

## **Board 84: Work in Progress: Development of Learning Skills Modules for First-Year Engineering Students**

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# **Work in Progress: Development of Learning Skills Modules for First-Year Engineering Students**

## **Abstract**

This Work in Progress paper will focus on the learning skills modules that were developed in the School of Engineering at Grand Valley State University (GVSU). These modules were developed to provide first-year students with tips on topics such as time management and avoiding procrastination, note taking, preparing for classes and exams, and reading science, technology, engineering, and math (STEM) textbooks. Included in the modules were a tutorial on how to set up a Google Calendar, a self-assessment of their strengths and areas for improvement, links to available resources, and advice from graduating seniors.

These learning skills modules were developed as one component of the Student Success Initiative within the School of Engineering at GVSU. The motivation for the Student Success Initiative and the development of the learning skills modules is the improved retention of the first-year students in the engineering program. The retention of students from the Introduction to Engineering Design I course to the Introduction to Engineering Design II course has historically been in the range of approximately 33% – 36%. A multi-pronged approach has been taken to help provide students with the skills and resources to be successful, access to academic support, creating a sense of engagement and community among students and within the School of Engineering.

The learning skills modules were developed to be incorporated into a first-year seminar. While the first-year seminar is under development, the modules were incorporated into an Introduction to Engineering course. This course is not a required course for engineering majors and there are non-majors that take the course, however, many students that are considering an engineering major and are taking the pre-calculus courses in preparation for the engineering foundation courses also take Introduction to Engineering. Therefore, it allowed for the modules to be utilized so that the results of their implementation could be reviewed for further updates.

## **Introduction**

When students enter their first year of college, they face many obstacles such as a new, more advanced curriculum, difficulty managing their time effectively, as well as difficulty navigating new expectations and interactions with faculty and other students [1]. It has been observed that over 50% of students that leave college prior to graduating do so between their first and second years at the institution [2, 3]. The University of Pittsburgh studied attrition of engineering students and found that half of the first-year students that left their program had been placed on academic probation at the end of their first term [4]. Although interventions can help students after they have been placed on academic probation, the driving force for the development of the learning skills modules at Grand Valley State University (GVSU) was to provide students with the skills to succeed prior to experiencing academic difficulty.

One tool for promoting first-to-second year undergraduate student retention is the use of a first-year seminar [5]. Most first-year seminars take place in small, discussion based settings and they

consist of curricular and co-curricular topics that are designed to help students integrate both academically and socially into college life [6]. Due to the high number of credit hours required for students in the GVSU School of Engineering, the first year curriculum is being reviewed to identify how to include a mandatory first year seminar in the program plans. Rather than waiting for the planning and approving of a first year seminar, the learning skills modules were implemented in an Introduction to Engineering course during the Fall 2018 semester.

## **The Modules**

The topics of the modules were focused on the skills they can develop to be better prepared for the expectations in their college classes. The topics of the modules were Time Management, Avoiding Procrastination, Preparing for Classes and Exams, Note Taking, Reading Science, Technology, Engineering, and Math (STEM) Textbooks, and Self-Assessment. Additionally, links to the many resources available to students at GVSU were compiled for the students. To reinforce the benefits of developing these skills, graduating seniors were interviewed and asked to give advice to the incoming students. Without telling the senior students of the topics of the modules, it was the skills emphasized in the modules that the seniors identified as the most important to their success in the engineering program.

Within the Time Management module, there was a large focus on The 60-Hour Rule [7, 8]. This “rule” is really a guideline to scheduling no more than 60 hours of work during an academic term. This work would include all academic work, paid employment, and time spent commuting. This model also assumes that a student will spend 2 hours studying or working on homework outside of class for every 1 hour spent in class. Within this module, the other items that consume a student’s time are identified so that even though the 60 hours are a small component of the 168 hours available during a week, it becomes clear that scheduling more than 60 hours of academic time and paid work can severely cut into time available to get enough sleep or to have time available for social activities. An example of a weekly schedule (Figure 1) is provided to emphasize this point. The example schedule was based on a 14 credit hour course load. To add 2 hours of homework/studying for every hour in class, a total of 42 hours is required in the student’s schedule. This then leave 18 hours available for a part-time job.

Another item that is stressed in the Time Management module is using a calendar to schedule their time. In addition to putting class times and their work hours for a part-time job on their calendars, students are also encouraged to allocate time for studying and completing homework assignments and other activities that they need to carve out time for such as going to the gym. These items can also be seen on the example schedule shown in Figure 1. To assist students with setting up a calendar to schedule their time, a tutorial was also prepared to walk students through the process of setting up their schedule within the free Google Calendar site. It was acknowledged that setting up a schedule and not adhering to it is useless, so the students were reminded that they are preparing to become professionals. As a professional, one is expected to keep appointments and attend meetings that are on their schedule, even if they would prefer to skip them. In the same way, as students they must develop the mindset that the classes, activities, and appointments scheduled on their calendars must be attended.

