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Leadership in Practice: A Model for Building Strong Academic Foundations in a Residential Learning Community

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Leadership in practice: A model for building strong academic foundations in a residential learning community

Abstract

This evidence-based practice paper describes a living-learning community model for first- and second-year engineering students. Our residential community is designed to foster an educational experience that effectively supports and reinforces academic excellence in the classroom while infusing leadership practices into the physical and developmental spaces our students share. We do this by supporting academic foundations in engineering, promoting community responsibility, and teaching principles of leadership. Our programming model includes cohort-style engineering coursework, bi-weekly course reviews, and a collaborative service-learning project in which second-year students are project managers and first-year students are team members.

The Engineering Leadership Community started as a retention strategy in 2009. Students who do not integrate socially and academically into their institution of higher learning are more likely to depart from college before earning a degree (1). In fact, student engagement can actually compensate for academic under preparedness, giving students the opportunity to connect to more academic support (2); (3); (4).   By providing a physical environment for students in engineering majors to live, our program has historically allowed students to make academic and social connections early in their college career, which better supports their persistence. In recent years, students in the Engineering Leadership Community have taken multiple classes in the same sections together, including a one-credit academic success course and their introductory engineering lab. This method uses Tinto's learning community model, helping students to make connections between courses with their peers (1).

The additional elements of service-learning and project-based learning have brought the residents of the Engineering Leadership Community into stronger leadership roles. Using (5) learning partnership model, we combine students' academic skills and interests in engineering with social justice and community service in order to produce what Baxter-Magolda calls "effective citizenship." In addition, the program design allows for a scaffolded educational experience, support students as freshmen and gradually challenging them to take on leadership responsibilities by the end of their second year.

We use qualitative analysis to assess how students interact and make sense of different elements of this program. In order to live in the Engineering Leadership Community, students submit a statement of purpose and a resume. These documents, along with work submitted in the academic success class, are analyzed inductively and deductively in NVivo software in order to code and connect themes in students' attitudes and beliefs. At the end of the academic year, students participate in interviews to share about their participation in the Engineering Leadership Community. These data are used to continuously evaluate the program.

Promising results have included continued academic success and retention, continued engagement in leadership activities within the college and the university, and a greater sense of

peer-support and accountability. Students have also demonstrated more self-efficacy in project management and team leadership.

What started as a program designed to retain students in the engineering discipline has turned into a multi-level developmental experience for first and second year students. The environment of both peer and administrative support has given students the opportunity to thrive in rigorous coursework, develop confidence in their planning, organization, and leadership skills, and connect their academic work to real-life applications of engineering.

Introduction

The Association of American Colleges and Universities (AAC&U), in a 2007 report titled *College Learning for a New Global Century,* highlights *integrative learning* as one of five essential learning outcomes for preparing students to address twenty-first century challenges. Integrative learning, "the application of knowledge, skills and responsibilities to new settings and complex problems," can be achieved through educational practices, such as first-year seminars, learning communities, E-Portfolios, service learning courses, internships and capstone projects (7). Barriers that exist for integrative learning in higher education today often point to a fragmented undergraduate curriculum (collections of independent classes in general education, specialized study, and electives) and the organization of knowledge into distinct and separate colleges and departments, "even though scholarship, learning, and life have no such artificial boundaries" (p. 16) (7). Learning communities, capstone experiences, and service learning projects can transcend these barriers by organizing around interdisciplinary themes, linking cross-disciplinary courses and concepts, and providing learning opportunities for students to connect, integrate, and synthesize knowledge (8).

Two underlying assumptions are at play when considering how integrative learning takes place: (1) students do not naturally integrate, or translate, their experiences to novel complex issues or challenges (9); (2) how a student integrates knowledge across contexts and over time takes work, and is unlikely to occur without commitment from the educational institution (8). The most prominent pedagogies of integration include service-learning, problem-based learning, collaborative learning, and experiential learning (10). What is essential to each of these pedagogies is the practice of reflection; "these pedagogies necessitate a more flexible approach to assessment…and multiple opportunities for structured reflection (as, for example, in portfolios) to help students take a more intentional approach to their own learning" (10). Reforms in engineering education have increasingly used these pedagogies to train the engineer of the 21st century, going beyond deep knowledge of technical fundamentals to meet other critical ABET outcomes, such as understanding the impact of engineering solutions in a global, economic, environmental, and societal context, communicating effectively, functioning on multidisciplinary teams, and understanding professional and ethical responsibility (www.abet.org).

