THE ROLE OF RESILIENCE ON EUDAIMONIC WELL-BEING OF FIRST-YEAR UNDERGRADUATE ENGINEERING STUDENTS

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Abstract – First-year undergraduate engineering students are exposed to numerous stressors, including high academic demands and adjusting to new social support networks. Positive adaptations through the use of personal resources e.g. resilience has been associated with improved well-being outcomes in literature. A sample of 8 first-year undergraduate engineering students was examined in terms of i) the prevalence of Eudaimonic Well-Being (EWB) and resilience and ii) the role of resilience on EWB. EWB was assessed using the Flourishing Scale and resilience was measured using the Brief Resilience Scale. Findings uncovered low prevalence of EWB and resilience in the study population. The means of both FS and BRS scores were found to be significantly lower in the study population, compared to findings from other empirical studies. No significant relationship was found between resilience and EWB. Areas for future research is discussed.

Keywords: transition, engineering, students, mental health, well-being, resilience, personal resources

1. INTRODUCTION

The Public Health Agency of Canada (PHAC) defines mental health as "the capacity of each and all of us to feel, think, and act in ways that enhance our ability to enjoy life and deal with the challenges we face. It is a positive sense of emotional and spiritual well-being that respects the importance of culture, equity, social justice, interconnections and personal dignity" [47]. Whereas, the World Health Organization's definition of mental health states, "Mental health is a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community." [74]. Both of these definitions point to a central idea that overall mental health is not just the absence of mental illness but also comprises of the state of well-being of the individual. This characterization is aligned with the dual continua model of mental health and illness [34]. A number of studies have provided evidence to the dual continua model, for example in American adults [35], American

adolescents (ages 12 to 18) [36], Dutch adults [40], and South-African adults [37]. High levels of mental well-being has been associated with preventative effects on the development of mental health problems over time [67]. Thus, in addition to mental illness, mental well-being also serves as an important function in the overall mental health of an individual.

Current research on well-being has been derived from two general perspectives: the hedonic approach and the eudaimonic approach. Hedonic well-being focuses on happiness and defines well-being in terms of pleasure attainment and pain avoidance. Eudaimonic Well-Being (EWB) focuses on the idea of realizing one's unique potential [3], through the means of optimal positive functioning and the act of striving **Error! Reference source not found..** While both HWB and EWB serve an important role in defining an individual's sense of well-being, in the academic context, high levels of EWB in particular has consistently been associated with better academic performance [1][68], and more adaptive coping strategies to manage the student life [21]. These studies motivates a need to study the driving factors that influences EWB in a student.

Individual difference factors such as resilience may serve as an important personal resource or capability that a student can utilize to achieve high levels of EWB. Resilience can be described as the ability of the individual to effectively negotiate, adapt to, or manage significant sources of stress. A number of studies have found resilience to be positively associated with EWB amongst the general population [28][62][66]. This paper aims to explore the relationship between resilience and EWB among first-year undergraduate engineering students.

2. MOTIVATION AND AIM

Despite an understanding of the first-year undergraduate engineering environment as being highly pressured and stressful from a student's perspective, there is a lack of research on factors that influences student well-

being amongst first-year undergraduate engineering students in Canada.

Students transitioning from high school to this environment could potentially face numerous changes. For example, students may have to leave their established routines and social support networks, develop new ones, take on new responsibilities such as independent living, and adapt to new, and often greater, academic challenges. Consequently, this transition marks a time period where there is an increased sensitivity and vulnerability amongst students [20]. Although studies focussed on first-year undergraduate engineering students in Canada are limited, one study of 351 first-year engineering undergraduate students across 7 Canadian universities asked students to self-report how stressed they feel on average on a Likert scale of 1-5 (5 representing the highest stress level). The study found that over 61% of students responded with a value of 4 or higher [24]. While the demands of university lifestyle are to some extent inherently stressful, negative adaptations to such stressful situations could impact a students' well-being [22][60].

