

STUDENT MOTIVATION FOR ELITES: A STEM Leadership Program

Abstract

In this article we explore the level of motivation held by students engaged in a specially designed leadership program - Emerging Leaders in Technology, Science and Mathematics (Elites). Elites was developed as part of a NSF S-STEM grant awarded to Radford University in 2014 that provides scholarships for meritorious students with financial need, which aligns with Involvement Theory (Astin, 1985). Elites was designed to incentivize student participation in high impact activities to develop their professional skills aligned with their degree program, in order to develop them into STEM leaders. Coupled with Proactive Advising (Schee, 2007, Varney, 2012), the Elites program overarching goal was to promote retention of these students at Radford University and in their STEM related disciplines. This paper presents the successes and challenges of the Elites program as measured by focus group interviews and evaluating the students' motivation levels to engage in the Elites program that is framed on an academic motivational model: M.U.S.I.C. (Jones, 2009). The results suggest students were motivated to remain with the Elites program and perceived the Elites program as effective as they prepared for their futures as STEM leaders.

Introduction

The nation is facing an increase demand for Science, Technology, Engineering, and Mathematics (STEM) professionals. In May 2016, almost 8.6 million STEM jobs were identified, which represents approximately 6.2 percent of the U.S. workforce (Bureau of Labor Statistics, 2017). Projections suggest that over the next ten years there will be an 8.9 percent growth rate in STEM jobs compared to a 6.4 percent growth rate in non-STEM jobs (Noonan, 2017). This trend requires our educational system be ready to meet this increasing demand. Students pursuing STEM careers require content knowledge, the ability to think critically, the capacity to solve novel problems, and possess the professional skills to be a vital contributor and leader in the workforce or in the laboratory.

The NSF S-STEM scholarship grant program supports meritorious U.S citizens with financial need who are enrolled in a STEM major at a two or four year college. The co-investigators wished to extend on this goal by developing these students into the next generation STEM leaders. This is accomplished through a new leadership program, intentionally designed for STEM majors at Radford University (RU), called Elites (Emerging Leaders in Technology, Science and Mathematics). Elites was designed to address current weakness to prepare STEM students for their future by informing and guiding these students to afford opportunities currently on campus that will hone their leadership skills and professional development. For example, internships, applying to graduate school, participating in undergraduate research projects, and taking leadership roles in a STEM discipline club. Institutional data shows that from the 2011-2012 STEM

graduates, less than 10% said they participated in an internship and only 11.5% planned to attend graduate school (Radford University, 2012). Elites intentionally filled these gaps and expanded on the professional and leadership development component for STEM majors. In this paper, the grant team evaluated the motivation level of the students to engage in the Elites program three years after the five-year grant was awarded.

Literature Review

The Elites program is founded on the notion that leadership skills can be learned, if a person has a desire to change (Begley, 2007), motivated to change, or learn, which is key (Goleman, et al. 2002). In addition, the program was designed to develop leadership skills within the student's discipline, which may provide the motivation to gain leadership skills. Yet we are mindful that not all student are seek out opportunities to gain leadership skills (Micari, et al., 2010).

The Elites program included high impact practices pedagogy and proactive advising to support students' engagement in the Elites program. This design aligns with Astin's (1985) notion of involvement theory that focuses on student behaviour as a way to evaluate their level of engagement. Astin (1985) maintains that motivation is included in involvement, but he places his focus on observing behaviour. We join this perspective with motivation in terms of self-reporting of students' affect in academic involvement to examine engagement more fully. Yet, we are mindful of the interplay between perception and behaviour and attempt to deal with each separately (Astin, 1973, 1991 as cited in Astin 1985). The behaviour component was observed through the point system associated with the Elites program. The perception component was captured by the academic motivation model, M.U.S.I.C. (Jones, 2009). Proactive advising by the Elites advisor, along with faculty mentors, was

the mechanism to support student involvement and persistence as they progressed through the Elites program. In the following sections we explain the motivational leadership development perspective followed by the support mechanisms associated with the Elites program.

