Understanding the Demands and Resources for Academic Success of Second Career Undergraduate Engineering Students Compared to Traditional Undergraduate and Graduate Engineering Students

Dr. Oleksandr Kravchenko, Old Dominion University

Dr. Kravchenko is working in the area of structural analysis with focus on composite materials for various engineering applications. He received his M.S. and Ph.D. from Purdue University and completed two years of postdoc from Case-Western Reserve University. Dr. Kravchenko is actively collaborating with his colleagues at ODU on understanding the key elements of academic success for non-traditional, second-career, engineering students.

Dr. Konstantin Cigularov, Old Dominion University

Dr. Konstantin Cigularov is an Associate Professor of Industrial and Organizational Psychology in the College of Sciences at Old Dominion University. He holds a Ph.D. from Colorado State University in Industrial-Organizational Psychology and a B.S. in Banking and Finance from the University of Economics in Bulgaria. As the Director of the Leadership and Employee Assessment and Development Research Lab, Dr. Cigularov has investigated various organizational issues related to leadership and culture, employee burnout and stress, as well as training programs and interventions. Dr. Cigularov has extensive experience with program design and evaluation and he has consulted numerous organizations, including the Colorado Department of Public Health and Environment, on designing, evaluating, and disseminating effective interventions and training programs. He has expertise in both quantitative and qualitative research methodologies, which he uses to better understand and help organizations create and engender safer, healthier, and more fulfilling workplaces. Dr. Cigularov has conducted numerous needs assessments of targeted student populations, including medical residents, STEM students, transfer students, graduate students in sciences, and second career engineering students.

Mr. Phillip Dillulio, Old Dominion University

Phil Dillulio is a 5th year Industrial - Organizational Psychology doctoral student at Old Dominion University in Norfolk, Virginia.

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O. G. Kravchenko, K. Cigularov, P. Dillulio

Old Dominion University, 4635 Hampton Blvd, Kaufman Hall, Norfolk, Virginia, USA

Introduction

Many non-traditional students, including engineering majors, face similar challenges like financial hardship and lack of an institutional support network, which may negatively affect degree persistence rates [1]. The specific category of engineering students of interest to this study are students who enter engineering academic programs with prior work or career experience outside of the engineering field. These students are identified as second career seeking (SCS) students [2], who may experience unique barriers/demands and may need specific supports/resources to be successful in their academic pursuits. The term career in this context is defined as an occupation, which relates to a range of aspects of an individual's life, learning, and work and is undertaken for a significant period of a person's life and with opportunities for progress.

Career adaptability can be significantly improved among adult workers considering SCS options [2] within engineering if effective supports/resources and key barriers/demands are identified and better understood. The economic recession of 2008 catalyzed the permanent removal of low-skill jobs [3], therefore creating a strong need for the retraining to match the growing demand for high-skill professions [4]. In order to avoid the pathway for low-skill jobs, potential SCS students must consider the opportunity cost of lost wages for the payoff of higher wages. Such opportunity costs are not usually explored by traditional students [5]. As a result, only 20%

of students aged 24-29 years completed their postsecondary degree within 6 years. This percentage decreased to 16% for students 30 years and older [6, 7]. Despite the extended timeframe for degree completion, SCS students have shown a strong commitment to completing their degree with exceptionally strong work ethic and engagement [8], while prior work experience provides SCS students with a valuable perspective that the career switch allows to recover losses in their professional development [9].

A number of critical environmental supports/resources and barriers/demands can significantly affect the academic success of engineering students [5, 10]. Traditional and SCS undergraduate students typically face different combination of environmental supports/resources and barriers/demands. This is due to the intrinsic differences in the professional development that both groups were subjected to prior to their academic studies.

Personal factors also play a role in facilitating and hindering engineering students' academic and career goals. For example, negative self-efficacy beliefs and low outcome expectations can affect interests, goals, and activities related to education and careers in STEM [11], as well as establish career path dependence for low skilled jobs often leading to limited career choices resulting in reduced human capital [12].

Using the job demands-resources (JD-R) theory [13] as a guiding framework and taking a needs assessment approach [14], we set out to examine the average levels of school and personal demands and resources, as well as important outcomes experienced by SC engineering students relative to traditional undergraduate students and graduate students. Developed in the organizational sciences, the JD-R model has emerged as the most widely applied, studied, and supported job design and occupational health psychological framework [15-16]. Schaufeli [17] aptly points out that "because of its comprehensive, broad, flexible and communicative nature the

JD-R model not only enjoys great popularity among academic researchers, but it makes the model also quite suitable for practical use in organizations" (p. 120). Consequently, the JD-R model has been applied in thousands of organizations in occupational [15], sports [18], and school [19]-[21] settings. The JD-R model aims to identify and explain a wide range of demands and resources that are relevant to people in different settings and their relationships with important individual outcomes, such as burnout, engagement, and performance [15].

Applied to the engineering education context, the model suggests that engineering school characteristics can be classified as either school demands or school resources, and certain engineering student characteristics can be viewed as personal demands while others as personal resources. School demands represent challenging features of the school environment (e.g., academic demands) that tax students' mental effort and energy, function as barriers to academic success and well-being, and are associated with certain physiological and psychological costs. Personal demands are individual characteristics that function as internal barriers to goal achievement (e.g., procrastination). School resources, on the other hand, are positive, supportive features of the school environment (e.g., campus resources) that increase student motivation leading to positive outcomes like school engagement. Likewise, personal resources, such as academic self-efficacy, are positive individual characteristics that facilitate the achievement of student goals, protect against school demands, and stimulate personal growth and development [13], [15].

Additionally, the JD-R model suggests several variables that represent important outcomes for individuals and organizations, such as engagement, commitment, burnout, and performance [15], which are relevant in various contexts. In the college context, it has been demonstrated that engagement and burnout are experienced by college students [15]. Furthermore, studies have demonstrated the importance for institutions of higher education to assess and take into consideration their students' levels of engagement and burnout if they aim to improve students' academic performance and retention [17], [20], [22]. For example, in a time-lagged study of first-year college students, those who were more engaged in college during their first year performed better academically and were less likely to drop out [22]. In another study using a quantitative diary design to investigate within-person changes in student engagement and performance, the researchers found that engagement was predictive of study performance [20]. Schaufeli et al. [17] also demonstrated significant relationships of college student burnout and engagement with academic success in a cross-national study.

Given the above research and its implications for engineering education, our primary goal was to understand how SCS undergraduate students' experiences of school and personal demands and resources differed from those of traditional undergraduate students as well as graduate students in engineering. Additionally, we aimed to examine group differences in important student outcomes, such as student engagement, fit with engineering program, school burnout, commitment to engineering major, and current/expected GPA. The inclusion of the comparison groups allowed us a broader and more refined view of students' levels of encountered demands, needed resources, and experienced outcomes across campus. Specifically, the inclusion of traditional engineering students provided a direct benchmark for the comparative analysis using the proposed methodology, while incorporation of the graduate students provided a further point of reference with respect to SCS students, as many of those students can be classified as adult learners and non-traditional students with prior work experience. Many graduate students in engineering do not always follow a direct path from their baccalaureate to Master's or Ph.D. programs, therefore, they offer a greater insight into the levels of demands and resources experienced by more academically mature individuals with work experiences outside of college. This information would be valuable for identifying the precise needs of SCS undergraduate students and targets for intervention and programmatic efforts to facilitate their academic and career goals and support their well-being.