However, positive adaptations to stressors through the optimal use of psychological resources has been associated with promoting well-being. This includes individual level resources such as sense of coherence [58], self-esteem [51], personality hardiness [39], optimism [57], and problem-solving abilities [12][14]. These findings support the notion that students with more positive psychological resources seem to be better equipped to manage student life [46]. Such resources might also represent as ideal points of intervention to ensure students are best equipped to manage such stressors [60].

This study seeks to meet two objectives. The first is to observe the prevalence of EWB and resilience in first-year undergraduate engineering students. The second, is to explore the role of resilience on an individual's EWB within the first-year undergraduate engineering student body from a Canadian university. The hypothesis is that resilience will be positively associated with EWB.

3. EUDAIMONIC WELL-BEING

Although various conceptualizations of Eudaimonic Well-Being (EWB) exist in literature, certain parallels can be drawn. In general, high levels of EWB is understood to be achieved through high levels of eudaimonic functioning within the following four facets: (i) *personal growth*: which refers to realizing one's true potential and is related to variables such as competence and excellence [53], accomplishment and progress [59], constant learning through openness to new experiences, self-esteem and self-efficacy [52] (ii) *meaning and purpose*: which refers to striving to serve towards a higher purpose and is related to variables such as sense of coherence [4] and self-

transcendence [23] (iii) *quality relationships*: which refers to having a sense of belonging and positive relationships with others and is related to social well-being [34] and (iv) *positive attitude*: which refers to being able to maintain a positive demeanor in the face of challenges and is related to concepts of hope [65]; and optimism [13]. Hence, the EWB perspective is focused on the blossoming of individual capacities and as a route to achieving full psychological functioning.

In the academic context, EWB is often assessed through a concept known as Psychological Well-Being (PWB) in literature [54][55]. This conceptualization draws from the EWB tenets to present six distinct aspects of human actualization, which are: autonomy, personal growth, self-acceptance, life purpose, mastery, and positive relatedness [52]

PWB is a phenomenon that is important for university students in order to successfully adapt to university life [8]. A study of 1,072 Spanish university students found PWB to be positively associated with adaptive coping strategies (e.g. positive reappraisal, support seeking and planning), while being negatively associated with dysfunctional coping strategies (e.g. ignoring the problem, blaming oneself about the situation or taking refuge in fantasizing thoughts) [21]. Another study surveyed 353 American university students to explore relationships of PWB with optimism, health as a value and engagement to religious and spiritual practices. The results suggested that PWB is positively associated with optimistic attitudes, adopting health promoting behaviours (e.g. performing exercise) and engaging in religious and spiritual practices [11]. Another study surveying 373 Canadian students found respondents who had a higher family income, reported better physical health, expressed a higher degree of satisfaction with their relationships with family, friends, and significant other, indicated a more positive self-image, and experienced less academic stress were found to exhibit a significantly higher level of PWB [15]. These findings reflect that high levels of EWB is important for students making the transition to university [8]. Furthermore, it emphasizes the need to study the factors that influence student EWB.

4. THEORETICAL FRAMEWORK

Pathways to EWB can be viewed through the lens of the Conservation of Resources (CoR) theory. The CoR theory [30] proposes that individuals seek to acquire and maintain resources. When these resources are gained, the result is an increase in well-being. According to the CoR theory, there are four kinds of resources that can lead to greater well-being, including physical objects (e.g. one's home), personal characteristics (e.g. self-efficacy), conditions (e.g. social support), or energies (e.g. time).

As per CoR theory, personal characteristics are a type of resource individuals employ to serve as “general resistance” to demands [58] and serve as important determinants of optimal functioning [29][33]. Personal resources are those that refer to individuals’ sense of their ability to control and impact upon their environment successfully [30] to achieve goals, and stimulate personal growth and development [75]. This paper proposes that resilience serves as a personal characteristic resource resulting in increased EWB when at high levels.

