Stress and Response Patterns in Adult Engineering Students within Higher Education

Audrianna Rodriguez [1], Maria-Isabel Carnasciali [1], Shannon Ciston [2], Melissa L. Whitson [1], and Viktoria Zelenak Berendt [1]
[1] University of New Haven, CT
[2] UC Berkeley, CA

Abstract

Adult learners face several challenges when reintegrating into the classroom setting after working for years. Adult engineering students may experience some of these challenges, especially, with the rigorous academic course load. The current study seeks to build upon the current literature by examining traditional age and adult learners pursuing engineering degrees to understand how these students differ on the factors that impact their academic experience. The results from our study indicated that adult learners differed from traditional age students on important factors. Adult learners reported using more positive appraisal techniques and coping strategies to deal with the pressures of being a student compared to traditional age students, who exhibited higher maladaptive appraisal styles. In contrast, adult learners reported higher levels of personal life stressors and health concerns compared to their traditional age cohort. Exploring engineering student experiences helps to create effective educational practices to offset the challenges that students face in efforts to retain a diverse pool of engineering students.

Keywords

Nontraditional students, Adult learner, Engineering Education

Introduction

Education can be considered the gatekeeper to the American Dream and plays an enormous role within the U.S infrastructure. In today's society, education leads to job prosperity and increased opportunity. Reports by the Census Bureau have shown direct correlation between education and earnings with the median salary for an individual with a bachelor's degree ($57,000) being twice that of an individual with just a high school diploma ($27,470).[1] As the job market "gradually shifts from manufacturing blue-collar oriented jobs to white-collar service related professions" [2] education becomes essential in providing career readiness. In consequence, many higher learning institutions have experienced an influx in enrollment rates among a variety of student populations. Adult learners are one of many student groups expected to proliferate within higher education. According to the National Center for Education Statistics (NCES) 2009 report, by the year 2018, it is projected that the number of students 25 to 34 years old will increase by

25%, compared to a 12% increase for those aged 35 and older, and only 9% of those aged 18 to 24 years old.[3] As diversity continues to increase within the student body, so does the range of needs. Many higher education institutions currently face the challenge of creating inclusive classrooms for diverse student populations including nontraditional and adult learners.

A nontraditional student can be defined as one who has either delayed enrollment into college, attends school part time, works full time while enrolled, is financially independent, or serves in the role of spouse, domestic partner, parent, or caretaker.[4] These characteristics often create different challenges for nontraditional students, placing them at greater risk for departure from higher education. While nontraditionality is defined by these characteristics, an adult student is defined using an age threshold. For the purpose of this study, we define "adult" as being aged 25 years or over, consistent with the threshold used to track federally-funded adult education in the United States. We recognize that while these groups (nontraditional, adult) are defined by different criteria, there is a strong overlap between the groups. Markle [5] cited an example from the NCES 2011 report, that 64% of 18-year-old students enrolled in 2003-2004 graduated within 6 years compared to 20% of those aged 24 to 29 years, and 16% of those aged 30 and older. Adult learners exhibit difficulty with immersing themselves within the academic environment which may account for higher attrition rates [6] in addition, to some campus environments not being hospitable toward nontraditional students.[7]

In response to these unique barriers, increased scholarly attention has focused on understanding the adult learner experience. Research "provides some important insights into the experiences of adults entering higher education, and identifies factors that interact and may present different challenges for adults than for other groups of students."[8] According to Crossan et al, [9] one barrier that has an impact within the classroom for nontraditional students is their "fragile learning identities". Within the academic setting, their sense of self may include a history of negative previous educational experiences and "enter with lower self-efficacy beliefs about personal academic skills than the traditional student."[10] In addition to this barrier, many nontraditional students experience "feelings of isolation and not fitting in, lack of access to resources, scheduling conflicts, lack of course availability and course times, financial difficulties, and the lack of catering to nontraditional students detracted from the overall college experience."[11] Additionally, the challenge of balancing work, school, and life can create pressures for the adult learner. "According to the resource scarcity theory, going back to school creates another role domain that competes for limited resources: the student's time, energy, and finances."[12] These obstacles (amongst many) create difficulty for the adult learner to integrate into the "traditional" university setting.