Learning communities, specifically those that exist in residence halls, are educationally purposeful environments that engage students in active and collaborative activities both inside and outside of the classroom, as well as promote critical thinking and contextual learning through structured reflection and dialog (11). Features of academic living-learning communities

include shared major interests (ex. Engineering), common coursework, faculty fellows, peer mentors, co-curricular programming (ex. service learning projects, field trips, etc.), and academic support (ex. tutoring and study groups). Residential learning communities serve as integrative spaces where students are able to grow along dimensions of cognitive, intrapersonal, and interpersonal development. Because of the potential for living-learning communities to be effective mechanisms for improving integrative learning in engineering education, it is in this space where the present study seeks to better understand the experience of first-year engineering students –how they engage with their peers, their coursework, and their out-of-class experiences.
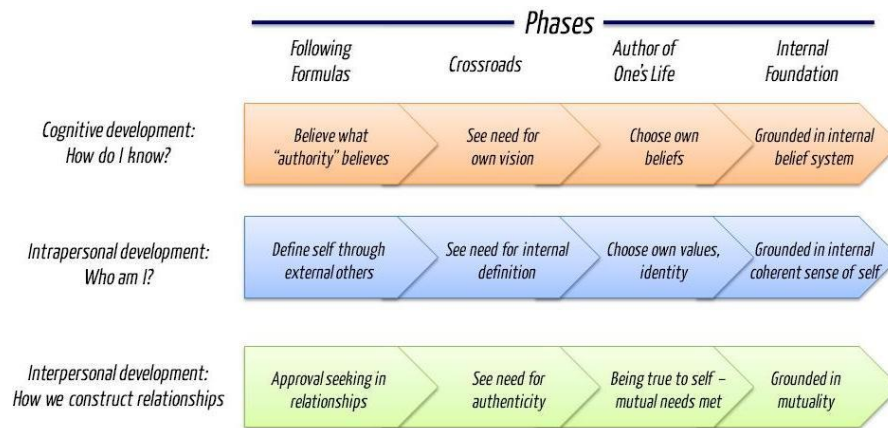
Literature Review

Learning Communities

Learning communities broadly defined are linked to a variety of desired outcomes of higher education related to improving student learning and success. Students living in *residential* learning communities demonstrate significantly higher levels of involvement, faculty-student interaction, satisfaction, and persistence than their peers living off-campus (12); (13). Using data from the National Survey of Student Engagement (NSEE), comprised of 80,479 first-year and senior student responses across 364 four-year colleges, (11) report that for both first-year and senior students, experience with a learning community (residential or other) is associated with "higher levels of academic effort, academic integration, and active and collaborative learning" (p. 124). Learning communities in this study were also positively linked to engaging more frequently with faculty, feeling supported in their academic and social needs, as well as engaging in diversity-related activities. The added value of learning communities has been demonstrated in numerous other studies (14); (13); (15); (16); (11).

Beyond academic performance and student engagement, learning communities also promote intellectual development and learning (5); (17); (18); (19); (20). Concepts introduced by these foundational theorists focus on how environments challenge and support students to move through autonomy and dualistic ways of interpreting the world towards ambiguity and interdependence. Pike (1999), in a survey of 626 first-year students, finds that residential learning communities provide opportunities for differentiation (developmental challenge and support) without enhancing integration (13). That is, "simply providing students with opportunities for integration is not sufficient to ensure that integration will occur" (p. 282).

