Student Descriptions of Self-Regulated Learning: A Qualitative Investigation of Students' Reflections on Their First Semester in Engineering

Kayla Nicole Arnsdorff
Ms. Ashley Tingting Chen
Dr. Rachel McCord, University of Tennessee, Knoxville

Rachel McCord is a a Lecturer and Research Assistant Professor in the Engineering Fundamentals Division at the University of Tennessee in Knoxville. She received her Ph.D. in Engineering Education from Virginia Tech. Her research interests include the impact of metacognitive and self-regulated learning development on engineering student success, particularly in the first year.

Dr. Steffen Peuker, California Polytechnic State University, San Luis Obispo

Dr. Steffen Peuker holds the James L. Bartlett, Jr. Assistant Professor position in the Mechanical Engineering Department at the California State University in San Luis Obispo. He is teaching courses, including laboratories, in the HVAC concentration and mechanical engineering including first-year courses. Dr. Peuker's educational research focuses on increasing student retention and success in engineering through implementation of a student success focused approach in introduction to engineering courses. In addition, his work in engineering education focuses on collaborative learning, student-industry cooperation, and developing innovative ways of merging engineering fundamentals and engineering in practice and research. He can be reached at speuker@calpoly.edu.

Work in Progress - Student Descriptions of Self-Regulated Learning: A Qualitative Investigation of Students' Reflection on Their First Semester in Engineering

Kayla Arnsdorff, Ashley Chen, Dr. Rachel McCord, and Dr. Steffen Peuker
karnsdor@vols.utk.edu, achen10@vols.utk.edu, rmccord1@utk.edu, speuker@calpoly.edu

Abstract - **This work in progress paper summarizes initial work conducted to understand how students discuss their self-regulated learning skills through an end of semester reflective assignment. As part of a first year seminar course for engineering students, students are asked to complete weekly reflective assignments relating the week's topic to their own practice as a student. At the end of the semester, students are asked to complete a summarizing reflective assignment where they look at their growth as a learner over the academic term. Using the framework of self-regulated learning, our research team has begun coding the end of semester reflective assignments to understand how students discuss their self-regulation. In this work in progress paper, we will discuss initial results of the qualitative coding. Specifically, we focus on defining themes in how students talk about their motivation during and after one semester as an engineering student. Themes for motivation include the fear of missing out on opportunities, tangible and indefinite rewards, and the expectation of family members.**

Index Terms – reflection, self-regulated learning, student success, retention.

INTRODUCTION

Many students enter the engineering disciplines unprepared to be successful in the rigors of engineering academia. Engineering student retention continues to be a significant area of research, partially due to lack of academic preparation or skill when entering a higher education institution. One theoretical framework that describes the needed skills to successfully progress through higher education is self-regulated learning. In this work in progress paper, we discuss an initial investigation into how students discuss their self-regulation in personal, professional, and academic pursuits in undergraduate engineering curriculums through the use of a structured reflective assignments called the Design Your Process for Becoming a World Class Engineering Student.

LITERATURE REVIEW

I. Framework: Self-Regulated Learning

Self-regulated learning (SRL) is described as the process that a learner goes through in order to engage in cognitive and metacognitive functioning, as well as to regulate several affective dimensions, such as motivational, behavioral, and emotional regulation [1-5]. Self-regulated learning can also be seen as a process that allows students to navigate through the lifecycle of a particular task by engaging in planning, monitoring, and evaluation activities. Research has demonstrated that the ability to self-regulate is not only a better predictor of student success than IQ or economic status but self-regulation can be learned by anyone [6]. Research in engineering education is beginning to look at how students with different profiles of self-regulation perform in the classroom [7] as well as level of self-regulated activity and performance in design and technical engineering spaces [8, 9]. With interest piquing in self-regulation in engineering education and evidence to show that students with higher level of self-regulation are more successful than their low engagement peers, it is important to investigate ways in which self-regulation can be developed and sustained in undergraduate engineering education.