Literature Review

Research suggests that different internal and external factors influence the learning process for adult learners. With the increasing number of adult students pursuing postsecondary education, it is imperative to understand how these students differ on factors that impact their academic experience and the influence this has on the learning process within the classroom.

Stress and role conflict

While "stress is acknowledged as part of the student experience"[13], regardless of student status (traditional age vs adult), excessive amounts of stress have been linked to psychological, physical, and emotional outcomes that are harmful. While there are common stressors among college students such as class assignments, homework, and exams, adult learners experience additional stressors that are unique. A major source of stress for the adult learner is balancing work and family while tackling the demands of school. "Unlike traditional, non-traditional students have responsibilities related to their work and personal lives that may lead to demand overload and role conflict when merged with school" [12]. The manner that adult students perceive the demands of the multiple roles and the extent of the demands has potential consequences on student learning, academic performance, and persistence. Martin[14] concluded that perceived stress influenced grade point average (GPA), intent to persist, and goal commitment. Kearns and Gardiner [15] found similar results and concluded that the levels of stress that a student encountered influenced academic performance and time management. They found within their study that adult learners that experienced lower levels of academic stress exhibited more satisfaction with their academic experiences and managed their time better. "The commitments and responsibilities adults have outside of university are consistently found to affect their participation in higher education." [8] In efforts to maximize the learning experience for adult learners, exploring stressors that impact the student within the classroom and beyond is essential.

Appraisal techniques and health concerns

Appraisal techniques are used to assess a distressing situation or event. The conclusion from the evaluation can be positive or negative depending on the student's capacity to gauge the situation. If an event is viewed as "harmful or threatening", the student will utilize negative appraisals and perceive the coursework or life events as overwhelming. In comparison to positive appraisals which views the event as a "challenge to be overcome". Students that utilize positive appraisal techniques are more likely to view difficult tasks as "manageable" and feel that they are able to accomplish the task. The appraisal techniques that a student uses has an impact on how a student perceives the event, the actions that one takes to resolve the issue, and issues revolving around health. Within this study, questions pertaining to health inquired about psychological well-being such as depression or self-worth. When exploring appraisal techniques, it is plausible that perceived control over a situation influences health outcomes. For example, students that utilize more negative appraisals techniques are likely to experience an inability to overcome difficulties,

lose confidence in themselves, and experience increased unhappiness compared to students that use positive appraisal whom might experience increased feelings of being able to face problems, an ability to enjoy normal day to day activities, and exhibit feelings of overall happiness. For academic success to occur, students must appraise good prospects in the domain and feel that they are able to handle the pressures. Hence, the importance to explore and build upon; especially, within an engineering degree program.[12]

Coping strategies and well being

"Coping style, as most commonly referred to in the literature, is the typical manner in which an individual will confront a stressful situation."[16] Within the academic setting, coping strategies can impede or promote learning within the classroom. Differences in coping strategies have been found between traditional age and adult students. Adult students tend to utilize solution driven coping strategies; such as: "task-oriented"[2], "Functional" [17], or "adaptive."[12] These methods are considered healthy because they "engage in direct action to modify the situation and reduce the amount of stress it causes" [2] and have been linked to positive characteristic traits such as optimism, control, self-esteem, well-being, and hardiness and is negatively associated with anxiety."[17] Exploring and understanding differences in coping strategies among different student groups has important ramifications in effectively providing services that help deal with the challenges of being a student.

Motivation

Research suggests that academic motivation is related to important educational outcomes, including learning, persistence, and performance. Deci and Ryan[18] proposed that behavior can be impacted by three different types of motivation: Intrinsic motivation (engaging in an activity for the pleasure and satisfaction of the action itself), extrinsic motivation (engaging in an activity in order to achieve some end or goal), and amotivation (essentially a lack of motivation in which one does not see any connection between engaging in an activity and any outcomes). It appears that nontraditional students tend to display more intrinsic motivation for pursuing higher education compared to traditional students. A report from the "NCES (2002), indicated that 73% of nontraditional students reported that personal enrichment or interest in the subject, gaining skills to advance in their job or obtain a new career, or simply completing a degree or certificate program were important factors in their perseverance." [19] The motivations students have for pursuing higher education appears to influence learning style within the classroom. "Nontraditional students are more concerned with what they can do with the knowledge they can get from a class" [20] compared to traditional students who exhibit more extrinsic motivation. "Traditional students tend to be more focused on getting high grades so they can take the next class and/or be recognized for having earned high grades." [20] Understanding the differences in motivational types helps to provide and encourage students to persist in school.