5. RESILIENCE

Resilience has been referred to as the personal qualities and skills that allow for an individual’s healthy/successful functioning or adaptation within the context of significant adversity or a disruptive life event [16][45][46].

Resilience literature typically falls into two distinct conceptualizations of resilience. One conceptualization positions resilience as a dispositional trait linked to personality (e.g. [6]), while another positions resilience as a learned capability which is dynamic and contextual (e.g. [71][73]) that involves complex interactions between internal characteristics and external conditions [49]. Another, more comprehensive perspective posits that while there are multiple ways of conceptualizing resilience, these divergent views may simply represent different facets of the same construct [45]. So, even if certain underlying innate predispositions for resilience exist, several malleable personal factors and processes for resilience exist as well. For instance, studies looking at the outcomes of resilience interventions show promise for a variety of age groups. One study found that it is possible to promote resilience in children by teaching them better thinking and problem solving skills [43]. Another study demonstrated that teaching resilience strategies (i.e. positive coping strategies) can foster self-efficacy, cognitive control and self-awareness in university students [17]. Similarly, another study demonstrated resilience training in the workplace to benefit employees on a number of positive outcomes such as well-being and performance indicators including lower stress, goal attainment and productivity [2][50]. Such studies provide evidence to support that at least certain facets of resilience could be viewed as a skill that can be developed in individuals [45].

Prior empirical studies demonstrate positive relationship between resilience and the facets of eudaimonic functioning. These include optimism [26] [19] [44][63], self-efficacy [25][42], self-esteem [7][5], meaning and purpose [63][69] and social support [19] [10][27][72]). In this study, we expect resilience to exhibit a positive relationship with EWB.

6. METHOD

6.1. Participants and Procedure

A sample of 75 students were randomly selected and invited to participate, out of all first-year undergraduate engineering students, who were registered with full course workload during the winter semester at the University of Toronto. Invitations were sent via an email with a Google Forms link to an online questionnaire. As an incentive to participate in the survey, these students were informed that three winners would be selected based on a draw where each winner would receive a \$20 gift card to the University of Toronto Bookstore. Out of 75 students who were invited, only 8 students participated and fully completed the online questionnaire. The online questionnaire comprised of the following instruments: The Flourishing Scale (FS) and the Brief Resilience Scale (BRS). Each participant provided informed consent prior to completing the questionnaire. The University of Toronto ethics review board approved all procedures and materials used in this study.

6.2. Measures

6.2.1. Flourishing Scale. The Flourishing Scale (FS) [18] is an eight-item self-report instrument. It is a unidimensional construct that combines numerous facets of eudaimonic functioning into a single PWB score. The components that the FS assesses include: meaning/purpose, positive relationships, engagement, social contribution, competence, self-respect, optimism and social relationships [32]. Each item is phrased in a positive direction using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The score is obtained by adding the respondents’ scores from each item (ranging from 8 to 56). The FS has been tested on undergraduate students with good psychometric properties, demonstrating its applicability in the university context. The scale has demonstrated good internal reliability ($\alpha = 0.87$) and has been found to correlate well with other measures of PWB including the 54-item scales of Psychological Well-being [53] demonstrating its convergent validity [18].

6.2.2. Brief Resilience Scale. The Brief Resilience Scale (BRS) [63] is a six-item self-report instrument developed to assess the ability to bounce back and recover from stress. Three questions are phrased in the positive direction, while the other three in the negative direction. Participants respond by indicating the extent to which they agree with each of the statements using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The score is obtained by reverse coding the three negatively phrased questions, and finding the mean of the six items to yield a single score (ranging from 1 to 5). The BRS has been tested on undergraduate students with good

psychometric properties, demonstrating its applicability in the university context. The scale has demonstrated good internal reliability ($\alpha = 0.84$) and has been found to correlate well with other measures of resilience, such as the Connor-Davidson Resilience Scale and the Ego Resiliency Scale [63] demonstrating its convergent validity.