II. Reflection in Learning

One method for helping students internalize how to use current skills and to identify learning needs is through the use of structured reflection in classroom activities. Turns and colleagues define reflection as "an intentional and dialectical thinking process where an individual revisits features of an experience with which he/she is aware and uses one or more lenses in order to assign meaning(s) to the experience that can guide future action (and thus future experience)." [10]. Turns et al., challenged the engineering education community to incorporate more structured reflection into classroom practice to allow students to think about past or current experiences in order to guide future action. Thus, the use of reflective activities is one way to challenge students to think about current learning processes to determine adequacies in order to direct future learning activities and pursuits.

III. Design Your Process Project

The Design Your Process For Becoming A World Class Engineering Student project (DYP) is a nationally adopted reflective activity originally developed by Raymond B. Landis [11] and Steffen Peuker [12, 13]. The primary purpose

of this reflective activity is to help students develop a plan for becoming a successful and engaged student throughout the remainder of their undergraduate curriculum. The DYP project is typically assigned at the end of an academic course that focuses on teaching students academic, personal, and professional regulatory skills. Examples of topics in the course would be the development of goals, building community, academic skill development, and personal development. Based on the topics covered during their academic skills course, students are asked to develop a plan for becoming a successful student by answering the following prompts:

1. Where would a "world-class" engineering students want to be in the topic areas covered in class?
2. Where are you currently on each of these items?
3. What do you need to do to move from where you are to where you would need to be to become a "world-class" engineering student?

For the context of the data set for this work in progress paper, participants were asked to provide their reflection in the form of a 6-7 page written paper.

METHODS

This work in progress paper is part of a larger study looking at the longitudinal impact of the DYP project on retention, performance, and affective measures for undergraduate engineering students who create the DYP plan in their first year. Pilot data in the form of DYP reflections were coded in order to begin the development of a qualitative coding scheme for future data collected for the project.

Participants: Participants included undergraduate engineering students enrolled in a first year seminar course (FYS) specifically design for engineering students at a large research university in the southeast. All participants had been admitted into the college of engineering and were either concurrently enrolled in pre-calculus, an introduction to engineering course and calculus, or an honors introduction to engineering course and calculus. The FYS course had a total enrollment of 17 students, 14 of which consented to participate in this study.

Data Collection: As part of the requirements for the course, students were required to submit a 6-7 page reflection using the DYP assignment outline provided. These reflections were submitted electronically through the course management website. Reflections from students who consented to participate were downloaded from the course management website. All identifying information was stripped from the reflection and participants were assigned pseudonyms to protect their identity.

Data Analysis: Using self-regulated learning as a theoretical framework, the research team developed an initial primary code list, including definitions of each primary code. Two members of the research team coded the same three reflective assignments using the initial codes. Memos were written to describe why each line was coded. Memos were also written to highlight other potential codes to the coding list. The research team met together to review the initial

coding from the first three reflective assignments to: 1) check intercoder reliability, 2) to further define the primary codes to help improve intercoder reliability, and 3) to add new codes based on memos generated. After this meeting, a portion of the remaining reflective assignments were coded by the same two members of the research team. The results discussion focuses on an initial analysis of 10 of the reflective assignments from the pilot data set.

RESULTS AND DISCUSSION

While the larger study focuses on understanding how students discuss their self-regulation in terms of cognitive, metacognitive, and affective measures, this work in progress focuses on reporting out initial results in how students talk about their motivation and how that impacts academic, personal, and professional choices. Here, we define motivation loosely as the impetus that drives a person to do something. Each of the specific areas we discuss in this results section aligns with a specific motivational framework.

I. Using Goals as a Motivator

Participants discussed using goals as motivators by keeping incremental tabs on progress made on a goal. Making progress towards a goal helps keep them motivated throughout a task such as school or a career. Chris talks in general about students using goals as motivation when he says that by keeping track of "progress they are making towards their goals they make it easier to have a strong commitment to the goal because they can see they are moving forward with it and not remaining stagnant". Chris also talks about another way students use motivation to reach goals. He talks about having an accountability partner to hold him to the goal and using his partner as motivation to continue towards the goal rather than just giving up on trying to reach the goal. Chris states:

> "I think one way to improve on my goal setting would be to find someone to keep me accountable with reaching the goals I set for myself...They could serve two purposes: ensuring that I don't sell myself short with my goal setting, but also making sure I keep the goals obtainable, and staying up to date with the longer terms goals I've set so that they can encourage me to keep going and not end up abandoning it completely."