Self-Authorship

Integrative learning, which emphasizes the development of students' capacities for self-directed learning, draws on a number of developmental theories, including self-authorship (9). Self-authorship is "the ability to reflect on one's beliefs, organize one's thoughts and feelings in the context of, but separate from, the thoughts and feelings of others, and literally make up ones' own mind" (5). Self-authorship comprises three dimensions: cognitive ("How do I know?"), intrapersonal ("Who am I?"), and interpersonal ("How do I want to construct relationships with others?") (21). Baxter Magolda (2009) outlines four non-linear phases of self-authorship, including *Following Formulas*, *Crossroads*, *Author of One's Life* and *Internal Foundation*. The dimensions of self-authorship can be visually represented by the following table (5):

Phases

	Following Formulas	Crossroads	Author of One's Life	Internal Foundation
Cognitive development: How do I know?	Believe what "authority" believes	See need for own vision	Choose own beliefs	Grounded in internal belief system
Intrapersonal development: Who am I?	Define self through external others	See need for internal definition	Choose own values, identity	Grounded in internal coherent sense of self
Interpersonal development: How we construct relationships	Approval seeking in relationships	See need for authenticity	Being true to self – mutual needs met	Grounded in mutuality

Several studies since the 1990s have attempted to find a link between living and learning communities and self-authorship, cognitive development, or persistence, and aside from some isolated results involving specific racial groups (22), there have been no statistically significant results that indicate a positive relationship. However, some scholars suggest that learning communities that group students into several courses together, regardless of where they reside, foster a "sense of 'educational citizenship' – that is, a sense of responsibility for the learning of others as well as for one's own" (12).
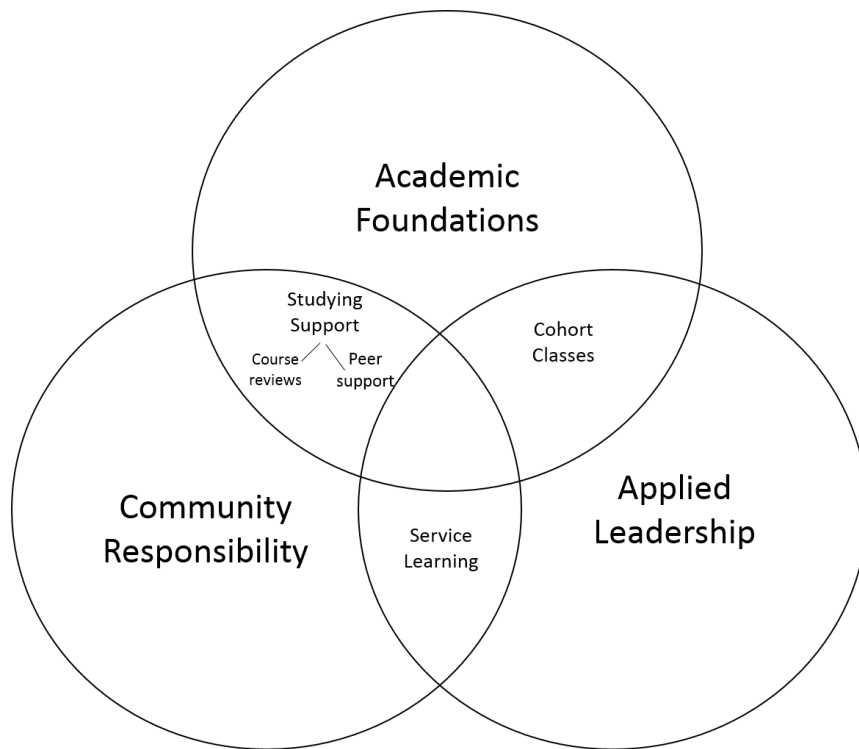
Theoretical Framework

The Engineering Leadership Community started as a retention strategy in 2009. Students who do not integrate socially and academically into their institution of higher learning are more likely to depart from college before earning a degree (1). In fact, student engagement can actually compensate for academic under preparedness, giving students the opportunity to connect to more academic support (2); (3); (4).