Specifically, we examined the following research questions:

Q.1 How do SCS undergraduate students differ from traditional undergraduate students and graduate students in terms of needs based on their levels of school and personal demands and resources?

Q.2 How do SCS undergraduate students differ from traditional undergraduate students and graduate students in their levels of student outcomes?

Method

Procedure

In April of 2019, a link to a 57-question anonymous online survey hosted in Qualtrics was emailed to 2,003 engineering students (1,873 undergraduate students; 130 graduate students) in the Batten College of Engineering and Technology at Old Dominion University (ODU) in Norfolk, Virginia. In addition to basic demographic information (e.g., age, gender, race, etc.), survey questions were constructed to measure a wide variety of demands and resources that were school-related and personal and were expected to hinder or facilitate success of engineering students. The anonymous survey took participants approximately 20 minutes to complete. Participants who completed the survey had the option to be entered into a raffle for one of five Visa gift cards worth $25.00. Participant survey responses were unlinked to the information they provided for the raffle. The survey officially closed on 5/13/19, after three reminder emails on 4/25/19, 5/7/19, and 5/9/19.

Participants

Participants in the current study were 342 engineering students, who completed the survey for a 17.1% response rate. They were predominantly white (63.4%) and male (73.4%), with an average age of 25.85 years old (*SD* = 8.2). Traditional undergraduate engineering students represented 59% (*n* = 200) of the sample; 26% (*n* = 90) were graduate engineering students, and 15% (*n* = 52) met the criteria of SCS undergraduate engineering students. In the current study, SCS undergraduate engineering students were operationalized as currently enrolled undergraduate engineering students, who, before starting their engineering studies, reported coming from one or more of the following: a) military, b) vocational / technical school, c) full-time job, d) part-time job, or e) another academic major at ODU.

Materials

The current study adopted a demands-resources conceptual and measurement framework [15] to examine perceived demands and resources to success of engineering students. The anonymous, online survey contained measures of personal/school demands and resources, as well as outcomes of interest.

Personal demands. Personal demands were measured with eight variables consisting of 26 items. The personal demands of difficulties with time management, difficulty staying organized, difficulty paying attention, difficulty prioritizing schoolwork, performance avoidance goal orientation, procrastination, and lack of persistence were all measured with two items each. For example, performance avoidance goal orientation was measured with the items: "I worry about the possibility of getting bad grades in my ODU classes" and "My fear of performing poorly in my ODU classes is often what motivates me." All personal demands were measured on a 5-point Likert-type scale, where 1 = Strongly Disagree and 5 = Strongly Agree, except for the personal demand of mental health symptoms. Mental health symptoms were measured with the 12-item version of the General Health Questionnaire (GHQ-12; [23]). Sample items included: "Lost much sleep over worry" and "felt constantly under stress." Participants responded to the prompt: "Have you recently:" on a 4-point scale, and responses were dichotomized to '0' or '1'. Scores on each of the 12 items were summed, and higher scores indicated a more severe condition.

School demands. School demands were measured with eight variables comprised of 34 total items, which included lack of campus resources, lack of support from students and Engineering faculty, academic demands, administrative demands, school-related financial demands, demands outside of school, and negative student campus climate. For example, the school demand of lack of Engineering faculty support included two items, "difficulty approaching Engineering faculty for questions and feedback" and "lack of consideration from Engineering faculty for individual needs and concerns." All school demands were measured on a 5-point Likert-type scale. While different variables had different response options, for all school demands a higher score indicated a greater perceived demand.

Personal resources. Personal resources were measured with five variables consisting of ten items. The personal resources of mastery goal orientation, performance approach goal orientation, self-esteem, and academic self-efficacy, and self-efficacy to graduate with an Engineering degree were each measured with two items. For example, mastery goal orientation was measured with the items "I want to learn as much as possible from my ODU classes" and "I desire to completely master the material presented in my ODU classes." All personal demands were measured on a 5-point Likert-type scale, where 1 = Strongly Disagree and 5 = Strongly Agree.

School resources. School resources were measured with three variables comprised of 13 total items. The school resources were the frequency with which students used administrative, campus, and people resources. For example, an administrative resource was using the financial aid office, a campus resource was using the University's writing center, and a people resource was using peer tutors or faculty mentors. All school resources were measured in terms of utilization using a 5-point frequency scale, where 1 = Never and 5 = Frequently if not always.

Outcomes. In addition to personal / school demands and resources, participants also responded to questions intended to measure important student outcomes. Student outcomes were measured with six variables comprised of 10 items, such as student engagement, fit with ODU Engineering program, school burnout, commitment to Engineering major, and current and expected GPA. For example, student engagement was measured with the items "I am enthusiastic about being an Engineering student at ODU" and "Being an Engineering student at ODU inspires me." All outcome variables (except the two measuring GPA) were measured on a 5-point Likert-type scale, where 1= Strongly Disagree and 5 = Strongly Agree. Higher scores indicated a more desirable result with the exception of school burnout for which a lower score would be more desirable.

The two GPA variables were measured on a 9-point scale (1 = *At least 1.99*; 2 = *2.00 - 2.49*; 3 = *2.50 - 2.99*; 4 = *3.00 - 3.24*; 5 = 3*.25 - 3.49*; 6 = *3.50 - 3.74*; 7 = *3.75 - 3.89*; 8 = 3*.90 - 3.99*; 9 = *4.00*). We wanted to measure both self-reported current GPA and expected GPA, and for comparison purposes, we chose to use a non-uniform interval scale to minimize the expected negative skewness in the GPA variables' distributions due to grade inflation [24]. Grade inflation occurs when GPA tends to skew upwards (to 4.00), thus affecting the distribution [24]. In fact, research shows that engineering grades tend to average above 3.00 and there is an increasing prevalence of A grades [25]. This provides justification for using smaller intervals in the GPA scale as the scale gets closer to 4.00, since it is likely more students will be at that end of the distribution due to grade inflation. Post-hoc analyses revealed that this response scale produced normal distributions for both current GPA (skewness = 0.13) and expected GPA (skewness = 0.20).

Results

Mean levels for all variables representing personal/school demands and resources and outcomes were organized by the three aforementioned groups (traditional undergraduate engineering students, SCS undergraduate engineering students, and graduate engineering students) and presented in the Table 1 and Figures 1-5.

Results for Personal Demands

Second career seeking undergraduate engineering students reported significantly lower average levels of difficulties with time management, performance-avoidance goal orientation, procrastination, lack of persistence, and mental health symptoms than traditional undergraduate engineering students. Furthermore, SCS engineering students indicated significantly fewer difficulties paying attention compared to both and traditional undergraduate engineering students and graduate engineering students. There were no significant mean differences between the groups on difficulties staying organized and prioritizing schoolwork (see Table and Figures 1 and 2).