Leadership. Leadership does not have one definition nor is it limited to a vertical structure aligned with a formal position. We build on transactional leadership theory that helps student develop relationships (Bass, 1998) with others in order to meet organizational goals. Knight and Novoselich (2017) state that within engineering, leadership is characterized as collaborative. We share the notion that within the STEM fields, leadership is collaborative and may not always align with the traditional vertical model. Northouse (2013) identifies four common themes within leadership research: leadership as a process, leadership in order to influence others, it occurs within groups, and the aim of leadership to reach shared goals (Northouse, 2013 as cited in Knight, et al., 2017). The notion that leadership is a process, an influencing process occurring on an individual level suggests that the level of influence may differ among members within the same group (Maxwell, 2013). These characteristics identified by Northouse (2013) align with the Elites program goal; creating STEM leaders who influence others in order to reach a groups' shared goals.

Involvement and Persistence. Students must be involved, active, in order to learn and gain experiences that advance their knowledge and skills. Involvement is defined as "the amount of physical and psychological energy that the student devotes to the academic experience" in order to fully develop students intellectually and personally (Astin, 1985, p. 36). Tinto (1993) recognized the interplay between student involvement and the quality of effort that students put forth, which in turn, impacts persistence. This requires activities and/or experiences that promote involvement, which in turn, fosters students

desire to put forth quality effort.

Research shows that activities, such as high impact practices (e.g. undergraduate research, career preparation, and leadership development), promote student engagement (Kuh, 2001). Kuh's (2001, 2003, as cited in Kuh, 2009) definition of student engagement is essentially the amount of time and effort students dedicate to activities provide by their institutions, which aligns with Astin (1985) and Tinto (1993) notions of involvement for talent development. We are mindful that high impact practices may produce a conditional effect versus the more desirable general effect on student engagement (Pacarella & Terenzini, 2005; Siefert, Gillig, Hanson, Pascarella, & Blaich, 2014). The general effect impact all students in the same way, while the conditional effect has a different impact on each student or subgroups of students (Siefert, et al., 2014). A large proportion, 40%, of the students attending RU are members of the first generation sub-group, which research shows benefit from high impact practices (Kuh, 2009), which is the pedagogical foundation for Elites.

Proactive Advising. The proactive advising model was introduced by Robert Glennen in the mid 1970's, which blends advising with counselling in order to provide information to students proactively while concurrently building a relationship with the student (Varney, 2012). This type of advising involves: thoughtful intervention to increase student motivation, applying tactics to show interest and connection with students, intensive advising intended to increase the likelihood of student success, informing students on all possible options, and addressing situations before issues develop (Varney, 2012, editor's note). Proactive advising is beneficial in many contexts within the university setting, such as bolstering retention, by helping students at academic risk and/or anticipating other student challenges (Varney, 2012). The proactive advising model fits well with the high percentage of first generation students attending RU.

The Elites Leadership Program. The Elites program attempts to develop RU STEM majors into the next

generation of STEM leaders, such as influential teachers, scientists, project/product managers, or citizen leaders tackling pressing STEM related issues (i.e. water pollution) within their communities. Other universities have STEM leadership programs for undergraduates that integrate the STEM leadership component throughout the science curriculum (i.e. Reed, Aiello, Barton, Could & McCain, 2016), this program differs in that the Elites leadership program does not overlay nor impact the current instructional practices or ongoing programs (e.g. clubs) in the departments, in the college or across the university. The goal is to draw from the current STEM academic curriculum, STEM academic practices, and the current student support services provided by the university (e.g. career services, tutoring services) to promote student success. In essence, the Elites leadership program recognizes the time and effort students currently spend in academic and non-academic activities but wishes to tailor a pathway for each student to develop his or her STEM leadership skills more intentionally to better align with his or her professional goals. As a result, the Elites leadership program has the potential to improve retention and graduation rates at both ends of the academic ability spectrum; high performing students who choose not to transfer to more notable universities because of the opportunities and struggling students because of the embedded structure that encourages success. Both groups benefit from the close relationships that develops with his or her in major faculty mentor, and the Elites advisor, also a STEM faculty member.