Kristen demonstrates another way students use goals as motivation; she talks about reflecting on goals to remember why the goals were set to begin with. Kristen says that, "this will be especially helpful on days when you ask yourself why am I putting myself through this "hell" they call college or even engineering, you can look back on your goals and remember why you started and why you are still here". Participants made a point to set both long term and short term goals because when short term goals are achieved, it provides motivation to continue working towards long term goals. Chris provides an example of this when he talks about when students "lay out the challenges before them so that the[y] can set goals respectively that satisfy both long and short term

challenges to keep them motivated and interested in what they are doing".

II. *Identifying Short and Long Term Benefits*

When discussing the reasons for choosing to participate in certain academic activities, both in class and extracurricular, participant discussed the perceived benefits they received from participation. These benefits were discussed in terms of long vs. short term benefits, or instant vs. future benefits. The benefit portion is usually split up into long vs. short or instant vs. future outcomes. Nancy weighed the benefits of joining the American Nuclear Society, which to him had "social advantage[s] to becoming intertwined with a group or groups in a college community which is simply gaining friends" and will "help with gaining a job in the future". He noticed the long term benefit of building his network early and the short term benefits of having friends that he could study with, go on outings with, and make lasting memories with. Furthermore, he chose to be an Orientation Leader to have an instant benefit of practicing public speaking and a future benefit of being able to interact better with strangers in large groups and authority figures. Similarly to Nancy, Sherry choose to be part of a program intended to support underrepresented minorities to gain a mentor as a first friend on an unfamiliar campus and a long term benefit of having someone he "could talk to at any time" and " help with a collegiate resume". She is also motivated to run for an officer position, despite being slightly introverted, for the short term benefit of practicing public speaking and the long term benefit of impressing his employers. Therefore, when the student weigh if the time and energy they invest in a task is worth the benefit they will receive, they are considering if they are more motivated to complete or give up on a task. If the benefit outweighs the cost, then the student is motivated to partake in the task, and if not, then the student will be less inclined to join the organization, complete the homework assignment, or apply for that scholarship.

III. Fear of Missing Out

Some other students join organizations, attend weekly meetings, or sign-up for excursions out of fear of missing out. Therefore, another subcategory of motivation we coded was Fear of Missing Out because if not for the fear, the student would most likely have not partook in the event. Participants discussed how fear was a strong motivator to push them to make a decision in participating in academic activities. Fear of missing out helped some participants engage in positive behaviors that pushed them out of their comfort zones will encouraging negative behaviors in others, resulting in stress and emotional distress. When talking about being more appealable to potential employers, Nancy was afraid she would miss out on "work[ing] with others as a team [and communicating] effectively to others" if she" spen[t] all their time in their own dorm focusing on classes by themselves". She was motivated to not always stay in her room due to her fear of missing out of valuable bonding time with her peers. Furthermore, some students, such as Sherry, stay

connected with people because they are afraid that "if you burn a bridge with someone, it could hurt you a couple of years down the road". Sherry did not want to be on anyone's bad side, because she was afraid it will hurt her in the future. While fear of missing out can be seen as a motivator to choosing certain activities, it can also be an added cause of stress to some participants. For example, Sherry described her experience in trying to achieve valedictorian status in high school, where she said she was "very depressed the entire year" and often cried herself to sleep due to the stress of trying to achieve this goal. Her fear of missing out on being valedictorian ended up being a negative motivator, as it led to adopting negative behaviors, such as sleep deprivation and stress.