Results for School Demands

Compared to traditional undergraduate engineering students, SCS undergraduate engineering students reported significantly lower levels of lack of support from students and Engineering faculty, academic demands, and school-related financial demands. Second career seeking undergraduate engineering students reported significantly higher levels of demands outside of school compared to the other two groups. There was no significant mean difference between the groups in terms of perceptions of a negative Engineering student campus climate (see Table and Figure 3).

Results for Personal Resources

Compared to traditional undergraduate engineering students, SCS undergraduate engineering students reported significantly higher levels of academic self-efficacy. There were no significant mean differences between the groups on the other four personal resource variables: mastery goal orientation, performance approach goal orientation, self-esteem, and self-efficacy to graduate with an Engineering degree (see Table and Figure 4).

Results for School Resources

Second career undergraduate engineering students and graduate engineering students reported significantly lower levels of utilization of campus resources compared to traditional undergraduate engineering students. Also, graduate engineering students reported significantly higher levels of utilization of administrative resources than both traditional and second career undergraduate engineering students. There was no significant difference between the groups on social resources (see Table and Figure 5).

Results for Outcomes

Across the six outcome variables, SCS undergraduate engineering students and graduate engineering students reported significantly lower levels of school burnout than traditional undergraduate engineering students. Additionally, both traditional undergraduate engineering students and SCS undergraduate students reported significantly lower levels of current and expected GPA than the group of graduate engineering students. All are undesirable outcomes (see Table and Figures 6 and 7).

Discussion

The purpose of this study was to identify specific needs of SCS undergraduate engineering students by comparing the mean levels of their school/personal demands, resources, and outcomes with those experienced by traditional undergraduate and graduate engineering students. Our results suggest that, overall, SCS undergraduate engineering students have more similar experiences to graduate engineering students than to traditional undergraduate engineering students. We found that SCS undergraduate engineering students tend to experience fewer personal and school demands, report fewer mental health symptoms, have higher academic self-efficacy (i.e., self-confidence), and are less likely to suffer from school burnout compared to traditional undergraduate engineering students. These findings imply that SCS undergraduate engineering students are generally well-adjusted and -prepared to be successful in their academic careers.

Specifically, our analyses show that SCS undergraduate engineering students tend to resemble graduate students in terms of levels of personal demands, reporting relatively low levels of time management difficulties, performance avoidance goal orientation, procrastination, and lack of persistence (Fig. 1). The largest statistically significant difference across the seven variables for personal demands was found for performance avoidance goal orientation with traditional undergraduate students demonstrating a significantly higher mean value of 4.03 compared to SCS undergraduate students (3.48) and graduate students (3.42), suggesting higher levels of anxiety related to academic performance and being afraid of failure (Fig. 1). Additionally, SCS undergraduate students had less difficulties with paying attention (2.60) than both traditional undergraduate (3.31) and graduate students (3.09), see Figure 1. It is also interesting to note that SCS undergraduate students reported significantly fewer mental health symptoms (3.50) than traditional undergraduate students (4.69) per Figure 2. The mental health of engineering students is of concern [26] and can be fostered by faculty and administrators with program/curriculum redesigning efforts to balance required and elective courses, stress-management resources and training, promotion of self-care and utilization of campus health resources, and individualized consideration of student needs.

Moreover, SCS undergraduate students demonstrated higher academic self-efficacy (4.14) compared to their traditional counterparts (3.82) and similar levels of mastery and performance approach goal orientations, self-esteem, and self-efficacy to graduate with an engineering degree (Fig. 3). The high scores on mastery goal orientation (4.18, 4.21, and 4.27) mean that all three groups of students are motivated to learn and seek to achieve a greater understanding of the core engineering subject matter. They are also similarly driven by the desire to demonstrate competence relative to others, albeit this orientation is lower than their mastery orientation. Overall, the above results speak to the relative maturity and psychological adjustment of SCS undergraduate students and their high motivation and preparedness to be successful in their new educational and career endeavors.

The picture depicted by our results for school demands (Fig. 4) is similar to that for personal demands with SCS undergraduate students exhibiting levels of lack of support from students (1.82) and engineering faculty (2.03), as well as academic demands (2.23) comparable to those of graduate students (1.93, 2.06, and 2.08, respectively), but significantly lower than the same demands for traditional undergraduate students (2.18, 2.53, and 2.56, respectively). Traditional undergraduate students perceive more administrative demands (2.24) than graduate students (1.68) and more school-related financial demands (2.37) than SCS undergraduate students (1.88). The latter finding is not surprising given that SCS undergraduate students have pursued other careers prior to returning to school and many of them continue to work outside of school.

However, our findings also show that SCS undergraduate students struggle more than the other two groups with demands originating outside of school, such as working and living off campus and responsibilities related to work and family interfering with schoolwork. It is likely that given their non-traditional status (e.g., family, children), these students are more pressured to work outside school in order to support their families, which can create conflicts between the family, work, and school domains. In fact, our samples characteristics reveal that 67% of SCS undergraduate students reported working outside the university for 33 hours per week on average, while only 32% of traditional undergraduate students did so for 21 hours per week. Furthermore, whereas 55% of SCS undergraduate students were married and 42% had children, only 4% of the traditional undergraduate students were married and 2% had children. Consequently, these students are likely to benefit from (a) flexible administrative policies and practices with regards to scheduling, class offerings, mentoring, and advising, (b) targeted programs and financial resources to alleviate family financial pressures, and (c) a heightened awareness by faculty and administrators of the demands they may be experiencing in their family and work domains and how these demands may affect these students' ability to complete school tasks timely and successfully.

Additionally, our findings show that both SCS undergraduate (1.51) and graduate students (1.36) tend to underutilize campus resources compared to traditional undergraduate students (1.74), highlighting the need to make campus resources more readily available and accessible, and to strategically market needed resources to these groups of students (Fig. 5).

Finally, SCS undergraduate students, traditional undergraduate students, and graduate students display similarly high levels of student engagement (4.00, 3.72, and 3.78, respectively), and fit with their engineering programs (4.05, 3.91, and 4.03, respectively), and even higher commitment to their engineering majors (4.45, 4.55, and 4.57, respectively). It is noteworthy that traditional undergraduate students are at highest risk for school burnout (3.87) compared to SCS undergraduate students (3.43) and graduate students (3.02). Research has shown an empirical link between college student burnout and a low psychological sense of university community, emphasizing the need for interventions to prevent and decrease student burnout not only by focusing on individual students (e.g., building stress-management and coping skills), but also by redesigning the physical, social, and institutional environments to foster supportive learning communities [27].

Conclusion

Taken together, the results suggest that traditional undergraduate engineering students are experiencing higher levels of personal and school demands and more undesirable outcomes like school burnout and low current and expected GPA compared to SCS undergraduate engineering students and graduate engineering students. Significant challenges for second career undergraduate engineering students are demands outside of school, such as lack of childcare, living as working off campus, and family and work responsibilities interfering with schoolwork. The significant differences in mean levels of experienced demands, resources, and outcomes across the three studied groups highlight the need for faculty and administrators to develop and implement strategies and interventions tailored to support the needs of different engineering student populations.