The Elites program develops leadership skills in four broad areas: (1) Research, (2) Communication, (3) Career Development, and (4) Management and Service. Each component offers the students opportunities to hone a particular aspect of their leadership skills that is consistent within their discipline. Table 1 describes these components and justifications.

Table 1. Elites overview.

Research	Develops research skills from design to dissemination; Includes product development.
Independent study (1 – 6 credits)	Develops research skills, surveying latest research projects on a particular topic or create software products
Honors contract course	Develops leadership skills such as: leading class discussions, and engaging in research;
Research assistant (RA) on a STEM project	Develops research or product development skills.
Attending a conference/symposium/competition in STEM	Motivates students to pursue research, interact with graduate programs and meet graduate students.
Present/publish paper/poster or develop a product (e.g., software)	Develops dissemination skills, communication skills, and team participation.
Communication	Develops communication skills in STEM.
Presentation at an RU outreach events (i.e. open house; bridge camps)	These presentations can range from a course project (e.g., developing a new computer game) to a report on college life at RU to prospective high school STEM majors, or individual research projects.
LEAD contract in a course or take a LEAD certified course (the University's leadership program)	Develops presentation skills. All majors in the college offered LEAD certified courses.
Career Development	Student identify specific career goals; interact with prospective employers or graduate schools.
Creating a resume or an effective professional online-profile (i.e. e-portfolio).	Students required to create a resume by second year to be positioned for employment or graduate school opportunities. Final resume update prior to graduation.
Participation in career focused event.	Prepares students for professional life. Events include: career development forum/workshop (i.e. interview skills), job and internship fairs.
Applying for an internship/co-op position/graduate school	Such applications can be easily made through the University's career services office or in case of graduate school in consultation with the student's advisor.
Acquiring an Internship/co-op during summer in STEM.	Provides students with valuable experience – and makes their resumes attractive for future career in STEM.
Management and Service	Encourages students to organize or participate in STEM related extra-curricular events that develop management skills (i.e. project, people, and events).
Student Peer-Mentor	Students who act as mentors are showing leadership skills
Officer in a STEM related academic club.	Officers in these clubs organize events; enroll new members; conduct meetings.
Organize/Volunteer in a STEM- related event	Develops skills such as planning, organization and interpersonal skills.
Organize/Volunteer in a community event	Develops skills such as planning, organization and interpersonal skills.

Students' progress within and through these four categories by completing related activities that are point based. The various activities allow for student-choice to better suit each student's overarching career goal, either in the workforce or graduate school. Empowering students by providing choice also positively impacts motivation (Wigfield & Eccles, 2002). Each category is capped at 10 points to encourage students to distribute their points over each of the four categories in order to hone more leadership skills and allows for multiple pathways to reach the maximum number of points. At graduation, a student who earns 20 points (or a transfer student who earns 10 points) is identified as an Elites scholar and is presented with a certificate from the Dean of the college at the college awards ceremony.

Each Elites student's progress is tracked in one of three ways. One, by meeting face to face with the Elites advisor twice each semester to address academic progress and progress in the Elites Leadership program. Two, by examining the students' transcripts at the end of each semester because some of the Elites activities will appear on the student's academic transcript (e.g. LEAD 110, a leadership course). Academic progress is tracked by examining overall GPA, GPA within the student's major and minor if applicable. Three, by examining students' reflections and completed tasks uploaded in the university's Teaching and Learning platform, Desire to Learn (D2L). This site contains the activities as assignments and the Elites handbook we created to better support students through the program.

The Academic Motivation model – MUSIC. The MUSIC Model is an academic motivation model that promotes motivation within an academic setting. The word MUSIC is an acronym for the five components of the model: eMpowerment, Usefulness, Success, Interest, and Caring (Jones, 2009). It is based on the social-cognitive theoretical framework targeting academic identity that says students have psychological needs and when met, it impacts students' perceptions and beliefs about their academic abilities (Jones, 2009). This model was originally designed for the college teacher-college

student relationship. We contend it holds potential when it is modified for the Elite program and the faculty advisors and the student. In the following paragraphs each component of this model is defined and described. First it is described in its original form and followed by the modification for the Elites program. The modifications to the five components and the survey instrument were made in consultation with Dr. Brett Jones, the creator of the MUSIC model.