The current study seeks to build upon the current literature by examining traditional and adult students pursuing engineering degrees at a small, private undergraduate institution in the Northeast United States, and to understand how these students differ on the factors that impact their academic experience. Limited literature exists examining adult engineering student experiences within higher education. A few studies explore STEM related fields and suggest that these students encounter similar challenges as other adult students within different degree programs. The adult learners within Shillingford & Karlin's study [19] self-reported lower levels of math self-efficacy and higher levels of math anxiety than their traditional peers. According to Byars-Whitson et al.[21], external environmental and personal factor were frequently cited for students leaving STEM majors. Based on the work of Giancola et al. [12], undergraduate engineering students were asked to report key stressors, appraisal techniques, perceptions of life satisfaction, role-conflicts, health concerns, coping strategies, and motivations. The original hypothesis were stated such that adult engineering students would exhibit higher levels of 1) Stress, 2) Appraisal Techniques, 3) Satisfaction with Life 4) Role Conflict 5) General Health 6) Coping Strategies 7) intrinsic motivation in comparison to traditional undergraduate engineering students.

Method

Participants

A convenience sampling method was utilized to recruit participants, via posted signs, flyers, and emails. The pool of eligible students consisted of all full-time undergraduate students who at the time were enrolled in an engineering program at University of New Haven. Of the 713 eligible students, 144 responses were collected of which 63 were excluded from analysis as a result of insufficient or missing data. The final sample consisted of 81 (27 adult learners, 54 traditional) undergraduate students pursuing engineering degrees at a small, private institution in the Northeast United States. Within the sample, 60 participants self-reported as male, 20 as female, and one participant identified as transgender. Most of the participants identified as Caucasian (70 %). Demographic differences emerged between the two engineering student groups. Traditional engineering students ranged in age from 18 to 24 years (M_{age} = 20.52) compared to adult engineering students who ranged in age from 25 to 49 years (M_{age} = 33.78). Nontraditional students within the sample presented similar characteristics as a "typical" adult learner such as: higher occupational engagement, advanced industry experience, and increased commitment to responsibility. Adult students displayed a range of industry experience and came from a variety of socioeconomic backgrounds. 70% (19) of participants reported full time employment, 26 % (7) part-time, 3% (1) unemployed and 58% indicated an annual household income over $40,000. Approximately, 70 % of participants reported being in a committed relationship or partnership. In contrast to the traditional engineering cohort, who exhibited characteristics such as: full-time student status (96.3%), part-time employment (46.3 %), single (92.6%) and less work experience (57.4%).

Instruments

An Engineering Student Experience Questionnaire was developed to allow comparisons between our adult undergraduate student population and traditional age engineering students. Students in the College of Engineering were emailed a description of the purpose of the study and an invitation to participate via Survey Monkey. The survey began with a consent form and then invited students to respond to several categories of questions regarding their experience. For this work, we drew from measures that had previously been applied in the work of Giancola et al., and also included the Academic Motivation Scale[22]. In this paper, we analyze trends in the Work-Family-School Conflict category form the Giancola et al. study and the Academic Motivation Scale. The following are examples of questions we asked in these categories.

Stress: Participants rated their perceptions of their level of work, personal, and school stressors during the past 6 months[23], using a 5-point Likert scale from "Never" to" Always" (41 items).

Unpleasant physical surroundings at work (work stressor)
Financial difficulties (personal stressor)
Excessive amount of school work (school stressor)

Work-Family-School Role Conflict: **Interrole conflict was measured using questions that asked** participants rated to what degree they agree with statements that indicate conflict or tensions between four potential areas: family to school, school to family, work to school, and school to work[24]. They responded using a 5-point Likert scale from "Strongly Disagree" to "Strongly Agree" (14 items).