IV. Development of a Network

In our research, we've noticed that more students are inclined to join clubs, make friends, talk to professors or advisors etc. if networking is and forming a connection is a potential outcome of the interaction. Participants realize that networking with peers and faculty is an important activity to participate in while in college. Isaac talks about this several times. He says, "peers are important for future contacts for jobs or help. They are also important for understanding difficult material," and "they are important for exchanging ideas. Peers can also be useful to build important skills needed in the workforce like communication, teamwork, and leadership". Networking provides benefits that motivate participants to participate in activities that allow for connections to be made such as joining clubs, making new friends in classes, talking to professors and advisors, and going to career fairs. Jake is motivated to go "converse with [his] advisor in order to see how" he is doing with regard to his classes and to "find out about possible job opportunities/job fairs, and also find out what I can do in order to stand out above other peers when competing for a job". Also, Kristen sums up using networking as motivation when she says, "networking is a huge positive influence in the professional field for any career. It is a huge positive influence to get involved on campus, it gives you almost since of community within the student body".

CONCLUSION

Reflective assignments can provide opportunities to dive deep into the processes that allow students to take control of their own learning. In this work in progress paper, we showed a preview of work that is currently on-going to investigate the ways in which students discuss their own self-regulation at the end of their first year of engineering school. We specifically previewed how students discuss their motivation in their first year and see that students discuss many different and complex facets of what motivates their short term and long term academic, personal, and professional goals. For the larger project, our goal is to describe the salient ways in which students discuss their self-regulation and how those factors impact their performance and retention in their undergraduate programs.

REFERENCES

1. Corno, L., *Work Habits and Self-Regulated Learning: Helping Students to Find a "Will" from a "Way"*, in *Motivation and self-regulated learning: Theory, research, and applications*, D.H. Schunk, amp, and B.J. Zimmerman, Editors. 2012, Routledge.
2. Zimmerman, B.J., *Becoming a self-regulated learner: Which are the key subprocesses?* Contemporary Educational Psychology, 1986. **11**(4): p. 307-313.
3. Zimmerman, B.J., *Self-Regulated Learning and Academic Achievement: An Overview.* Educational Psychologist, 1990. **25**(1): p. 3-17.
4. Pintrich, P.R., *Understanding self-regulated learning.* New Directions for Teaching and Learning, 1995. **1995**(63): p. 3-12.
5. Pintrich, P.R. and E.V. de Groot, *Motivational and self-regulated learning components of classroom academic performance.* Journal of Educational Psychology, 1990. **82**(1): p. 33-40.
6. Nilson, L., *Creating Self-Regulated Learners: Strategies to Strengthen Students' Self-Awareness and Learning Skills*. 2013: Stylus Publishing.
7. Nelson, K.G., et al., *Motivational and Self-Regulated Learning Profiles of Students Taking a Foundational Engineering Course.* Journal of Engineering Education, 2015. **104**(1): p. 74-100.
8. Lawanto, O., et al., *Comparing Self-Regulated Learning of Secondary Shool Students and College Freshmen during an Engineering Design Project.* Journal of STEM Education, 2013. **14**(4).
9. Lawanto, O., et al., *An Exploratory Study of Self-Regulated Learning Strategies in a Design Project by Students in Grades 9-12.* Design & Technology Education, 2013. **18**(1): p. 44-57.
10. Turns, J.A., et al. *Integrating reflection into engineering education*. in *121st ASEE Annual Conference & Exposition. http://scholar. google. com. hk/scholar*. 2014.
11. Landis, R.B., *Studying engineering: A road map to a rewarding career*. 1995: Discovery Press (Los Angeles, CA).
12. Peuker, S. and N.A.G. Schauss, *Improving Student Success and Retention Rates in Engineering: An Innovative Approach for First-year Courses*, in *2015 ASEE Annual Conference and Exposition*. 2015, ASEE Conferences: Seattle, Washington.
13. Schauss, N.A. and S. Peuker. *Improving student success and retention rates in engineering: one year after implementation*. in *Proceedings of 2014 FYEE Annual Conference*. 2014.

AUTHOR INFORMATION

Kayla Arnsdorff Undergraduate Research Assistant, The University of Tennessee - Knoxville, karnsdor@vols.utk.edu
Ashley Chen Undergraduate Research Assistant, The University of Tennessee - Knoxville, achen10@vols.utk.edu
Dr. Rachel McCord Lecturer & Research Assistant Professor, The University of Tennessee - Knoxville, rmccord1@utk.edu
Dr. Steffen Peuker Assistant Professor, Cal Poly San Luis Obispo, speuker@calpoly.edu