Empowerment. Empowerment (M) is defined as the amount of perceived control students have over their learning or autonomy. In the classroom, teachers can allow students to choose their collaborative learning partners, or students can control the pace of a lesson, or co-create course policies. Empowerment gives students a sense that they and the teacher are in this together (Jones, 2009).

Likewise, we believe it is essential for the Elite students to have control as they develop their leadership skills to suite their career goals. The Elites advisor, guide these students as they choose activities that enhance their academic goals. The Elite students are empowered by choice.

Usefulness. Usefulness (U) is the why component. Teachers need to let students know why the content is useful to them now and in the future. In the classroom, the teacher shows usefulness by connecting the content to the real world and/or to students' everyday experiences using activities or projects (Jones, 2009).

For the Elites scholar, usefulness is linked to his or her future goal. The Elites Leadership program is designed to provide opportunities to develop the students' leadership skills in ways that are relevant to future employers and to graduate school admission boards. Usefulness, for the student, is the heart of the Elites Leadership program. The usefulness component assures the Elite

scholar that time and effort engaged in this program are aligned with his or her future professional goals.

Success. Success (S) in the classroom is within reach when the coursework is designed so all students can experience success, if they put forth the effort to gain the knowledge and skills. For the students, believing they can be successful means they need to know 1) the teacher's expectations, 2) the learning experiences are within their capabilities, and 3) they receive timely feedback that is useful to the student. Allowing students to modify or redo their work, indicates learning is valued (Jones, 2009).

Recently this component was addressed more explicitly by designing an Elites Leadership handbook to clarify expectations. Prior to the handbook, a chart was used to show the students the four categories and the activities associated with each. In face-to-face meetings each semester, students were given feedback on their progress in the program. The Desire To Learn learning management platform allows students to upload completed activities and to a limited extent, tracks their progress. The Elites advisor manages the students' progress in a spreadsheet, which is shared with each student during individual meetings each semester.

Interest. Interest (I) is sparked in the classroom when the teacher designs lessons so that student interest, or a genuine liking, for the content can naturally develop. There are two kinds of interest: situational and individual. Situational interest is short term and it describes the interest a student may have for the duration of the activity or lesson. Individual interest is longer lasting. It describes the positive feelings

that a student develops with respect to a topic and indicates a willingness to seek additional opportunities to interact with the topic outside of the classroom setting. A way to foster interest is to connect the lessons or activities to students' out of school life experiences and background. Interest is promoted when emotions are sparked. Students demonstrating negative emotions can, at times, be used as the devil's advocate or critic in the classroom (Jones, 2009).

Elites Leadership program seeks to development each students' unique interest within their major. Specifically, the goal of the mentorship provided by the Elites advisor is to guide students to identify specific areas of interest. This is accomplished by engaging in brainstorming sessions during the face-to-face meetings with the Elites advisor and/or with a particular professor within the student's major. The focus is to help students identify and nurture their individual interest. At times, this also entails seeking ways to join interests that at first appear inconsistent (e.g. chemistry and cosmetics).

Caring. Caring(C) is demonstrated by teachers in one of two ways: (1) student learning and (2) personally. Teachers show caring when they are concerned about student's failures, provide reassurance for struggling students, and celebrate student's successes. Designing engaging lessons so that students can develop content knowledge and knowledge about their classmates demonstrates personal caring within the classroom (Jones, 2009).

The Elites Leadership advisor and the faculty mentors promote caring for the students academically and as they progress through the Elites program and on a personal level. Proactive advising is

instrumental in identifying and taking a course of action to support struggling students early, which demonstrates academic caring. On a personal level, caring is demonstrated during the individual face-to-face meetings in which students share issues and achievements that go beyond academics with the Elites advisor and with their academic mentor. Celebrating success with the students throughout the program and at graduation confirms caring on both levels.