My school life makes it difficult to be the kind of worker I would like to be.
My employer and colleagues are supportive of my educational goals.
Because my school work is demanding, at times I am irritable at home.

Appraisal: Participants rated their positive and negative appraisal styles with eight items from the appraisal scale[25]. Four items measured positive appraisal and four measured negative appraisal. Participants rated their agreement with statements using a 6-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree*."*

I tend to focus on the positive aspects of any situation
I worry that I will say or do the wrong things

Coping: The COPE scale was used to measure problem-focused, emotion-focused, and dysfunctional dimensions of coping[26]. Participants responded to 32 items assessing eight coping strategies: positive reinterpretation
and growth, focus on and venting emotions, use of instrumental social support, active coping, denial, behavioral disengagement, substance use, and planning. Participants responded using a 4-point scale from "I usually don't do this" to "I usually do this a lot."

I make a plan of action
I let my feelings out.

Satisfaction With Life: The Satisfaction With Life scale (SWLS)[27] asks participants to respond to five items measuring global life satisfaction, using a 7-point Likert scale from "Strongly Disagree" to "Strongly Agree."

In most ways, my life is close to my ideal.
The conditions of my life are excellent.

General Health: The General Health Questionnaire 12 (GHQ-12[28]) was used to measure participants' overall well-being. Participants reported the extent to which they experienced particular symptoms during the last few weeks, using a 4-point scale from "Not at all" to "Much more than usual*."*

Felt constantly under strain?
Been able to enjoy your normal day to day activities?

Academic Motivation Scale[22]: Participants indicated the level to which they agree with statements about why they go to school, using a 7-point Likert scale ranging from "Totally Disagree" to "Totally Agree" (20 items). Responses are combined for three subscale scores: Intrinsic motivation, extrinsic motivation, and amotivation.

For the pleasure I experience when I discover new things never seen before.
Because I want to have "the good life" later on.
Honestly, I don't know; I really feel that I am wasting my time in school.

The survey concluded with a demographics questionnaire. Required questions asked for: gender, class load (full- or part-time), class level (freshman, sophomore, etc), and age. Optional questions requested ethnicity/race, employment status, marital status, length of employment in current job, level in the organization, whether the student was first in the family to attend college, number of children, yearly income, and GPA. The survey concluded with a debriefing page that included contact information for questions on the results of the study.

Procedure

A list of names and e-mail addresses of all qualifying students were obtained from the Office of Institutional Research. A total of 713 students were emailed and invited to participate in the online study. Participants reviewed and signed the informed consent document before moving on to complete all the questionnaire items. The study was approved by the university's institutional review board.

Data Analysis

All statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) version 21.0. Independent-sample t-tests were conducted for the following variables: stressors, work-family-school role conflict, appraisal, coping, satisfaction with life, general health, and academic motivation to examine if differences emerged between adult learners and traditional students. Statistical significance was set at.05.

Results

Stress

Table 1. Student Status and Differences in Stress Response Patterns

	Adult	Traditional Age			
	Mean (SD)	Mean (SD)	t	df	Significance
Work Life Stressors	42.07 (10.66)	38.98 (12.85)	-1.08	79	.284
Personal Life Stressors	26.33 (5.82)	22.20 (6.24)	-2.87**	79	.005
School Life Stressors	28.89 (8.94)	32.94 (9.97)	-5.66	79	.078.

Note. * $p < .05$, ** $p < .01$. t = t-test value; df = degrees of freedom

Stressors in work, school, and life were examined among traditional age and adult students. For work stressors and school stressors, there was no significant difference between traditional age and adult students. There was a significant difference in personal life stress, with adult students reporting higher levels of personal life stressors compared to their traditional counterparts.

Appraisal Techniques

Table 2. Student Status and Differences in Appraisal Techniques

	Adult	Traditional Age			
	Mean (SD)	Mean (SD)	t	df	Significance
Positive Appraisal	20.70 (2.55)	18.56 (3.39)	-2.91**	79	.005
Negative Appraisal	9.63 (4.19)	12.67 (4.44)	2.96**	79	.004

Note. * $p < .05$, ** $p < .01$. t = t-test value; df = degrees of freedom

The use of positive and negative appraisal techniques was investigated to explore if differences emerged between the two student groups. A significant difference was found for positive appraisal styles between traditional age and adult students. Adult students utilized more positive appraisal techniques to deal with the pressures of being a student compared to traditional age students. Traditional age students appeared to use more maladaptive appraisal styles, as indicated by a significant difference for negative appraisal styles between traditional age and adult students.