Acknowledgement

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Table 1: Means, Standard Deviations, and Significance Testing for Study Variables and Outcomes

Variable	Traditional Undergraduate Students (n = 200)		Second Career Seeking Undergraduate Students (n = 52)		Graduate Students (n = 90)		One-Way Analysis of Variance Mean Difference Testing	
	Mean	SD	Mean	SD	Mean	SD	F	p
Personal Demands								
Difficulties with Time Management*	2.82	0.91	2.52[a]	0.96	2.57	0.85	3.71	.026
Difficulty Staying Organized	2.80	1.02	2.58	0.98	2.64	0.99	1.45	.236
Difficulty Paying Attention*	3.31[b]	0.93	2.60[a,c]	0.88	3.09[b]	0.86	12.83	.000
Difficulty Prioritizing Schoolwork	2.77	0.97	2.83	1.01	3.02	1.00	2.03	.132
Performance Avoidance Goal Orientation*	4.03[b,c]	0.73	3.48[a]	0.88	3.42[a]	1.03	20.42	.000
Procrastination*	3.13[b,c]	1.10	2.62[a]	0.95	2.66[a]	1.00	8.96	.000
Lack of Persistence*	2.73[b,c]	0.89	2.24[a]	0.97	2.42[a]	0.83	7.94	.000
Mental Health Symptoms*	4.69[b]	2.29	3.50[a]	2.59	4.30	2.46	5.21	.006
School Demands								
Lack of Campus Resources*	2.14[c]	0.79	2.02	0.83	1.71[a]	0.76	9.25	.000
Lack of Support from Students*	2.18[b,c]	0.77	1.82[a]	0.85	1.93[a]	0.74	6.15	.002
Lack of Support from Engineering Faculty*	2.53[b,c]	1.15	2.03[a]	0.99	2.06[a]	1.02	8.27	.000
Academic Demands*	2.56[b,c]	0.83	2.23[a]	0.78	2.08[a]	0.70	12.50	.000
Administrative Demands*	2.24[c]	0.89	2.02	0.88	1.68[a]	0.68	13.59	.000
School Related Financial Demands*	2.37[b]	1.12	1.88[a]	0.86	2.08	1.02	5.63	.004
Demands Outside of School*	1.89[b]	0.85	2.27[a]	0.83	2.13	0.89	5.11	.007
Negative Engineering Student Campus Climate	2.45	0.82	2.38	0.88	2.27	0.85	1.51	.223
Personal Resources								
Mastery Goal Orientation	4.18	0.63	4.21	0.71	4.27	0.61	0.61	.543
Performance Approach Goal Orientation	3.42	1.04	3.16	1.19	3.27	1.11	1.44	.238
Self-Esteem	2.75	0.49	2.83	0.30	2.82	0.48	0.90	.407
Academic Self-Efficacy*	3.82[b]	0.73	4.14[a]	0.60	3.96	0.68	4.72	.009
Self-Efficacy to Graduate with an Engineering Degree	4.47	0.75	4.42	0.84	4.54	0.59	0.50	.608
School Resources								

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Variable	Traditional Undergraduate Students (*n* = 200)		Second Career Seeking Undergraduate Students (*n* = 52)		Graduate Students (*n* = 90)		One-Way Analysis of Variance Mean Difference Testing	
	Mean	SD	Mean	SD	Mean	SD	*F*	*p*
Utilization of Administrative Resources*	2.07[c]	0.86	2.27	1.01	2.56[a]	0.76	10.11	.000
Utilization of Campus Resources*	1.74[b,c]	0.46	1.51[a]	0.50	1.36[a]	0.42	22.45	.000
Utilization of Social Resources	1.99	0.63	2.10	0.67	2.07	0.74	0.88	.415
Outcomes								
Student Engagement	3.72	0.94	4.00	0.85	3.78	0.83	2.09	.126
Fit with Engineering Program	3.91	0.90	4.05	0.95	4.03	0.72	0.96	.384
School Burnout*	3.87[b,c]	0.99	3.43[a]	1.17	3.02[a]	1.17	20.12	.000
Commitment to Engineering Major	4.55	0.76	4.45	0.86	4.57	0.62	0.46	.632
Current Overall Cumulative GPA[e]	4.68[c]	1.93	4.71[c]	2.31	6.56[a,b]	1.69	30.55	.000
Expected Overall Cumulative GPA[e]	4.91[c]	1.61	5.04[c]	1.69	6.55[a,b]	1.49	34.13	.000

*Significant at $p < 0.05$

[a] Indicates a group that is significantly different from traditional undergraduate engineering students.

[b] Indicates a group that is significantly different from second career seeking undergraduate engineering students.

[c] Indicates a group that is significantly different from graduate engineering students.

[d] Measured on a 4-point scale dichotomized for each item with scores ranging from 0 to 12 (higher scores indicating more severe symptoms).

[e] Measured on a 9-point scale starting at a GPA of 1.99 to 4.00.