To build on the Time Management topic, information was also presented on the topic of Avoiding Procrastination. Some tips were identified of ways to make progress on the tasks that need to be completed. Some methods identified to avoid procrastination were to make a deal with yourself to spend just 10 minutes on a task. Getting started and seeing some progress will make the overall task seem less daunting. Students were also encouraged to break larger task into smaller tasks and to create deadlines to complete each of the smaller tasks so that they will gradually make progress on the larger task. The importance of avoiding distractions was also emphasized. However, the students were encouraged to work with other students in their classes. Although this could result in distractions if they do not stay focused on their task, more often they hold each other accountable to complete the tasks at hand.



**Figure 1.** An example of a student’s schedule that applies the 60-Hour Rule to an academic semester that includes 14 credit hours.

Many students may have found that they did not require much preparation for their high school classes and exams. This can cause them to be caught off guard during their first classes at the university level when they realize that they will need to spend much more time outside of class preparing for the class by completing reading assignments, doing homework, or studying for exams. Simply showing up for classes is not enough, however, being present for all class periods and engaging in the classes by asking questions will help them during the out-of-class activities. Unfortunately, this realization usually does not happen until after the students have performed poorly on an exam or assignment. The Preparing for Classes and Exams module identifies the activities that should be done before class, during class, after class (but before the next class meeting), in preparation for tests or exams, and in preparation for the final exam.

The module on Reading STEM Textbooks identifies how to approach a reading assignment in a technical class. In addition to identifying the steps that should be taken before beginning the reading, while reading, and after reading, there is an animated example that shows a reading passage and each of the steps such as, skimming the passage before beginning the detailed reading, notes being made from the reading, important points being highlighted, and unclear points being identified for asking questions about during the next class period. The example from a textbook that they could be using in their classes make it clear that a reading assignment in a technical class is very different than reading a novel simply for entertainment.

Although the modules were developed based on the most common areas where students are underprepared for the expectations of their university classes, each student will have different strengths and areas where they most need to improve their performance. A module on Self-Assessment was prepared to walk students through the process of assessing their strengths and the areas where they need to improve in order to be able to attain the goals they have set for themselves. Rather than just identifying the areas where they need to make improvements, they are also directed to develop plans to address these areas.

Throughout the modules, there are activities for the students to apply the various techniques or skills that were presented. They are asked to reflect on what worked best for them, whether they noticed any improvements in their academic performance or ability to complete assignments because of the use of the skills and techniques they had learned.

Finally, graduating seniors were interviewed to provide their advice or words of wisdom for the incoming students. Without telling the senior students about the modules or suggesting topics to discuss in their advice, it was very interesting to see that so many of the points discussed in the modules were the focus of the advice that was given by the students that had completed the engineering program (see Figure 2). This highlights the fact that these are important skills and that successful students may be able to identify and develop them on their own, however, giving all students these insights upfront can help them develop these skills earlier. Establishing these skills early in their college careers can prevent some initial poor performance, which can lead to discouragement and attrition.

“The amount of time needed to do engineering homework is so much more than in high school. Make sure you balance your priorities.”

— Mechanical Engineering Student

“Professors are here to help you, don't hesitate to ask them questions until you understand the materials.”

— Computer Engineering Student

“Develop good study habits. You will need to study multiple days before an exam to do well. Studying the night before is not good enough.”

— Mechanical Engineering Student

**Figure 2.** Advice from graduating seniors to incoming students in the engineering program at Grand Valley State University.

“Writing things out [in class] helped me remember things a lot better. It helped me pay attention. I would write down questions I had or circle something that seemed really important. It doesn’t have to be everything that was said.”

— Product Design & Manufacturing Engineering Student

“Find a good group of other students to work with.”

— Mechanical Engineering Student

“If you’re organized, it really helps a lot. I put every class on my calendar and every assignment that was due on my calendar.”

— Product Design & Manufacturing Engineering Student

**Figure 2 continued.** Advice from graduating seniors to incoming students in the engineering program at Grand Valley State University.

## Conclusion

This project is a work in progress. The learning skills modules have been developed and implemented in an Introduction to Engineering course. The goal of developing these modules was to use them as a foundation for a first-year engineering seminar, which is still under development. Based on the advice that students that have successfully completed the engineering program at Grand Valley State University, the topics of the modules focus on the skills that have contributed most to their success. Having that validation by actual students that have been in the same position as the incoming students provides further support for the first-year students to apply the skills for their academic success.

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