6.3. Analyses

To compare any difference in EWB and resilience between our study population and findings from other empirical studies in literature, independent t-tests were conducted to examine the results. Simple linear regression was conducted to examine whether resilience played a role in enhancing EWB. A criterion of $p < 0.05$ was adopted to determine statistical significance.

7. RESULTS

The number of responses (N), mean, standard deviation (SD) and the 95% confidence interval for the FS and the BRS can be found in Table 1. To check univariate normality of each measure, one guideline [38] suggested a cut-off of absolute values of 3.0 and 8.0 for skewness and kurtosis, respectively. The skewness and kurtosis for FS was found to be -0.24 and -1.05 respectively. The skewness and kurtosis for BRS was found to be 1.30 and 1.78 respectively. These results indicate that the responses for both measures were relatively normally distributed. All 8 survey respondents provided responses to all questions in each measure. The mean score for the FS was found to be 32.7 (95% CI: [25.4, 40.0]) and the mean score for the BRS was found to be 2.6 (95% CI: [1.98, 3.22]). A relatively high variance in the scores was found for both measures, which is likely due to the low sample size. Both measures were found to be internally reliable, with FS showing excellent internal reliability ($\alpha = 0.92$) and BRS showing good internal reliability ($\alpha = 0.87$).

Although the authors of the FS do not provide a guideline on thresholds for interpreting individual scores, they do present a norm in terms of percentiles to enable relative interpretation of individual scores. The norms are based on a sample of 689 college students comprising of 508 students from 5 American colleges and 181 students from a college in Singapore [18]. The percentile rank of each respondent from our survey, based on their FS score, can be found in Table 2. For the BRS, the authors provide a guideline for interpreting individual scores as follows: 1-2.99 as “low resilience”, 3.00-4.30 as “normal resilience” and 4.31-5.00 as “high resilience” [64]. These are tabulated in Table 2.

The results of the linear regression model to predict EWB (as measured by the FS) based on a student’s resilience (as measured by the BRS) can be found in Table 3. The table

presents the unstandardized regression coefficient (β) with its respective 95% Confidence Interval (CI), and the standard error (SE). No violation of the assumptions of normality, linearity and homoscedasticity was found. The regression analysis produced a statistically insignificant model ($F(1,6) = 0.43$; $p = 0.54$; $R^2 = 0.07$). The unstandardized regression coefficient of BRS was found to be $\beta = 2.943$ (95% CI: [-8.05, 13.93])

Table 1: Descriptive Statistics for the scores from the FS and the BRS

	N	M	SD	95% CI
FS	8	32.7	10.5	25.4 - 40.0
BRS	8	2.6	0.9	1.98 - 3.22

Table 2: Interpretation of Individual Scores for FS and BRS

Respondent	FS ¹	BRS
1	1	Low
2	1	Low
3	3	Low
4	5	Low
5	7	High
6	21	Low
7	39	Normal
8	53	Low

¹ – Percentile rank based on norm [18]

Table 3: Linear Regression Results with BRS ($N = 8$)

Term	Coefficient (β) [95% CI]	SE
Constant	24.962 [-5.202-55.125]	12.327
BRS	2.943 [-8.049-13.934]	4.492

8. DISCUSSION

The first aim of the research was to observe the prevalence EWB and resilience in first-year undergraduate engineering students. Student EWB was assessed using the FS, while resilience was assessed using the BRS. Table 3 shows that most of the students in the sample (5 out of the 8 students) fall in the bottom 7th or lower percentile relative to the norm, suggesting a relatively very low EWB in these individuals. Moreover, the mean FS score was found to be significantly lower in the study population compared to the norm (i.e. 32.7 vs. 44.97, $t(7) = 3.30$, $p < 0.01$). Relatively low FS scores indicates that the students in this cohort are generally not optimally functioning in one or more facets of eudaimonic functioning including, self-esteem, sense of purpose or meaning, social well-being and maintaining a positive attitude.