Figure 1 – Group Comparisons of Personal Demands for Engineering Students

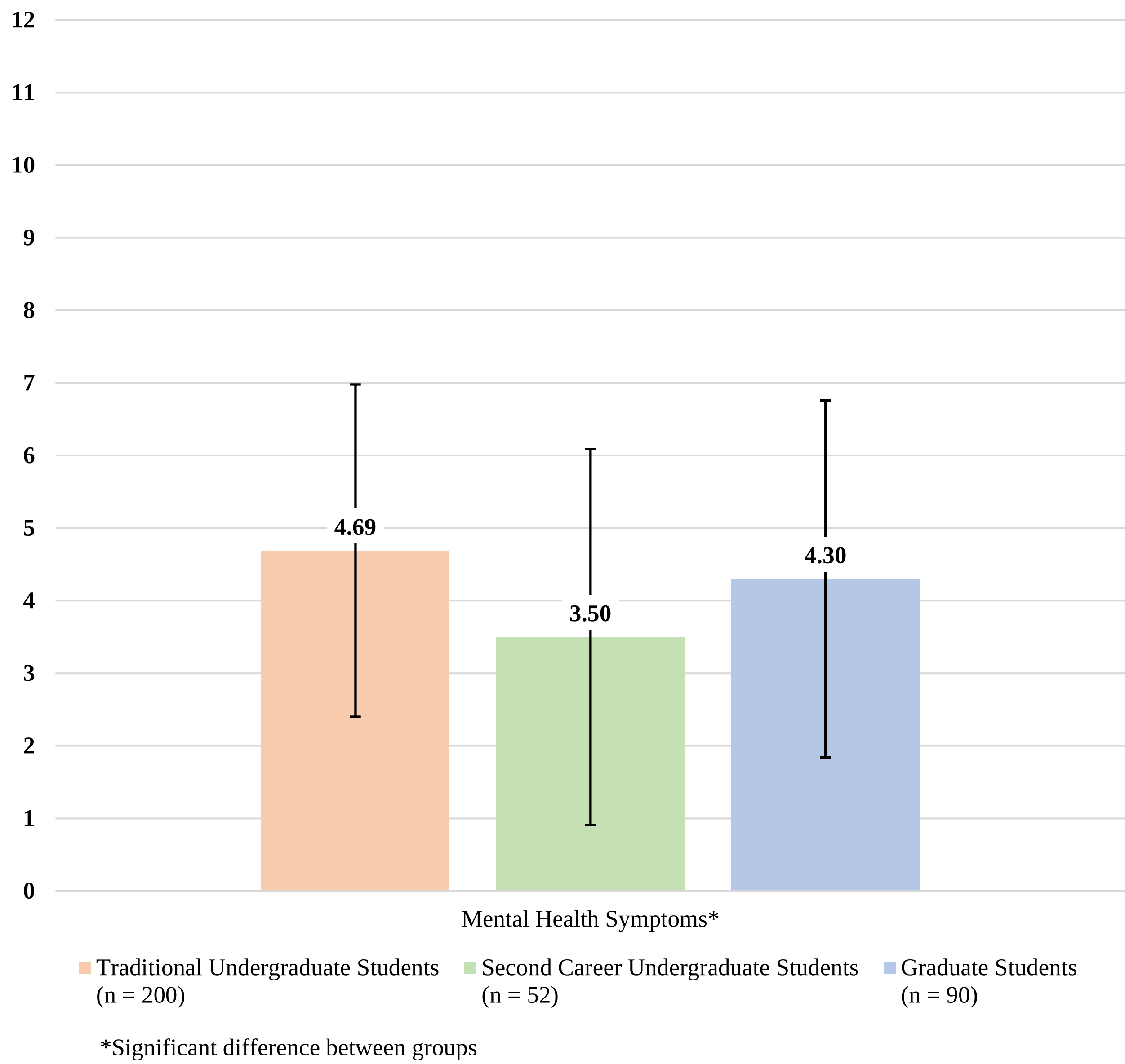

Figure 2 – Group Comparisons of Mental Health Symptoms for Engineering Students

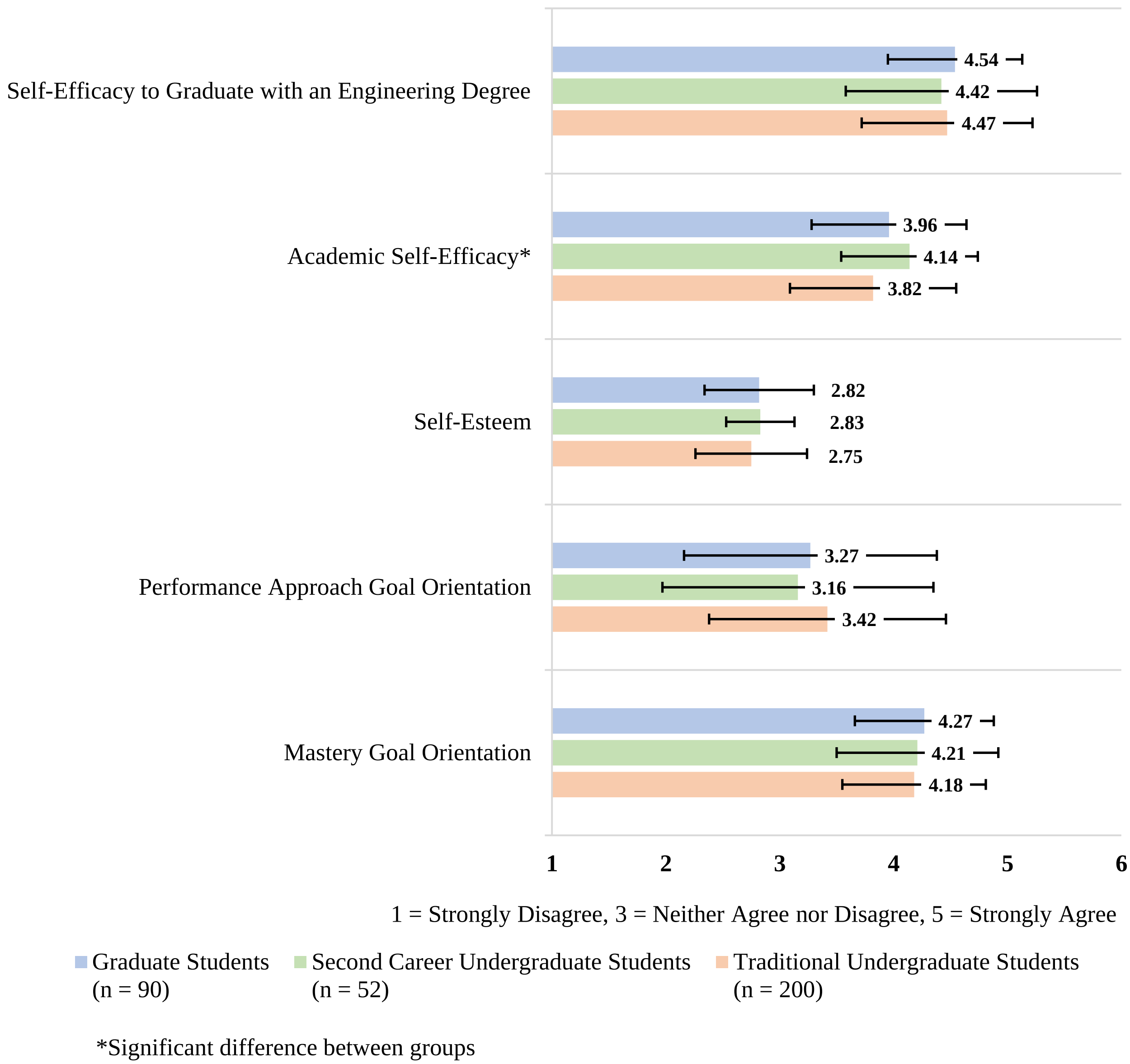

Figure 3 – Group Comparisons of Personal Resources for Engineering Students

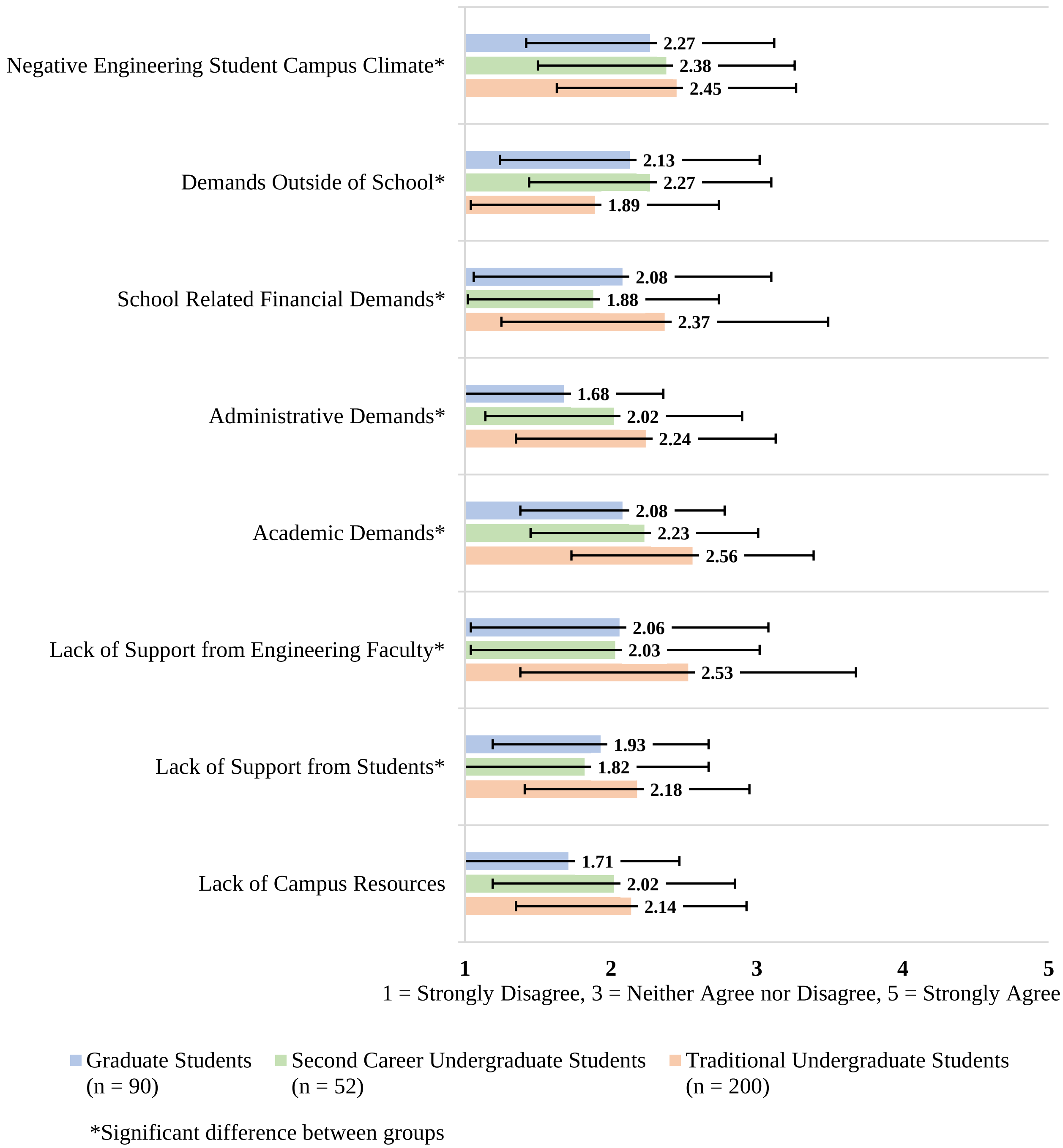