By providing a physical environment for students in engineering majors to live, this program has historically allowed students to make academic and social connections early in their college career, which better supports their persistence. In recent years, students in the Engineering Leadership Community have taken multiple classes in the same sections together, including a one-credit academic success course and their introductory engineering lab. This method uses Tinto's learning community model, helping students to make connections between courses with their peers (2003).

Conceptual Framework

The learning outcomes for the Engineering Leadership Community have three main spheres: academic foundations, community responsibility, and applied leadership. All programmatic and structural decisions surrounding the community are strategic toward developing these ends. Figure 1 illustrates these values.

Figure 1. Values and learning outcomes.

Academic Foundations

The Academic Foundations sphere is easily most tangible and understandable component of the Engineering Leadership Community for first-year students. Students self-select into this residence hall because of their close-proximity to other engineering students and the potential to form study groups and get homework help. The College of Engineering advertises course reviews and tutoring sessions for students as well, so structurally, students understand this to be one programming objective.

Applied Leadership

A more subtle objective is widely understood among new students as a program objective, however less obvious than Academic Foundations, is Applied Leadership. Students take a one-unit success course in their first semester that's exclusively offered to them. They learn academic success strategies like time-management, but they also learn "soft" leadership skills like conflict management and effective communication styles. Students' big assignment for this class is to create an e-portfolio that demonstrates how they have developed their *engineering competencies* in academic and out-of-classroom settings. This activity "validates [the] learners as knowers" (6) and challenges students to author the ways that they use their engagement experiences to accomplish their goals. The e-portfolio allows students to record and reflect upon important learning outcomes, for example, the ability to communicate effectively or function on an interdisciplinary team. The success course is the main vehicle by which we connect Academic Foundations and Applied Leadership. A description of the competencies can be found in the *Recommendations for Future Research* section of this paper.

In addition to the success course and e-portfolio assignment, students engage in a service-learning project throughout the academic year. Sophomores living in the community lead this project while first-year students participate as team members. Students have additional opportunities to apply leadership principles learned in class and in other activities in the service-learning project.

Community Responsibility

The service-learning project also serves as an intentional intervention for the Community Responsibility component of the program model. The Community Responsibility sphere of programming is intended to produce what Baxter-Magolda calls "effective citizenship" by combining students' academic interests in engineering with social justice and community service. The service-learning project provides an actively engaged learning environment through which students can reflect on their role in improving society as engineers.

Students also integrate into the Community Responsibility sphere through their academic engagement with their peers. Reflection essays in the academic success course challenge students to evaluate their role in their residential community. Therefore, Community Responsibility has a dual role in our programming. On a macro-level, students should learn about and define their responsibility to their community through the service-learning project. On a micro-level, however, students should also come to understand their roles and responsibilities in their immediate environment.

Purpose

The purpose of this research is to examine how first-year engineering students engage with their peers, their coursework, and their out-of-classroom learning experiences. By using a realist data collection method, this study focuses on the perceptions of participants rather than our own inferences (23).

Methods

Sampling

Maxwell (2013) reviewed strategies to gather an effective sample to answer the research question. He recommended the use of a *purposeful sampling*, selecting participants particularly on characteristics that are important to the research. These students were "selective deliberately to provide the information that is particularly relevant to [the] questions and goals" (23). This study is driven by a sample of students who live in a specific living and learning community on a specific college campus. Students share similar experiences in their common coursework, cohort class model, and interest in living in a residence hall with other engineering students. To narrow our sample, we chose data from 11 female residents.

Data

The data used for this study were reflection essays written by the participants. Students responded to various prompts in 200-word reflection essays throughout the semester. Each reflection was graded based upon completion in order to prompt honest self-evaluations. Table 1 describes the essay prompts and the week each was due during the semester.