The MUSIC inventory provides a way to evaluate the effectiveness of the Elites program to engage students in activities designed to develop their professional and their leadership skills. Focus group interviews draw out students perceptions of their experiences in the program. The activities within each of the four areas of leadership development, show involvement of the students based on their behaviour. Together, all three instruments help to answer the following research question: How do the students perceive the Elites leadership program to help them prepare for their futures as the next generation of STEM leaders?

Method

We used a multi-phase mixed methods design (Creswell & Plano-Clark, 2011). The qualitative and quantitative data were collected sequentially (Creswell & Plano-Clark, 2011). The qualitative data was collected from focus group interviews and the quantitative data was collected using the MUSIC survey inventory and the Elites management tool.

Participants. At the time of this study the Elites Leadership program had existed for almost two years. The participants included the scholarship recipients in three cohorts, with six to seven students in each cohort. In addition, there were seven non-scholarship recipients students who joined the Elites program in fall 2015 for a total of 26 students; 16 males and 10 females. Ninety-two

percent of the students were Caucasian and 8% were African American.

Procedures. Recruitment for the focus group interviews began by sending out emails to each of the students. The emails informed the students about the focus group interviews dates and times identified by a poll that was most convenient to the students. An email was then sent requesting the students complete the online motivational survey. Reminders for each of these events were sent to the students on several occasions as needed.

Three sets of instruments were used in this study: the Elites program management tool, focus group interviews, and the MUSIC Model Inventory.

Elites Program Management Tool. The first instrument is the management tool used by the Elites advisor to track the leadership skill development for each student. The Elite program management tool is presented in Table 2.

Focus Group Interviews. The focus group interviews were conducted over several days with a total of seventeen students participating during spring 2016. Seven questions were created collaboratively by the grant team. During the focus group interview sessions, students were asked to respond to each question individually, then the floor was open for additional comments. Not all students answered each question and some students addressed questions with multiple answers. At the end of each session, students were encourage to comment on other aspects of the program, positive or negative that were not addressed earlier during the interview. In this study, one question was used, "How has the Elites leadership program prepared you for your future?"

MUSIC Model Inventory. The MUSIC academic motivation inventory contains twenty-five questions using a six point Likert scale to identify differing levels of agreement/disagreement for each statement. On the lower end of the scale, number one is associated with a person who strongly disagrees with the statement and six is associated

Table 2.
Elites Program Management Tool

Student Name	ID Number	Year	Major	Points Earned
Research		Tasks	Possible points	
		Independent study	5 points/credit hour	
		Honors contract course	1 points/course	
		Research Assistant (RA) on STEM project	10 points /semester	
		Attend conference/symposium/competition in STEM	5 point/event	
Communication		Tasks		
		Present, publish paper/poster or develop product	1 - 10 points	
		Present at a RU outreach event (Open house, Summer Bridge Program)	2 - 5 points with a talk	
		Lead contract in a course or take a LEAD certified course	2 points/credit hour	
Career Development		Tasks		
		Creating a resume and an effective professional online profile	2 points, mandatory	
		Participation in career focused event	3 points/forum	
		Applying for an internship/co-op position/graduate school	1 - 4 points to activity	
		Acquiring a STEM internship/co-op during the summer	5 - 10 points	
Management & Service		Tasks		
		Student peer mentor	1 - 10 points /semester	
		Officer in a STEM related academic club	1 - 5 points	
		Organize/volunteer in a STEM related event	1 - 3 points /event	
		Organize/volunteer in a community related event	Max 2 points /event	

with a person who strongly agrees with the statement. The numbers in between represent the agreement or disagreement to each statement from disagree (2), somewhat disagree (3) to somewhat agree (4) to agree (5). Each question is linked to one of the five MUSIC model components. The MUSIC model questions were modified for this study to reflect the program team-student relationship rather than a

teacher-student relationship. The revised questions were reviewed by Dr. Jones, the creator of the MUSIC Model Inventory, to ensure the theoretical integrity was not compromised. The modified Elites MUSIC motivation survey instrument was administered, online using QUALTRICS, during the fall of 2016 with a 70% response rate.