Satisfaction with Life

Table 3. Student Status and Differences in Satisfaction with Life

	Adult Mean (SD)	**Traditional Age** Mean (SD)	t	df	Significance
Life Satisfaction	25.22 (6.61)	24.52 (7.41)	-.417	79	.678

Note. * $p < .05$, ** $p < .01$. t = t-test value; df = degrees of freedom

No significant difference was found between traditional age and adult students on general life satisfaction.

Interrole Conflict

Table 4. Student Status and Differences in Interrole Conflict

	Adult Mean (SD)	**Traditional Age** Mean (SD)	t	df	Significance
Family to School	5.30 (2.23)	5.57 (2.45)	.494	79	.622
School to Family	13.67 (4.53)	12.06 (3.99)	-1.64	79	.106
Work to School	5.56 (1.93)	6.65 (2.76)	1.844	79	.069
School to Work	11.44 (4.50)	12.31 (3.85)	.906	79	.368

Note. * $p < .05$, ** $p < .01$. t = t-test value; df = degrees of freedom

For work to school role conflict, the difference between traditional age and adult students approached significance. No significant differences were found between traditional age and adult students on any of the other role conflict subscales (family to school, school to family, school to work).

General Health

Table 5. Student Status and Differences in General Health

	Adult Mean (SD)	Traditional Age Mean (SD)	t	df	Significance
Health	35.85 (6.65)	32.70 (5.71)	-2.213*	79	.030

Note. * $p < .05$, ** $p < .01$. t = t-test value; df = degrees of freedom

There was a significant difference general health scores with adult students reporting more health concerns than traditional age students.

Coping Strategies

Table 6. Student Status and Differences in Coping Strategies

	Adult Mean (SD)	Traditional Age Mean (SD)	t	df	Significance
Adaptive Coping	51.59 (8.42)	43.81 (9.54)	-3.592**	79	. 001
Maladaptive Coping	21.48 (3.47)	23.19 (5.01)	1.59	79	.117

Note. * $p < .05$, ** $p < .01$. t = t-test value; df = degrees of freedom

There was a significant difference in scores for adaptive coping strategies between traditional age and adult students, with adult students using more adaptive coping strategies. There was no difference between traditional age and adult students on maladaptive coping strategies.

Motivation

Table 7. Student Status and Differences in Motivation

	Adult Mean (SD)	Traditional Age Mean (SD)	t	df	Significance
Intrinsic Motivation	23.93 (4.31)	21.93 (5.68)	-1.610	79	.111
Extrinsic Motivation	66.07 (12.25)	67.11 (12.32)	.358	79	.721
Amotivation	6.37 (3.13)	7.94 (5.43)	1.393	79	.167

Note. * $p < .05$, ** $p < .01$. t = t-test value; df = degrees of freedom

There were no significant differences between traditional age and adult students on any of the motivation measures, including intrinsic motivation, extrinsic motivation, and amotivation.

Discussion and Conclusion

Higher education institutions face the challenge of providing services and programming to meet the needs of traditional age and adult learners. In efforts to enhance the understanding of the student experience, this study explored factors that influenced the learning process for adult and traditional age students. One variable that has displayed mixed results were stressors pertaining to school, work and personal life. Within the literature, researchers [12, 23] found conflict between family and student roles more prevalent in comparison to other researchers which found conflict between work and student roles as a greater stressor in student's lives.[23] Adult learners within our sample reported higher levels of personal life stressors than traditional age students; while interestingly, not reporting higher levels of interrole conflict within any area of their lives. The interrole conflict result can be attributed to role perceptions between genders. "Women experience high levels of conflict due to their internalization of the intensive mothering and ideal student roles while men do not experience this."[5] According to Stone and O-Shea[29], men may not experience this sense of conflict because prioritizing school is "privileged, allocated special significance within the family" and is the expectation of being a "good provider."[30] The majority of our sample were males and may hold similar "good provider" ideologies. This result may serve to support that men experience interrole conflict in a different manner than women. Within the educational setting, this ideology may have an impact and have potential consequences on student learning, academic performance, and persistence; especially, for women.