Table 1. Reflection essays and due dates

Reflection	Prompt	Due
Expectations	What expectations do you have about attending college? What will you need to make a successful transition from high school and home to college and independence?	Week 5
Purpose	Who and what influence your decision to attend college? What do you want to gain from your college experience? What personal and academic goals do you have for this year? How do your academic goals affect the way you study? Are you aware of anything that could prevent you from achieving these goals?	Week 6
Balance	What is your reaction to the pace and quantity of course material and assignments? How are you organizing and making use of your time? One challenge faced by many freshmen is finding a way to allocate time so that they are both happy personally and effective in their academic work. What has been easy or difficult in balancing academics and your social life? Describe your experience with your new freedom and independence. How well prepared were you for this responsibility?	Week 8
Connections	Address whether or not you feel you belong and fit in here. How has your living arrangement contributed to your college experience? In what ways to do you participate in and contribute to your community? How satisfying are the connection you've made?	Week 14
Learning	How accurate were your expectations about college? What expectations turned out to be true? What important things have you learned in and out of the classroom since coming to [this university]?	Week 15

Limitations

There are some inherent limitations in this study. Although we have five reflection essays from 11 students, each essay is about 200 to 250 words. Interview transcripts tend to have 5,000 or more words, so the data sources used in our study will not provide the rich data that one might normally find in qualitative interviews.

The role of the researcher is also a limitation in this study, since the researchers are seen as authority figures. Students turned in reflection essays and completed their e-portfolio for a grade, so it is possible that these students would not have felt comfortable being completely candid, or perhaps said what they thought the researchers wanted to hear. The class was graded as Pass/Fail, and students were explicitly told that they earned credit as long as they answered the prompt and wrote at least 200 words, so that could have helped lessen the effect of the researchers' role as instructors. A few students wrote scathing reviews of the class itself in the *Balance* essay, so we believe that limitation was adequately addressed and the validity of the research remained uncompromised.

Our positionality and familiarity with the relevant topics and participant experiences may have had some benefits however, including the ability to build a strong rapport with participants (24), as well as increasing my sensitivity to the data –"having insight, being turned into, and being able to pick up on relevant issues, events, and happenings in the data" (25).

The sampling method could also lead to a limitation. These participants all self-selected into living in this residence hall. It is important, therefore, to be cognizant as researchers of selection bias and limitations of generalizability. The themes found in the analysis are likely not representative of every first-year engineering student's experience. This is important to acknowledge not only in the analysis, but also in the implications for practice and future research.
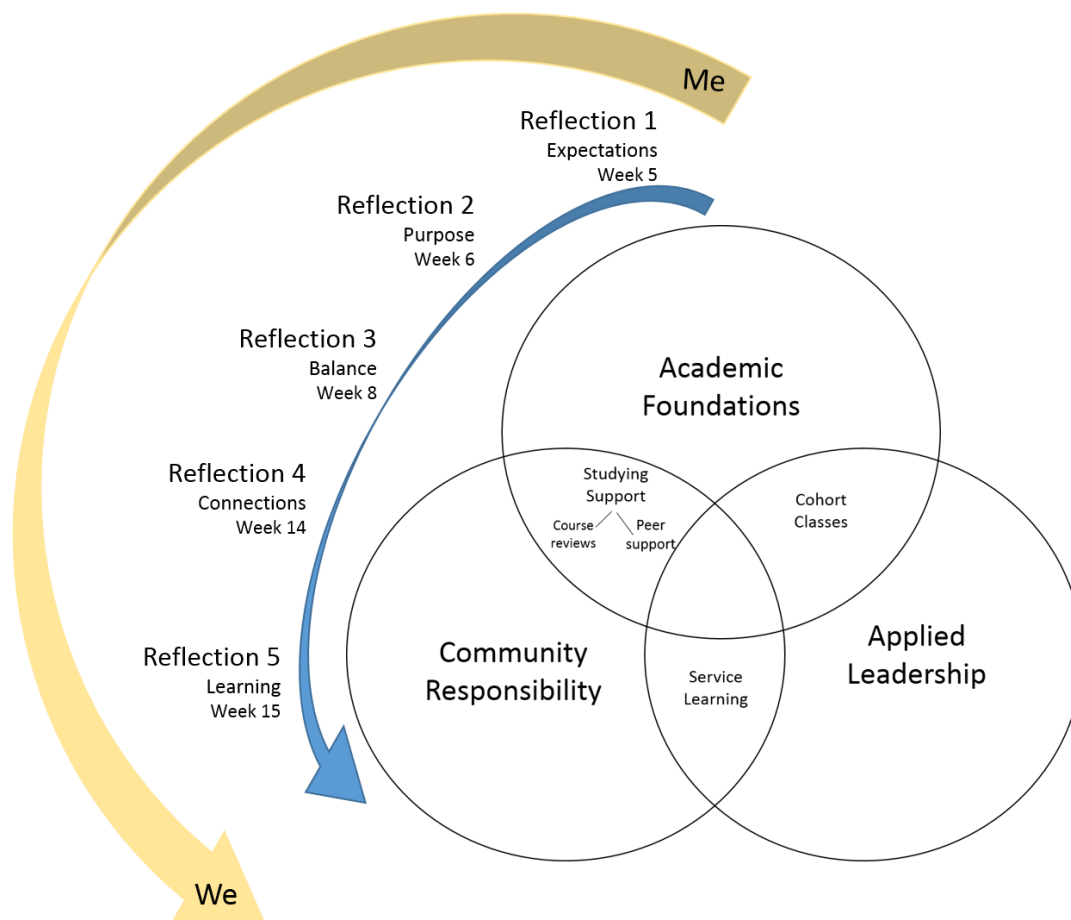
Analysis