Figure 4 – Group Comparisons of School Demands for Engineering Students

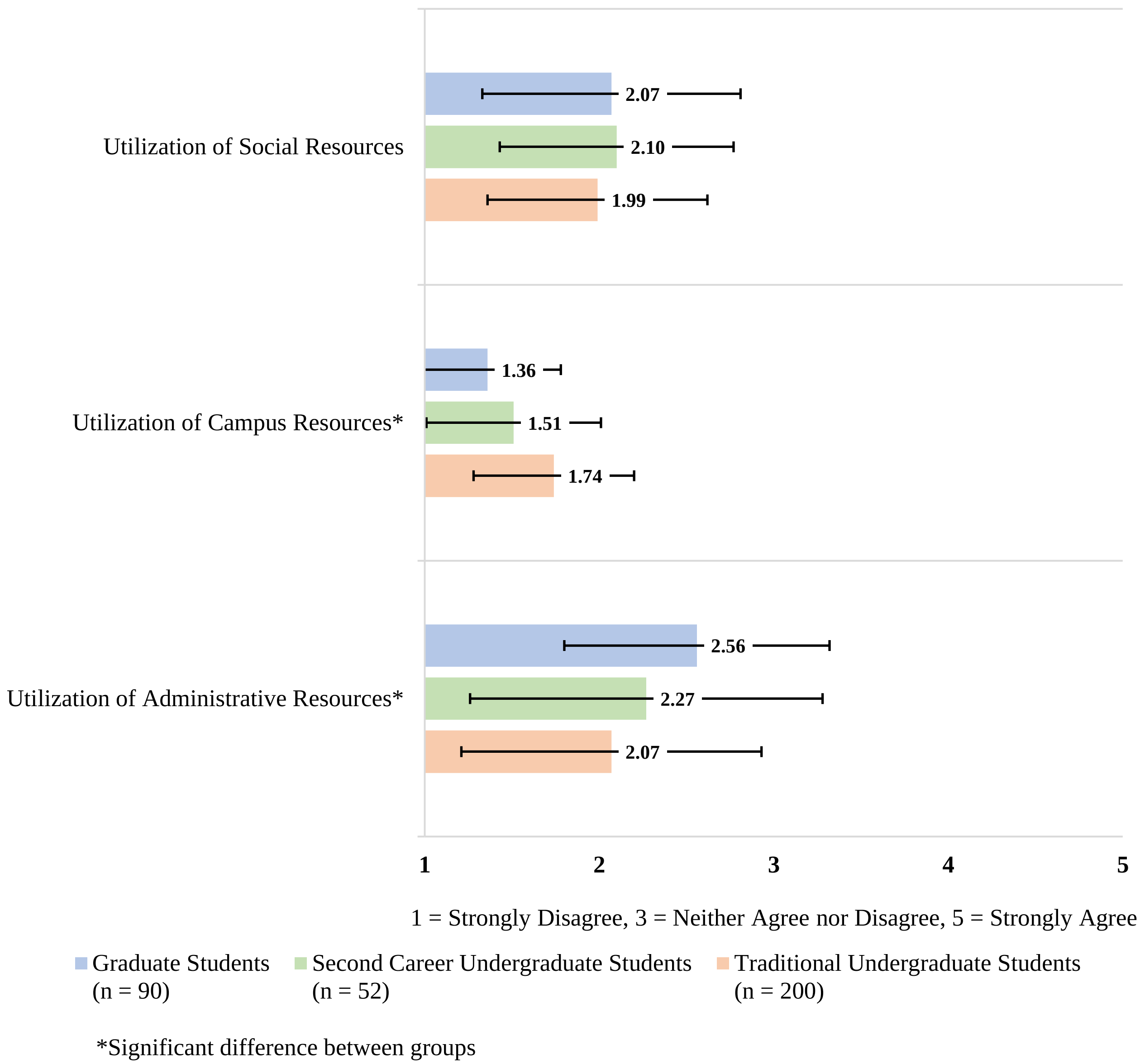

Figure 5 – Group Comparisons of School Resources for Engineering Students

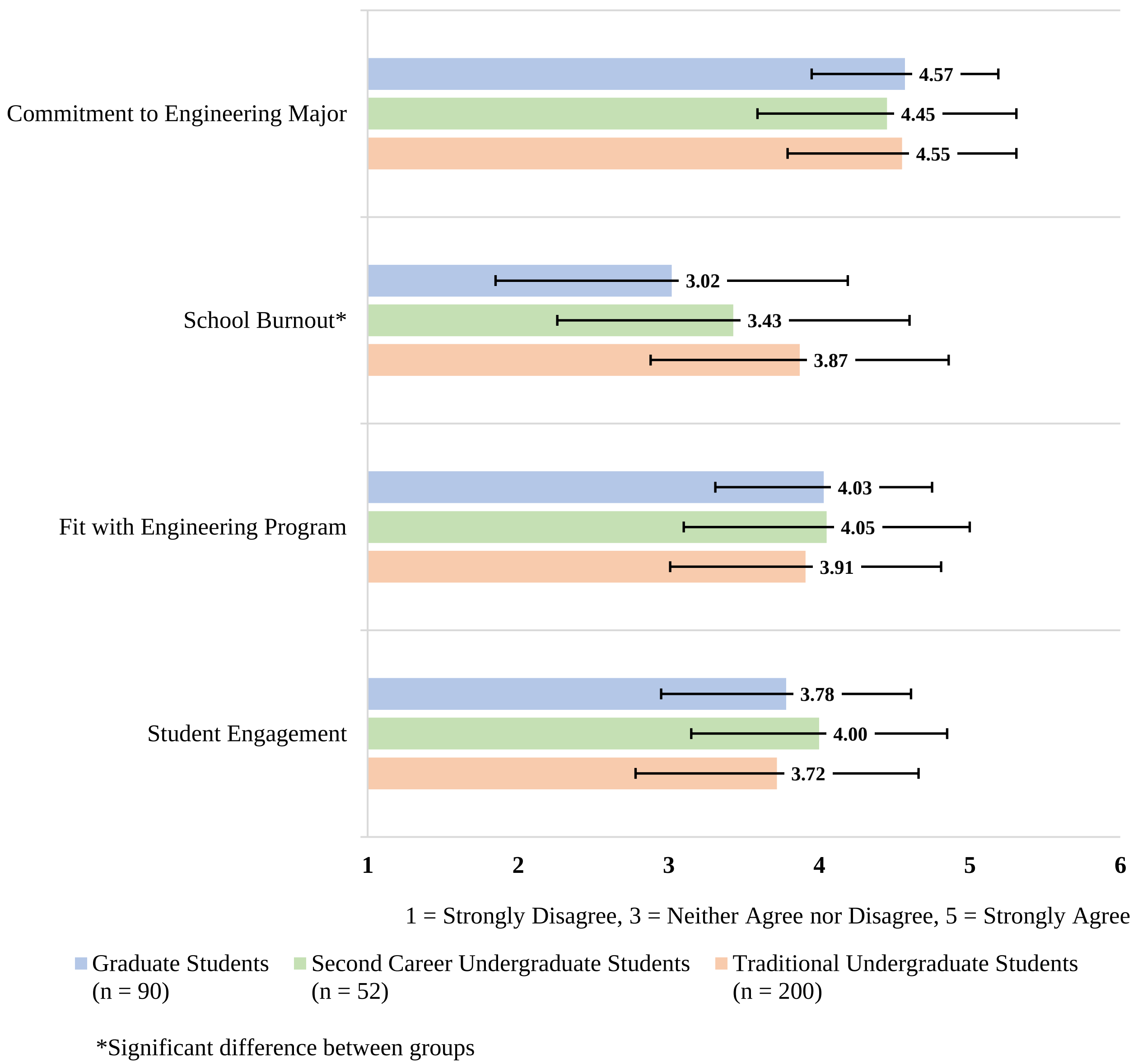

Figure 6 – Group Comparisons of Outcomes for Engineering Students

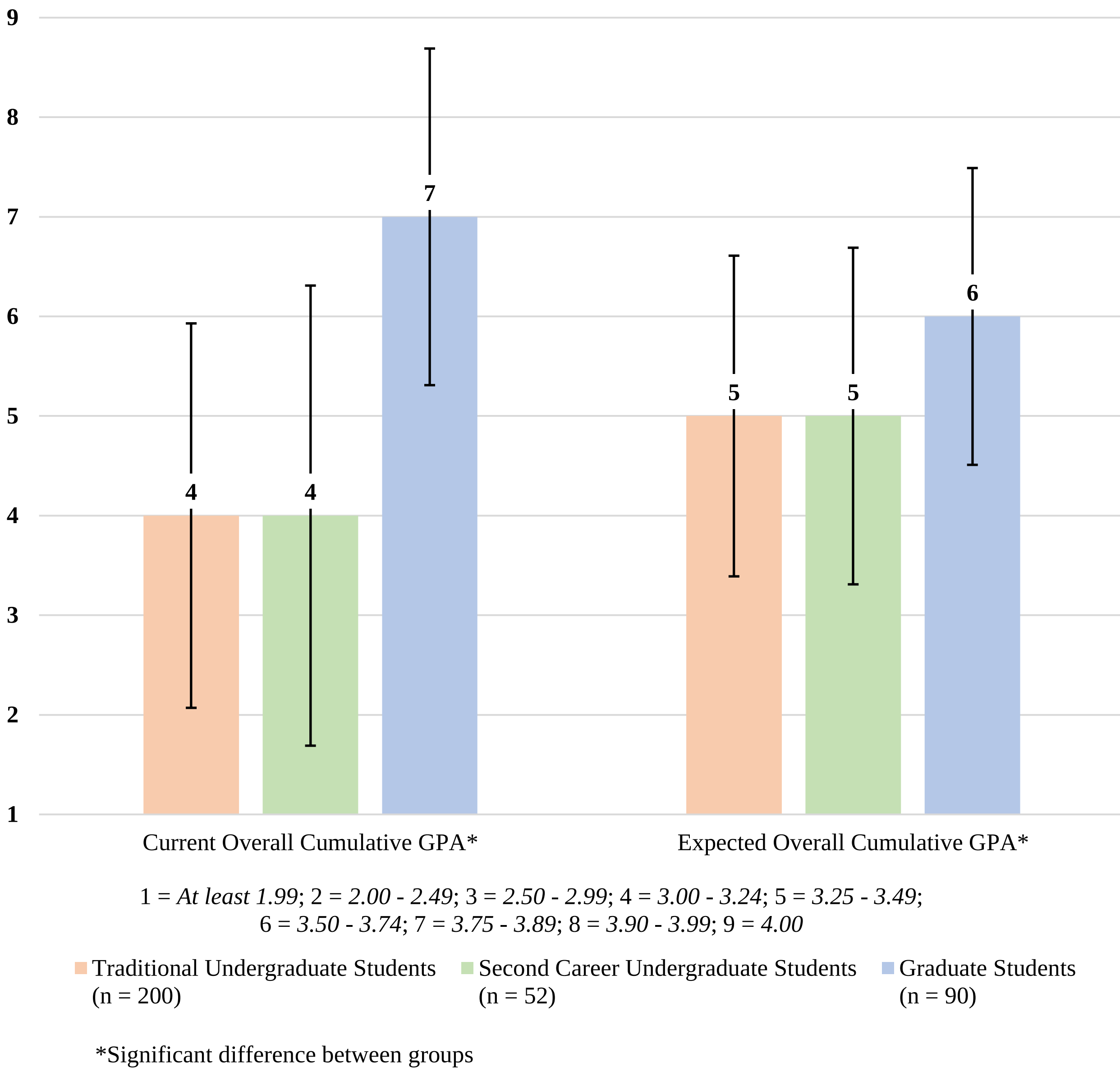

Figure 7 – Group Comparisons of Median Current and Expected GPA for Engineering Students

References

[1] “National Center for Educational Statistics: Enrollment in Postsecondary Institutions Fall 2011 and graduation rates, selected cohorts 2003-2008. Retrieved from https://nces.ed.gov/programs/digest/d11/tables/dt11_200.asp.”

