorous empirical research studies. With further testing, EUSWQ may become a useful tool to quantify and understand more completely the unique aspects of MHW of undergraduate engineering students.

Keywords: wellbeing, mental health, undergraduate, engineering education, questionnaire

1. BACKGROUND

Studies related to the wellbeing, or investigating what positively contributes to the wellbeing of undergraduate engineering students are rare [1]. Our search for such studies only returned a few studies that were directly aimed at investigating such positive contributors in addition to negative contributors like stress, anxiety, and depression [2, 3]. We were able to identify several scales/questionnaires to investigate both positive and negative psychological constructs in different populations but none was specifically developed or validated for undergraduate engineering populations. In this present study, the conceptual framework for an Engineering Undergraduate Subjective Wellbeing Questionnaire (EUSWQ) will be proposed. This proposed questionnaire will include 35 items that correspond to 7 factors or latent variables including faculty support, learning experiences, support environment, financial support, task organization, engineering practice opportunities, and task orientation.

2. THEORETICAL ORIENTATION

This work-in-progress is part of a larger project [4 - 6] relating the mental health and wellbeing of undergraduate engineering students at a Western land grant higher education institution. Positive psychology provides a theoretical foundation for this project. Most of the work in the field of psychology is based on the traditional understanding of mental health which is characterized by psychological issues and their negative influencers [1]. Therefore, Asghar and Minichiello [1] propose engineering education researchers studying the mental health and wellbeing of engineering students should incorporate theoretical and conceptual works from positive psychology to investigate and understand positive influences affecting human behavior.

Our previously conceptualized seven factors analytical framework through an exploratory study [4] is used to develop the proposed items for the Engineering Undergraduate Subjective Wellbeing Questionnaire (EUSWQ). We developed five items to correspond to each factor (a total 35). As shown in Figure 1, these seven factors contribute to overall Subjective Wellbeing (SWB) through four psychological constructs. SWB is “a person’s self-perceptions of “positive” inner events, which are defined as personally or socially desirable patterns of thinking (cognition) and feeling (emotion) [7]. SWB may refer to a state of life satisfaction or in more simple words happiness [8].

As shown in Figure 1, faculty support is the most important factor to contribute to the overall SWB of undergraduates in engineering education through four constructs i.e., academic satisfaction, social connectedness, academic efficacy, and college gratitude. Learning experiences in the college of engineering contribute to SWB through academic satisfaction and school connectedness. The supportive environment at the college of engineering was also contributing to SWB through school connectedness. Financial support and task organization contributed to SWB through the academic efficacy construct while engineering practice opportunities and task orientation made their contribution through college gratitude.

Figure 1

Conceptualized factors contributing to cumulative SWB via four constructs



3. METHODS

The present work-in-progress study is guided by two other empirical studies. Both studies were approved by the IRB.

3.1 Study 1

An exploratory study involving interviews with eight engineering undergraduates (3 females, and 5 males) was conducted during the fall 2021 semester [4]. The participants were purposefully selected to care for gender, race/ethnicity, year of study, and other demographic data. The interview data were transcribed, de-identified, and thematically analyzed by two researchers [9, 10]. Emerging themes from the data analysis were then conceptualized into the seven factors (Figure 1).

Table 1

Open-ended survey questions developed from Study 1 findings

Factor(s)/Construct(s)	Open-Ended Question
Faculty support/All constructs	In what ways does the college of engineering faculty contribute to your wellbeing?
Learning experiences/Academic satisfaction and school connectedness	How do the learning experiences provided within the college of engineering contribute to your academic satisfaction and/or feelings of connectedness within the college?
Financial support/Academic efficacy	How does financial support from different sources enable you to complete your assigned academic tasks successfully?
Task organization/Academic efficacy	How do task organization strategies enable you to complete your assigned academic tasks successfully?
Support environment/School connectedness	How does the support provided within the college of engineering contribute to your feelings of connectedness within the college?
Engineering practice organization and task orientation/College gratitude	How does an environment focused on engineering practice contribute to your feelings of gratitude toward the college of engineering?
General	Can you please describe any other factors that contribute to your wellbeing within the college of engineering?

Open-ended questions shown in Table 1 were then developed based on the seven factors for a follow-up study.

3.2 Study 2

This was a larger follow-up study with one non-conforming, 22 female, and 82 male (total of 105) participants responding to the open-ended questions (Table 1). Data collected through the seven open-ended questions were thematically analyzed involving two researchers [9, 10]. The items for EUSWQ were then developed based on the emerging themes.

4. FINDINGS FROM STUDY 2 AND CONSEQUENT ITEM DEVELOPMENT FOR EUSWQ

Emerging themes from study 2 provided a clearer idea of how the seven factors, conceptualized through study 1 [4] related to the overall SWB of undergraduate engineering students. As shown in Table 2, five survey items, corresponding to each of the seven factors were developed. The items are representing the themes/subthemes from the findings of study 2. We propose Engineering Undergraduate Subjective Wellbeing Questionnaire (EUSWQ) to be a Likert scale with scores from 1 to 7. There are three negative and three positive response items with a middle neutral point.