We used NVivo software to analyze and code reflection essays and e-portfolios. Students were coded into class classifications differentiated by gender, resident status (in-state or out-of-state students), and service learning project team.

Maxwell (2013) encourages researchers to begin by "developing… coding categories, based on what data (including the participants' terms and categories) seem most important" (p. 107). In order to see themes emerge over time, we started by using word clouds and word trees in NVivo. Data sources were cleaned of essay prompts, names, dates, and common response stems from prompts in order to cultivate word clouds more closely aligned with students' authentic streams of consciousness. We developed process codes that were "words and phrases that facilitate categorizing sequences of events, changes over time, or passages from one type or kind of status to another" (p. 176).

Findings and Discussion

Using open coding, case classifications, and word clouds, themes emerged that showed how students interacted with their engineering coursework, the conceptual model of the Engineering Leadership Community, and each other. Figure 2 illustrates our analysis of students' interactions with the program model.

Figure 2. Student interaction with programming model

Me

Reflection 1
Expectations
Week 5

Reflection 2
Purpose
Week 6

Reflection 3
Balance
Week 8

Academic
Foundations

Reflection 4
Connections
Week 14

Studying
Support

Course
reviews

Peer
support

Cohort
Classes

Reflection 5
Learning
Week 15

Community
Responsibility

Service
Learning

Applied
Leadership

We

In this section of our paper, we will unpack our analysis of how students move through the model in their writing throughout the first semester.

Targeted development through Academic Foundations and Community Responsibility spheres

Through the open-coding process, it became clear to us that the reflection statements parallel the Academic Foundations and Community Responsibility spheres of the program model. This is not to say that first-year students do not engage in the Applied Leadership sphere, but based on the data that we analyzed, the reflection statements provide a glimpse into how students in this group developed and interacted with one section this model.

Focus on the Individual

During the first several weeks of the semester, responses to the assignments center on individualistic thinking. Students emphasize what they want and need—from themselves and from outside resources— in their college experience.

Consider this excerpt from one student's essay about Balance:

> *My personal and academic goals for this year include becoming an Engineering Ambassador, joining the Engineering Student Council, and landing a summer internship where I can apply what I learn in the classroom to the real world. Having goals allows me to feel purposeful when studying. I am not just here to graduate, I am here to get as much out of my education as I can—to grow as a person, learn concepts on a new level, and understand complex ideas.*

This student's goals revolve exclusively around what she wants for herself. Even though some of her ambitions around extra-curricular involvement relate to service and leadership, she situates her comments around how that involvement will help her in the long term.

Another student referenced her ambition to use her college education as a vehicle to gain post-baccalaureate employment.