[2] A. Brown, J. Bimrose, S.-A. Barnes, and D. Hughes, “The role of career adaptabilities for mid-career changers,” J. Vocat. Behav., vol. 80, no. 3, pp. 754–761, Jun. 2012.

[3] Help Wanted: Projections of Job and Education Requirements Through 2018. Lumina Foundation, 2010.

[4] A. P. Carnevale, N. Smith, and J. Strohl, “Recovery: Job Growth And Education Requirements Through 2020,” Jul. 2013.

[5] G. Markle, “Factors Influencing Persistence Among Nontraditional University Students,” Adult Educ. Q., vol. 65, no. 3, pp. 267–285, Aug. 2015.

[6] “National Center for Educational Statistics: Enrollment in Postsecondary Institutions Fall 2011 and graduation rates, selected cohorts 2003-2008. Retrieved from https://nces.ed.gov/programs/digest/d11/tables/dt11_200.asp.”

[7] C. Hittepole, “Nontraditional Students: Supporting Changing Student Populations.” Student Affairs Administration in Higher Education, 2015.

[8] R. Brindley and A. Parker, “Transitioning to the classroom: reflections of second-career teachers during the induction year,” Teach. Teach., vol. 16, no. 5, pp. 577–594, Oct. 2010.

[9] S. S. M. Bauman, N. Wang, C. W. DeLeon, J. Kafentzis, M. Zavala-Lopez, and M. S. Lindsey, “Nontraditional Students’ Service Needs and Social Support Resources: A Pilot Study,” J. Coll. Couns., vol. 7, no. 1, pp. 13–17, Mar. 2004.

[10] Ross-Gordon J.M., "Adult Learners in the Classroom," New Dir. Stud. Serv., vol. 2003, no. 102, pp. 43–52, Jun. 2003.

[11] R. W. Lent, H.-B. Sheu, M. J. Miller, M. E. Cusick, L. T. Penn, and N. N. Truong, "Predictors of science, technology, engineering, and mathematics choice options: A meta-analytic path analysis of the social–cognitive choice model by gender and race/ethnicity.," J. Couns. Psychol., vol. 65, no. 1, pp. 17–35, 2018.

[12] K. Dlouhy and T. Biemann, "Path dependence in occupational careers: Understanding occupational mobility development throughout individuals' careers," J. Vocat. Behav., vol. 104, pp. 86–97, Feb. 2018.

[13] Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B., "The job demands-resources model of burnout," *Journal of Applied Psychology, 86*(3), 499–512, 2001. https://doi-org.proxy.lib.odu.edu/10.1037/0021-9010.86.3.499

[14] Kaufman, R. & Guerra-Lopez, I. (2013). *Needs assessment for organizational success.* Washington, DC: Association for Talent Development.

[15] Bakker, A. B., & Demerouti, E., "Job demands–resources theory: Taking stock and looking forward," *Journal of Occupational Health Psychology, 22*(3), 273-285, 2017. http://dx.doi.org/10.1037/ocp0000056

[16] Lesener, T., Gusy, B., & Wolter, C., The job demands-resources model: A meta-analytic review of longitudinal studies. *Work & Stress, 33*(1), 76-103, 2019. https://doi-org.proxy.lib.odu.edu/10.1080/02678373.2018.1529065

[17] Schaufeli, W. B., Martínez, I. M., Marques Pinto, A., Salanova, M., & Bakker, A. B., "Burnout and engagement in university students: A cross-national study," *Journal of Cross-*

Cultural Psychology, *33*(5), 464–481, 2012. https://doi-org.proxy.lib.odu.edu/10.1177/0022022102033005003

[18] Jones, R. A., Mahoney, J. W., & Gucciardi, D. F. (2014). On the transition into elite rugby league: Perceptions of players and coaching staff. *Sport, Exercise, and Performance Psychology*, *3*(1), 28–45. https://doi-org.proxy.lib.odu.edu/10.1037/spy0000013

[19] Bass, B. I., Cigularov, K. P., Chen, P. Y., Henry, K. L., Tomazic, R. G., & Li, Y. (2016). The effects of student violence against school employees on employee burnout and work engagement: The roles of perceived school unsafety and transformational leadership. *International Journal of Stress Management*, *23*(3), 318–336. https://doi-org.proxy.lib.odu.edu/10.1037/str0000011

[20] Bakker, A. B., Sanz Vergel, A. I., & Kuntze, J. (2015). Student engagement and performance: A weekly diary study on the role of openness. *Motivation and Emotion, 39*(1), 49–62. https://doi-org.proxy.lib.odu.edu/10.1007/s11031-014-9422-5

[21] Salmela-Aro, K., & Vuori, J. (2015). School engagement and burnout among students: Preparing for work life. In J. Vuori, R. Blonk, & R. H. Price (Eds.), *Aligning perspectives on health, safety and well-being. Sustainable working lives: Managing work transitions and health throughout the life course* (p. 51–64). Springer Science + Business Media. https://doi-org.proxy.lib.odu.edu/10.1007/978-94-017-9798-6_4

[22] Ayala, J. C., & Manzano, G. (2018). Academic performance of first-year university students: The influence of resilience and engagement. *Higher Education Research & Development, 37*(7), 1321–1335. https://doi-org.proxy.lib.odu.edu/10.1080/07294360.2018.1502258

[23] Goldberg, D. (1972). *The detection of psychiatric illness by questionnaire*. London: Oxford University Press.

[24] Kostal, J. W., Kuncel, N. R., & Sackett, P. R. (2016). Grade inflation marches on: Grade increases from the 1990s to 2000s. *Educational Measurement: Issues and Practice*, *35*(1), 11-20.

[25] McAllister, C. D., Jiang, X., & Aghazadeh, F. (2008). Analysis of engineering discipline grade trends. *Assessment & Evaluation in Higher Education*, *33*(2), 167–178. https://doi-org.proxy.lib.odu.edu/10.1080/02602930601127802

[26] Deziel, M., Olawo, D., Truchon, L., & Golab, L. (2013). Analyzing the Mental Health of Engineering Students using Classification and Regression. EDM. Retrieved from https://www.semanticscholar.org/paper/Analyzing-the-Mental-Health-of-Engineering-Students-Deziel-Olawo/c763af55ef907db530a9cca589ce161e3994b1bd

[27] McCarthy, M. E., Pretty, G. M., & Catano, V. (1990). Psychological sense of community and student burnout. *Journal of College Student Development*, *31*(3), 211-216.