Numerous studies have indicated that adult learners utilize more positive coping strategies to deal with the pressures of being a student. The results from our study add to the current body of

knowledge by including engineering adult learners. Coping strategies that are solution driven help adult learners to deal with the demands of multiple roles of student, employee, or spouse or caretaker. The possibility of having multiple roles increases task-oriented strategy out of necessity in supporting the focus on learning for its own sake.[16] Engineering adult learners would rely more on task-oriented coping strategies; especially, with the rigorous academic course load, Major, Holland & Oborn [17] found that students who disengage or use maladaptive coping strategies will not adequately cope with obstacles they encounter in their major. Thus, they will have a more difficult experience and will be more likely to experience negative outcomes, feeling less committed to the major as a result.

Although previous research has associated adult students with increased intrinsic reasons for pursuing higher education, this study did not find similar results and can be linked to the high degree of motivation required for pursuing an engineering degree. One explanation for this result is student status of participants. According to Seymour & Hewitt[31], the greatest attrition among STEM majors occurs in the freshmen and sophomore years. Within our sample 20 of 27 participants were junior standing or higher, which may suggest that our study respondents internalize high levels of motivation required to persist through engineering degree completion.

Government and industry continue express high demand for STEM-trained workers and much effort has been put in place by government agencies and academia to increase the pool of trained candidates. Yet, the output of qualified candidates remains low. In 2012, "only about 40% of students who enter a STEM major graduated". [17] With the increasing number of adult learners students pursuing higher education, federal, and institutional initiatives call for increased retention and degree completion rates; especially within the engineering degree program. From this work, different factors emerged that may influence the adult engineering students within higher education. This contributes to the knowledge base and assists in development of programs that increase retention rates and diversity within engineering programs. Further research should focus more closely on support programs or services that may address various coping strategies for this population.

Limitations

The results of the present study need to be considered with some caution due to a number of potential limitations. First, the results are limited in generalizability because this was a small sample from one university. Second, the study utilized a quasi-experimental design in order to compare adult and traditional age students, but therefore did not allow for random assignment. Similarly, "adult" students were defined by an age cutoff only, but operationalizing adult and traditional in different ways could yield different results. Another limitation is that the dependent variables were all obtained through a self-report questionnaire. The inclusion of multiple sources of information or more objective sources would have provided more comprehensive data. Finally,

the cross-sectional nature of the study does not allow for us to examine if these constructs change over time. Perhaps an analysis of these variables over time would reveal new patterns; this is an important consideration for future research.

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Biographical Information

1. *Audrianna Rodriguez* received her M.S. in Clinical & Community Psychology from the University of New Haven, 2016.

2. *Maria-Isabel Carnasciali* is an Associate Professor of Mechanical Engineering at the University of New Haven, CT. She obtained her Ph.D. in Mechanical Engineering from Georgia Tech in 2008. She received her Bachelors of Engineering from MIT in 2000. Her research focuses on the nontraditional engineering student – understanding their motivations, identity development, and impact of prior engineering-related experiences.

3. *Shannon Ciston* is a Lecturer and Director of Undergraduate Education in the Chemical and Biomolecular Engineering Department at the University of California, Berkeley. She teaches undergraduate and graduate courses in technical communications, chemical engineering design, and applied pedagogy. She conducts research on the experience of nontraditional, adult, and transfer students in engineering. She has chemical engineering degrees from Northwestern University (PhD) and Illinois Institute of Technology (BS).

4. *Melissa Whitson* is an Associate Professor of Psychology at the University of New Haven. Her current research interests include examining risk factors, protective factors, and services that affect mental health outcomes for low-income students and families and the implications for prevention and intervention. She received her PhD in Counseling Psychology from Columbia University and carried out postdoctoral work in Community Psychology at Yale University.

5. *Viktoria Zelenak* Berendt received her M.S. in Industrial & Organizational Psychology from the University of New Haven, 2014.