> *I want to gain the skills and knowledge necessary to obtain a permanent job that I actually enjoy and that I know will pay well enough for me to support myself and my future family.*

Again, this student demonstrates an understanding of how college completion will help her individually. This excerpt is distinct from the first excerpt in that the student references her responsibility to her "future family." Near the beginning of the semester, if students referenced outside relationships, it was often in reference to their immediate families.

Family relationships and social capital

Students' understanding of university coursework and expectations came from their experiences prior to enrolling in college, and often their goals were closely tied to their relationships with their families.

> *The person that influenced my decision to attend college was my mom. She is easily the most influential person in my life and has truly been a replica of the saying "Your mother always knows best". From being a first generation college student and systems engineer graduate… following in her footsteps has influenced me to work hard and have patience while encouraging me to take the next step in advancing my career.*

This student ties her desire to attend college, and even her college choice, to her mother's experience with college. From another student:

> *Attending college was all my decision because I wanted to increase my knowledge*
> *and become an engineer to eventually work in a job that requires higher education.*
> *Both of my parents as well as my brothers have all gone to college.*

This theme is worth noting for two reasons: although students' narrative might be individualistic, this group's self-driven motivation is still insulated and influenced by social capital from family. Students attribute their ability to form goals, however self-serving, to their families' influences.

> *My parents moved when I was 3 so that I would be in one of the best schools in the*
> *nation, and my biggest dreams as a child were of what career I would have.*

These examples correspond to previous findings studying transfer student resiliency, where academically successful students reflected on using what was dubbed a *problem-solving schema* to navigate new educational systems, classroom styles, and procedural barriers. The students in this study, although not transfer students, used similar processes for understanding their transition to college. This pattern is important to note, because it reflects a need to involve students' outside understanding and resources (including parents) in their construction of knowledge as it relates to college success (26).

Frustration with new expectations

Midway through the semester, reflection essays began to reveal students' fears, anxieties, and frustrations about their coursework. Students continue to view and recount their experiences through an individualist lens, but they lack the assuredness that was present in their statements in earlier essays.

The student in the following excerpt expresses such frustration about her chemistry and math courses:

> *I feel that in my math and chemistry courses that we only learn simplified versions of*
> *the unit and then are expected to know advance meaning behind the material. It gets*
> *extremely confusing and frustrating when I feel confident going into a test and then*
> *realize that it seems like I haven't seen the material. This is because the material on*
> *the test is advance compared to what is being taught and its review.*

In that excerpt, there is a lot of frustration expressed about her coursework. The student goes on to discuss potential solutions to her problems.

> *I still need to get more organized. I feel that I have been trying to keep a schedule but every day I have classes till 6pm which makes it hard to do work late at night. I try to get things done throughout the day but it I still feel behind.*

Her solutions are still individually-centered. The only explanation that she is able to conjure as to why she feels overwhelmed and frustrated are that *she* needs to get more organized.

Proxemics and peer-relationships

Students began to acknowledge their peers' presence midway through the semester in their reflection statements. Students' understanding of how they interact with their neighbors and the meaning of those relationships became clear in the fourth reflection essay.

> *I also believe that this is where I'm supposed to be, because I had a realization today during Calculus. We were starting section 6.3, which is differential equations. It had to do with a lot physics I had learned last year. However, after class, I was excited to do the homework, because I enjoy solving physics problems! My living arrangements has contributed to my college experience by helping me connect with my roommate, and her friends as well!*

This student expressed confidence that they had overcome the tension between their individual goals and frames of references and the reality of engineering coursework. Coupled with the confidence in academic foundations, this student also celebrated the relationships she had formed with her neighbors in the residence hall. Another student also noted the utility of close proximity to her engineering classmates:

> *I have made really goods with my next-door neighbors and I know I will have them for a lifetime. It is very nice having them so close, I can just walk a couple steps and I'll be there rather than having to drive to each other's houses. It is also helpful living around so many engineers in case of homework questions.*

These excerpts demonstrate students' processes from individualist goals to dissonance and frustration to collaborative problem-solving and community responsibility.

