Self-Regulated Learning: A Process Tool to Improve Student Success Skills Acquisition

Peter J. Shull
Penn State Altoona, pjs18@psu.edu

Abstract - **Today there is general agreement that student high school success skills do not readily translate to college success skills and, therefore, there is a need to train new college students. Typical college success training programs essentially provide a series of common success topics such as time management, test taking, communication, and motivation that if used would improve their learning. While these efforts have met with some success, I pose 3 questions regarding training methods, 1) Can they be more efficient? 2) Can they be more effective? and 3) Can they be design for life-long learning, i.e., success beyond college? The answer is emphatically yes! What is often missing in these success trainings is a robust implementation process that guides the student through the entire cycle of problem identification, solution development, implementation, and assessment. Self-Regulated Learning (SRL) offers such a process that not only is more efficient and effective in student success skill development but the method can be applied to any problem, i.e. it is not limited to this particular application.**

The workshop is based on the results of an 8 year longitudinal study on effective methodologies to improve student success in college. The criterion of success for this study went beyond actual student success. First, the success training methods had to respect resource limitations of the students and of the faculty. This is particularly true for engineering programs that have restricted curriculums with little room to add additional programming no matter how valuable it might be. The author used the following criterion in developing the success program:

- **Efficiency,**
- **Effectiveness,**
- **Use as a life-long learning tool,**
- **Recognition of the individual needs of the learner,**
- **Develops clear understanding of students' responsibility for their own learning,**
- **Easily integrated into engineering curriculum, and**
- **Grounded in engineering principles.**

The result of this effort combines Self-Regulated Learning and the engineering design process to create a robust metacognitive learning strategy. This strategy defines specific steps in a process for acquiring traditional success skills.

In this highly interactive workshop, participants with develop the basics of implementing this unique methodology and how it is implemented in coordination with student acquisition of traditional success skills.

Index Terms – Self-regulated learning, student success, responsibility, reflection, engineering design process, victim engineer.

BACKGROUND

There is an abundant amount of literature devoted to study the retention issues in engineering education. In spite of the best effort by scholars and educators, retention rates of students studying in engineering programs remains to be low. [1] Majority of the dropout from engineering education happens early with students either switching major or leaving school within the first two years of their study. [2] [3] It is worthwhile to note that the high dropout rate from college is not unique to engineering education. In fact, studies found that, comparing to students of other majors, students in engineering programs have similar to higher persistence rates. [1]

Apparently, any intervention efforts aim to increase student retention should begin early. In the case of engineering education, it is paramount for educators to intervene as soon as engineering students enroll. While the format of such interventions varies greatly, to be effective they must transform the individual student from a high school student into an effective college student, i.e., identify and discard ineffective learning habits and identify and adopt effective ones.

Self-regulated learning is an ideal tool to effect this change

SELF-REGULATED LEARNING AND ENGINEERING EDUCATION

Self-regulated learning, originated from Bandura's social-cognitive learning theory, refers to a directive process where learners understand and control their own learning environments [4]. Particularly, self-regulated learners, rather than passively learn from teacher, approach learning in a proactive manner by creating an environment that facilitate the learning process. [4] This format focuses student skill acquisition on their own needs rather than the more traditional approach of one size fits all.

According to Zimmerman [5], self-regulation is conceptualized as three cyclical phases: forethought, performance, and self-reflection. During the forethought phase, the learners are expected to analyze the task at hand and formulate a plan to tackle the problem. The performance phase is referring to the time when learners execute their planned actions. In the third stage, self-reflection, students engage in self-assessment of the effectiveness of the performance as well as the implementation plan.

To connect this tool to engineering, i.e., to make the method relevant to the student, the process and the individual components are couched in engineering vernacular. The overall SLR method is related to the engineering practice of continuous quality improvement (CQI). Other elements are translated into the engineering design process. A result of this translation to common engineering tools, student now have a personal (meaningful) reason to use and practice them.

WORKSHOP FORMAT

1) Introduction: What is the issue we are trying to solve?
2) Self-regulated learning (SLR): Understanding the cyclic learning strategy and its effectiveness in improving student learning
3) SLR and the student: How to make student engagement with their own learning process relevant to them?
4) SLR and engineering: Understanding that SLR is a basic engineering tool that we want student to learn.
5) Incorporating SLR into engineering curriculum: Fitting SLR with the constraints of your program.

TARGET AUDIENCE

This workshop is for any educator looking for a robust method to train student in *how* to effectively engage in developing the necessary learning/success skills for a demanding discipline such as engineering. Further, these skills and the method will serve the students as professional engineers.

REFERENCES

[1] Ohland, M. W., Sheppard, S. D., Lichtenstein, G., Eris, O., Chachra, D. and Layton, R. A., "Persistence, Engagement, and Migration in Engineering Programs," Journal of Engineering Education, Vol. 97, 2008, pp. 259–278.

[2] Budney, D, "Assessment of the Impact of the Freshman Engineering Courses," Frontiers in Education Conference, 1997, pp. 1100-1106.

[3] Gainen, J., "Barriers to success in quantitative gatekeeper courses," New Directions for Teaching and Learning, 1995, pp. 5–14.

[4] Bandura, A., "Social Cognitive Theory of Self-Regulation," Organizational Behavioral and Human Decision Process, Vol. 50, 1991, pp. 248=287.

[5] Zimmerman, B. J., "Becoming a Self-Regulated Learner: An Overview," Theory into Practice, Vol. 41, Issue 2, 2002, pp. 64-70.

AUTHOR INFORMATION

PETER J. SHULL is Associate Professor of Engineering at The Pennsylvania State University. After a successful career in the technical field of Nondestructive Evaluation (NDE), and having worked at the Nation Institute of Standards and Technology (the location of the atomic clock used as the United States time standard), Dr. Shull made the decision to return to academia and began his career in education. From the first day, Dr. Shull noted an apparent lack of sound educational practice at the higher educational level. This is reflected in a statement made by Dr. Shull's Ph.D. advisor regarding teaching—"If you know the material, you'll be a great teacher!" Recognizing that one's degree of knowledge of a subject has no relationship to their understanding of pedagogy or their ability to apply it, over the past 18 years, Dr. Shull has maintained an active focus on sound pedagogy as related to STEM education. These efforts have been divided into understanding pedagogical theory and *the pragmatic application in the classroom*. His primary areas of focus are teaching functional, effective teamwork, how professional skills function as student success skills, and primary factors that influence student success. Much of the work is based in social-emotional development and personal responsibility (inherently difficult areas for most STEM students) and cognitive and metacognitive methods to improve student learning.

Dr. Shull has developed a series of popular workshops designed to educate and train faculty in pragmatic methods to address these issues. He has authored numerous publications in the field of pedagogy, student success factors, and the technical area of NDE including the popular textbook entitled *Nondestructive Evaluation: Theory, Technique, and Applications* (Marcel Dekker, 2001), he is a Fulbright Scholar (Argentina—2006).