Table 2*Proposed Items for Engineering Undergraduate Subjective Wellbeing Questionnaire (EUSWQ)*

Faculty Support							
My professors are flexible with deadlines	1	2	3	4	5	6	7
My professors are accessible when I need their help	1	2	3	4	5	6	7
My professors give guidance to support my future professional life	1	2	3	4	5	6	7
My professors provide practical real-life examples to support theory	1	2	3	4	5	6	7
My professors provide engineering hands-on opportunities	1	2	3	4	5	6	7
My professors respect me for who I am	1	2	3	4	5	6	7
Learning Experiences							
I get a sense of accomplishment through my learning experiences offered by my college of engineering	1	2	3	4	5	6	7
The courses offered by my college of engineering make me a better problem solver	1	2	3	4	5	6	7
The engineering hands-on opportunities offered by my college of engineering are designed so that students can work on them in teams	1	2	3	4	5	6	7
I feel safe reaching out to my peers in the college of engineering to achieve academic success	1	2	3	4	5	6	7
The college of engineering provides opportunities for students to work together	1	2	3	4	5	6	7
Financial Support							
I have abundant financial resources to continue my engineering education	1	2	3	4	5	6	7
I know about part-time job opportunities at the college of engineering	1	2	3	4	5	6	7
My family helps me with my finances to support my engineering education	1	2	3	4	5	6	7
I know about job opportunities to work as a lab assistant in engineering labs	1	2	3	4	5	6	7
My financial security provides me with more time to focus on my engineering studies	1	2	3	4	5	6	7
Task Organization							
I know about many strategies to organize my engineering education tasks	1	2	3	4	5	6	7
I keep a strict schedule to complete my engineering education tasks	1	2	3	4	5	6	7
I can effectively manage time to complete my engineering education tasks	1	2	3	4	5	6	7
I get my engineering education tasks done on time							
I divide my engineering education tasks into smaller chunks to do them more effectively	1	2	3	4	5	6	7

Support Environment							
The overall environment of the college of engineering is supportive	1	2	3	4	5	6	7
I feel that I belong to my college of engineering	1	2	3	4	5	6	7
There are support systems available in my college of engineering to help with my academics	1	2	3	4	5	6	7
There are support systems available in my college of engineering to help me with my mental health and wellbeing	1	2	3	4	5	6	7
The college of engineering provides opportunities to interact with my peers (i.e., events, and clubs)	1	2	3	4	5	6	7
Engineering Practice Opportunities							
The practical hands-on experiences offered by my college of engineering will help me in my professional career	1	2	3	4	5	6	7
I am grateful for the quality of education offered by my college of engineering	1	2	3	4	5	6	7
The practical hands-on experiences offered by my college of engineering increase my job prospects	1	2	3	4	5	6	7
I can see the practical implications of the theoretical concepts taught to me in the college of engineering	1	2	3	4	5	6	7
Available practical experiences offered by my college of engineering help me connect with my peers	1	2	3	4	5	6	7
Task Orientation							
My peers in the college of engineering are focused on completing their tasks	1	2	3	4	5	6	7
The objective nature of engineering education helps me succeed academically	1	2	3	4	5	6	7
Available Engineering practice experiences help me identify as an engineer	1	2	3	4	5	6	7
I mostly focus on achieving academic goals when I work in teams	1	2	3	4	5	6	7
I like the objectivity of engineering education	1	2	3	4	5	6	7

1=Strongly Disagree, 2=Disagree, 3=Slightly Disagree, 4=Neutral, 5=Slightly Agree, 6=Agree, 7=Strongly Agree

The list of items is not final. Our ongoing research may direct us to add/remove or amend items. Our future work aims to further refine and psychometrically validate the EUSWQ.

4.1 PSYCHOMETRICS OF EUSWQ AND FUTURE WORK

For our future work, we are planning to validate the EUSWQ after presenting it to a larger number of the undergraduate engineering student population. We aim to conduct two types of psychometric validation analysis. As part of the structural validity of the EUSWQ, exploratory factor analysis (EFA) will be conducted to verify if relations between the observed variables in the study and their latent constructs exist [11]. To investigate the convergent validity, of the overall

scale and its subscales, the Satisfaction with Life Scale (SLS) [12], the Beck Anxiety Inventory (BAI) [13], and the Beck Depression Inventory (BDI) [14] will be used.

5. DISCUSSION AND CONCLUSION

The present work-in-progress study aimed at proposing a new scale/questionnaire called Engineering Undergraduate Subjective Wellbeing Questionnaire (EUSWQ). Thirty-five items, five corresponding to each of the seven conceptualized factors i.e., faculty support, learning experiences, financial support, task organization, support environment, engineering practice opportunities, and task orientation were presented. We believe that this questionnaire, when fully developed and validated, will be helpful in research work aiming at investigating the status of subjective wellbeing (SWB) of undergraduate engineering students. It will inform about the validity of both human and technical structures put in place aiming at increasing the wellbeing and academic success of undergraduate engineering students.

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