Data Analysis. Three sets of data that were analysed: data from the Elites program management tool, the focus group interviews, and the motivation survey. Descriptive statistics summarized the responses for each leadership component identified in the Elites Management Tool: (1) research skills, (2) communication skills, (3) career development, and (4) management and service. The focus group interview data were analysed using thematic analysis (Braun & Clarke, 2006) to identify overarching themes. The Elites MUSIC motivational instrument was analysed using the scoring rubric developed by Jones (2014), which did not require modification.

Results

The results of the data analysis are presented in the

following sections beginning with the summarized participation in the leadership activities. This is followed by the focus group results and then by the MUSIC motivation results.

Leadership Activities. The leadership activities were identified according to the Elites leadership program. In Table 3 below contains the summarized results that show the number of students or number of activities completed tasks for each section in the Elites leadership program. This list reflects cohorts 1 and 2. Cohort 3 is in their first year in the program. They are encouraged to focus on their academics and become aware of leadership opportunities that may interest them. Students typically become actively engaged during their second year in the program, although some during the second semester of their first year attending RU.

Table 3.

Number of Activities Completed by Category.

Elites Leadership Section	Number of Times or Students Engaged
Research	10
Communication	7
Career Development	6
Management and Service	6

The average number times or students involved within each category is seven. This represents approximately 56% involvement.

Students engaged in ten research activities that included roles as research assistants or teaching assistants. Other activities included creating their own research project, completing a leadership course, or a STEM Honor course. In the communication section, most students engaged in presentations through on-campus forums (i.e. undergraduate research) or presenting at a professional conference. Some of the students presented more than once. The Career Development activities included students participating in internships and completing a professional resume. Other students participated in shadowing professionals (e.g. biology – pre-health, dental specialists) and mentoring other students (e.g.

computer science – labs). In the Management and Service section, most the students took an active role as a club officer in a department level club. Others planned and implemented STEM related community events either on or off campus that were sponsored by the STEM club, by department clubs, or other college level events.

Focus Group. During the focus group several questions were asked. However, for this study, one question is relevant, “How has the Elites leadership program prepared you for your future?” The most common themes for this question are shown in Table 4.

Table 4.

Common Themes for Focus Group Question

Question	Themes
How has the Elites Leadership program prepared you for your future?	. Research experience (60%) . Career planning/Internship (40%) . Extracurricular activities (30%) . Leadership (27%)

One student said “Elites really helped me figure out what I want to do, in terms of a career path. I am a double major, and one is not a STEM field, but research has helped bring the two together.” In addition, many students felt that the Elites program gave them motivation to complete activities they might not do on their own. One student said “I am thankful to be motivated to do these things, but I don’t think I would be going out and doing [these] things on my own. I would wait until the last minute or forget.” This comment shows that the program structure and the proactive advising fostered persistence among some students. Although the student fails to state explicitly professional or leadership development, the activities within the four categories are designed to hone these skills.

MUSIC Model Inventory. The Elites MUSIC Inventory was analysed using the scoring system developed by Jones (2014). Each component of the Elites MUSIC model is addressed by several questions interspersed throughout the questionnaire (Jones, 2014). For example, eMpowerment is addressed in questions 2, 8, 12, 17, and 26. The mean scores for all participants linked to these items are averaged in order to calculate the mean score for eMpowerment, 5.1 on a 6 point scale. This process is used for each of the remaining components. The mean scores for each component are presented in Table 5.

Table 5.

Mean Scores for MUSIC Components

Component	Description	Score
eMpowerment	Students feel they have control over learning	5.1
Usefulness	Students feel the activities are useful	5.2
Success	Students feel the activities prepare them for success	5.0
Interest	Students develop interest in the subject	4.9
Caring	Students feel cared for	5.3

The data shows the mean score for the components range from a low of 4.9 for Interest, to a high of 5.3 for Caring. The overall mean score for all of the components when each component mean score is weighted equally, is 5.1, which is linked to the agree response on the Likert Scale.

Discussion

The Elites leadership program was developed to encourage STEM students to develop leadership skills within their discipline. The program aligns with Astin’s (2000) involvement theory to include professional and leadership skill development activities that

draw on high impact practices to promote student engagement (Kuh, 2001). Varney (2007) proactive advising provide students with support and direction before asked, in addition to monitoring student involvement. In this study, our goal was to explore students' perception of the Elites program. The focus group interviews, the motivation questionnaire, and the management tool are used together to answer and discuss the following research question: How do the Elites scholars perceive the effectiveness of the Elites leadership program as they prepare for their futures as STEM leaders?