In terms of the prevalence of resilience as measured by the BRS, Table 3 shows that most of the students in the sample (6 out of the 8 students) fall in the “low resilience” category. Moreover, the mean BRS score was found to be significantly lower in the study population, compared to results from other samples of undergraduate students i.e. relative to sample 1 of 128 students (2.6 vs. 3.5, $t(7) = 2.88$, $p < 0.05$) and relative to sample 2 of 64 students (2.6 vs. 3.5, $t(7) = 2.92$, $p < 0.01$) [63]. Low BRS scores indicates that the students in this cohort generally see themselves as having a low ability to bounce back from stress. Taking this finding together with the low prevalence of EWB, the results may be indicative of negative adaptations to the numerous changes due to the transition to the first-year undergraduate engineering environment, as mal-adaptations and poor coping mechanisms have been linked to poor well-being outcomes in literature [21][22][60].

The second aim of the research was to examine the role of resilience on EWB. To examine this, a linear regression model was developed. The results, as summarized in Table 3, yielded a statistically insignificant model. A high variability in the 95% confidence intervals of the effect size of BRS on FS was also observed ($\beta = 2.943$ (95% CI: [-8.05, 13.93])), which is due to the low sample size of this study. Consequently, the current data was found to be insufficient to allow any direct interpretation of the significance, magnitude and direction of the possible relationship between BRS and FS. It is worthwhile to note, that the 95% CI of the BRS coefficient includes effect sizes that are noteworthy and non-trivial in both directions. For example, in the positive direction, a BRS coefficient value of 12 would suggest that just a 1 unit increase in the BRS score, would represent a change in the FS score that corresponds to an increase in the percentile rank from the 7th percentile to the 53rd percentile. A positive relationship between resilience and well-being is generally congruent to empirical studies [56] [61] [70]. On the other hand, an effect in the negative direction is meaningful, as this is contrary to general literature. Future studies engaging larger sample sizes is required to better understand the possible role of resilience on EWB.

9. LIMITATIONS

This study has several limitations. One of the major limitations is the low sample size. Future research on the unidimensional structure of the FS, we cannot interpret FS scores in relation to the various facets of eudaimonic functioning. Future research may use multi-dimensional instruments such as the Ryff's scales of Psychological Well-Being [53]. Moreover, due to the cross-sectional nature of the study, causality between resilience and EWB cannot be established. The results of this study are subject to response bias because EWB and resilience were measured using self-report instruments [31]. In addition, these results

cannot be generalized as it is restricted to a particular cohort of first-year undergraduate engineering students from one Canadian university. More information should be collected in future studies, including the student's demographic data, social environment, learning environment, characteristics of the stressors, and hedonic well-being level.

10. CONCLUSION AND NEXT STEPS

Clearly, students vary in their ability to cope with and adjust to new challenges, such as adjusting to the first-year undergraduate engineering environment. EWB is a construct that has been shown to explain this variation in students. Students with high EWB successfully engage in meaningful relationships, positively adapt to challenges and are able to realize their fullest potential [8]. Personal resources may serve as an important determinant to an individual's EWB [29][33]. Consequently, we contend that further studies examining the possible role of personal resources (e.g. resilience) on EWB within first-year undergraduate engineering students in Canada is warranted for two reasons. Firstly, our findings uncovered low prevalence of both EWB and resilience within the cohort, revealing signs of sensitivity and vulnerability amongst these students. Secondly, studies in this area show promise, as the possible role of personal resources on EWB is theoretically supported (i.e. by CoR theory) and is empirically evidenced in literature, albeit primarily within the general population. Future research directed towards personal resources that are more malleable as opposed to stable intrapersonal constructs is recommended. Such resources may be more amenable to practical implications, such as serving as possible points of intervention [60]

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