Another student summarized her experience balancing school and her social life:

> *Balancing my academic and social lives has been quite easy because I often work together with friends on group projects or studying for exams together. Many of the extracurricular activities I am involved in also encourage academic or career*

> *development opportunities at meetings, so I often meet people with similar academic and career goals at these events.*

Since this student's individual goals and plans aligned with her social activities, she discovered it was easier to balance academic and social integration into college. Another student described the following:

> *I absolutely love living in the ELC because everybody is always so welcoming and eager to help with homework because we are all going through the same material in all of our classes.*

This student noted the role proximity played in her social and academic integration into college:

> *Being close to all of my classes has also given me plenty of time to spend time with others outside of class, and I'm able to walk to my classes with my friends.*

What students are describing are examples of socio academic integration, where students combine their academic success and the social support they cultivate with friends in class (27).

Gilligan's Model of Women's Moral Development

The development from "me" to "we" throughout the first semester with these women resembled some of the more prominent theories of moral development in higher education research. Students' understanding of their academic integration and transition into college centered on relationships with others. Whether they referenced their families, their peers, or even their future families, students often situated themselves in relation to others. What changed for many students over the course of the semester was the role they gave themselves and others in these relationships. Early discussion of others referenced family role models and resources from outside the campus. There was some talk of the responsibility students would have with their families later in life. Later writing reflected how students interacted with others reciprocally. There were no distinct citation of one party having a formal role of responsibility. Rather, students' responsibilities seemed to arise from an understanding of the mutual benefits of the relationships. Gilligan's (1977) theory also centers on individuals orientations toward others. Gilligan's model moves individuals from self-serving, to responsibility toward others, to insightful balance between the two (28). This sample of students made a subtle transition from individual to community responsibility. In the larger program model for this community (Figure 1) students' engagement in community responsibility is linked both to applied leadership and academic foundations, so the intentional composition of an engineering residence hall helps to cultivate the sphere of community responsibility.

Recommendations for Future Research

In addition to the reflection essays, students built an online e-portfolio where they wrote about how current and past experiences help them develop the skills necessary to be an engineer. We refer to these skills as engineering competencies. An excerpt from the course syllabus describing the assignment is shown in Appendix A.

Future research can focus on analyzing data from students' e-portfolios. Based on our findings from the analysis of the reflection essays, we anticipate that students' e-portfolio responses may reflect their transition from the Academic Foundations piece to the Applied Leadership piece of the ELC program model.

In addition, the sophomores living in the ELC who mentor the first-year students could provide further insight to how they interact with the program model. Future research could combine analyses of e-portfolios with phenomenological interviewing to understand the continuum of development that occurs for students in their first and second years of the engineering curriculum.

More analyses can also emerge from coding all of the students' reflection papers, rather than the small sample we chose for this paper. Our purposeful sample of all female students helped focus the discussion on Gilligan's Theory of Women's Moral Development, but analyzing a more robust sample could help guide discussion of educational practice that's more generalizable to all first-year students.

Conclusion

Strategies to improve engagement and persistence in engineering education often include a myriad of external interventions such as service-learning, learning communities, project-based learning, and other active pedagogies. We employ many of these evidence-based practices in our own institution, and often do not take time to qualitatively examine how students are working through challenges in communication, identity, moral and ethical decision making, or simply, their goals and expectations for the future. The developmentally-sequenced reflection essays facilitate a structured pause for students to identify an important experience, challenge, or dilemma, describe why it matters, and make meaningful connections that advance their ways of knowing and being, as individuals, engineers, and authors of their own lives.

This analysis examined one reflective component of a living and learning community for engineering students: reflection essays. Through our analysis of the purposeful sample's essays, we were able to see how students interact with one piece of a larger program model. As practitioners, this helps affirm the purpose and value of the reflection essays for furthering student's cognitive, interpersonal, and intrapersonal development. It also allows us to consider what other interventions and program elements drive students to engage in the Community Responsibility sphere through the Applied Leadership sphere. As researchers, we are able to consider how other forms of data collection means might assist with program evaluation, especially for other areas of the program model.

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