Overall, the Elites scholars claimed that the Elites leadership program helped them with their professional and leadership development as STEM leaders. The Elites program tool shows an average of 56% of the students in cohort one and two participated in the activities by the end of their second or third year in the program. This is satisfactory since half of the cohorts were in their first year still seeking ways to get involved. Others were mentored about potential research topics, research opportunities, and other suitable opportunities for professional development and leadership development. It is during the first and second semesters that proactive advising is most crucial to keep students motivated and engaged as they navigate the collegiate experience. This is most beneficial to RU's large first generation student population.

The focus group interviews showed that the Elites Leadership program prepared students for their future by providing them research experiences, internship/career planning opportunities, and opportunities to hone their project management, and interpersonal management skills. For example, one student said,

Elites really helped me figure out what I want to do, in terms of a career path. I am a double major, and one is not a STEM field, but research has helped bring the two together.

This student's research project required her STEM academic knowledge in order to explore her non-STEM interest. Working with a professor in her STEM major allowed her to find a way to bring her two passions together. Another student claims, 'The program has help me be more forward... usually I wait for things, but now I go forward and get opportunities for myself.' This student, as many STEM students, tend to be introverted and timid. The program is designed to encourage students to seek out opportunities within their STEM discipline and within the community when meeting with the Elites leadership advisor and/or with STEM faculty about research opportunities. The activities promote involvement that is necessary for motivation, which in turn, provides leadership development.

Results from the Elites MUSIC Motivation inventory reinforce the notion that the Elites Leadership Program is useful to most students. The four categories in the program, promote leadership and professional development, which is built on student engagement in the activities outside of the classroom. Students are expected to put forth the time and effort to achieve success in the program, and the faculty facilitate that success through proactive advising. Our goal was to evaluate the students' perceived effectiveness of the Elites program as they honed their professional and leadership skills. We found that Elites program was perceived effective to the students in their developing professional and leadership skills.

Conclusion

The Elites Leadership program was developed as part of the National Science Foundation Scholarship STEM grant that was awarded in 2014. We adopted a transactional leadership model that aligns with STEM leaders because their leadership roles tend to be collaborative and less positional. The student-centered Elites Leadership program provides the involvement structure for the STEM students to hone their professional and leadership skills, which are grounded in many high impact pedagogical

practices that motivate students to increase their academic engagement, while the proactive advising supports students in the process. We found that the Elites program is a pragmatic approach to foster development and student success.

Limitations. This study has limitations which includes a small sample size. This is due to the recent implementation of the Elites Leadership program and that it was recently opened to all students in the college. As more students join the program over the next couple of years, results will gain statistical significance and hopefully demonstrate the beneficial impact on RU's STEM students.

A second limitation was the tacit definition of leadership. The program embraced informal leadership (i.e. a leader in a research lab or a leader in a field of study) along with formal leadership positions (e.g. club officer). The Elites program was designed to pull the four areas (research, communication, professional development, and service) to develop the students into effective leaders. Yet, in the focus group interviews, 27% of the students identified the Elites program to leadership, the lowest theme mentioned. It could be the case that in the mid-point in the program, many of the students were not eligible to run for club office or they lacked an understanding about our transactional leadership model, which may need to be explained explicitly.

Future Research. Our next step is to take these findings to improve the Elites Leadership program (i.e. improve the sense of community and explicitly identify targeted leadership skills). Our future research focus will take these findings and enhance the program and examine the leadership development process over time. In addition, more clearly address professional skills required by the workforce in order to assess the programs' overall effectiveness for professional and leadership development that is valued by the workforce and graduate schools.

References

- Astin, A. W. (1999). Student involvement: A developmental theory for higher education. *Journal of College Student Development*, 40(5).
- Astin, A. W. (1985). Involvement: The cornerstone of excellence, *Change*, 17(4), 34-39.
- Bass, B. M. (1998). *Transformational leadership*. Hillsdale, NJ: Erlbaum.
- Begley, S. (2007). *Train your mind change your brain: How a new science reveals our extraordinary potential to transform ourselves*. New York, NY: Ballantine Books.
- Braun, V. & Clarke, C. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 93.
- Bureau of Labor Statistics, U.S. Department of Labor, *The Economics Daily*, 8,8 million science, technology, engineering and mathematics (STEM) jobs in May 2016 on the internet at <https://www.bls.gov/opub/ted/2017/8-point-8-million-science-technology-engineering-and-mathematics-stem-jobs-in-may-2016.htm> (visited July 27, 2017).
- Creswell, J. W., & Plano-Clark, V.L. (2011). *Designing and Conduction Mixed Methods Research* (2nd. Ed.). Los Angeles, CA: Sage.
- Glaser, B. G., (1965). The constant comparative method for qualitative analysis, *Social Problems*, 12(4), 436-445.
- Goleman, D., Boyatzis, R. E., & McKee, A. (2002). *Primal Leadership: Revealing the power of emotional intelligence*. Boston, MA: Harvard Business School Press.
- Jones, B. D. (2009). Motivating students to engage in learning: The MUSIC model of academic motivation, *International Journal of Teaching and Learning in Higher Education*, 21(2), 272-285.
- Jones, B. D. (2017, January). User guide for assessing the components of the MUSIC model of motivation. Retrieved from <http://www.theMUSICmodel.com>, March 16, 2017.
- Knight, D. B., Novoselich, B. J. (2017). Curricular and co-curricular influences on undergraduate engineering student leadership. *Journal of Engineering Education*, 106(1), 44-70.
- Kuh, G. D. (2001). Assessing what really matters to student learning inside the national survey of student engagement. *Change: The Magazine of Higher Learning*, 33(3), 10-17.
- Kuh, G. D. (2009). What student affairs professionals need to know about student engagement. *Journal of College Student Development* 50(6), 683-706. The Johns Hopkins University Press. Retrieved March 16, 2017, from Project MUSE database.
- Maxwell, J. C. (2013). *How Successful People Lead: Taking Your Influence to the Next Level*, New York, NY: Center Street.
- Micari, M., Gould, A. K., & Lanez, L. (2010). Becoming a leader along the way: Embedding leadership training into a large-scale-peer learning program in the STEM disciplines. *Journal of College Student Development*, 51(2), 218-230.

References

- Northouse, P.G. (2013). *Leadership: Theory and practice* (6th ed.). Thousand Oaks, CA: Sage.
- Noonan, R. Office of the Chief Economist, Economics and Statistics Administration, U.S. Department of Commerce. (March 30, 2017). *STEM Jobs: 2017 Update* (ESA Issue Brief # 02-17). Retrieved from <http://www.esa.gov/reports/stem-jobs-2017-update>.
- Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students* (Vol. 2). K. A. Feldman (Ed.). San Francisco, CA: Jossey-Bass.
- Radford University (2012) Unpublished Raw Data.
- Reed, K. E., Aiello, D. P., Barton, L. F., Gould, S. L., McCain, K. S., & Richardson, J. M. (2016). Integrating leadership development throughout the undergraduate science curriculum. *Journal of College Science Teaching*, 45(5), 51.
- Schee, B. A. (2007). Adding insight to intrusive advising and its effectiveness with students on probation. *NACADA Journal*, 27(2), 50-59.
- Siefert, T.A., Gillig, B., Hanson, J.M., Pascarella, E.T., & Blaich, C.F. (2014). The conditional nature of high impact/good practices on student learning outcomes, *The Journal of Higher Education*, 85(4), 531-564.
- Varney, J. (2012). Proactive (intrusive) advising. In J. Drake, P. Jordan, & M. Miller (Eds.), *Academic advising approaches: Strategies that teach students to make the most of college*. San Francisco, CA: Jossey-Bass.
- Wigfield, A. & Eccles, J. S. (Eds.). (2002). *The development of achievement motivation*. San Diego, CA: Academic Press.