Transitioning from Active to Self Directed Learning

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Abstract

Students at FGCU are well aware of “active” learning techniques, if not by name then at least in practice. The U.A. Whitaker College of Engineering (WCE) courses were designed as integrated lecture-labs with extended contact time in the classroom; for a three credit hour course, students meet with the faculty four hours a week. Most faculty use this additional classroom time to incorporate some type of hands-on activity, e.g. integrated labs, worksheets, or various short hands-on activities. As a young program, none of the faculty have ventured down the path of a full problem-based learning course where students take greater ownership for their own learning.

The ***objective*** of this engineering education study is to determine if transitioning students from active to self-directed learning in a senior level class will help students take ownership for their learning as they prepare to enter industry (or continued education) where they need the critical lifelong learning skills. While this course has included hands-on activities and a large class project in the past, the students have not been guided through the self-directed learning process. This study best fits in the ***Active and Self-Directed Learning pedagogical topic***.

Introduction & Objectives

The senior-level **Biomechanics** course will be modified to incorporate ***four shorter learning modules***, where students gradually move from active to self directed learning, to a ***final, longer module*** where students are fully responsible for assessing what needs to be accomplished to fully complete the module. Previous learning outcomes included:

- Use engineering tools, including motion analysis equipment and modeling software to analyze human motion, e.g. gait mechanics.
- Examine human movement and changes between groups by describing movement in terms of kinematic and kinetic parameters.
- Evaluate and communicate clinical aspects of human movement.

By changing the course from a typical integrated lecture/lab course to a module based course that emphasizes self-direct learning,

1. ***Do students not only gain a deeper understanding of the material but also gain an appreciation for appropriately guiding their own learning?***
2. ***Are students aware of improvements in their own learning if they are eased into the role (and skills) of a self-directed learner?***

Developmental History of Innovation

How and Why: Over the past four years, since the first course offering, this course has been a project based course, but not a project based ***learning*** course. I attempted a project based learning course the second course offering, but the students did not know how to direct their own learning and I did not know how to properly guide them. The reason for implementing a self-directed learning course, is not so much to create a PBL course, but rather in recognition that ***seniors are still struggling with how to assess their knowledge and understanding and how to navigate their resources without the traditional lecture and homework assignments***.

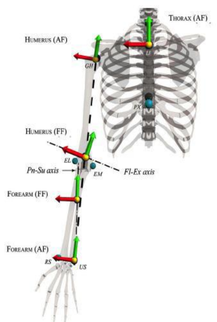
Authors of “How Learning Works: Seven Research-Based Principles for Smart Teaching” suggest several strategies for promoting student development of metacognitive skills and helping students to become self-directed learners, including ***assessing the task at hand, evaluating one’s own strengths and weaknesses, planning an appropriate approach, applying strategies and monitoring performance, and reflecting on and adjusting one’s approach.*** One reason for participating in FOEE is assistance in understanding how this is accomplished.

Learning Activities & Materials / Execution

This course was typically taught with a standard lesson using either board notes or a few PowerPoint slides to introduce and discuss a topic, and then the students usually ran through worksheet problems designed to apply content from the lesson. While they were participating in active learning, they were allowing (as was I) a worksheet to guide them through the learning process with a well defined problem. Students were assessed through weekly quizzes, homework, exams and a final project.

For this next session, topic areas will drive a project within a learning module. The selected learning modules for this next course offering are [number denotes classes devoted to learning the topic]:

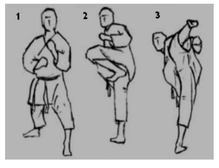
1. Anatomy & Muscle Mechanics of Human Motion [4]
2. Kinematics of Human Motion [6]
3. Kinetics of Human Motion [5]
4. Pulling it All Together in the Equation of Motion [3]
5. Analysis of Human Motion [10]



Students will be assessed based on their final submissions and their ability to answer questions during their presentations.

Module 1 - Anatomy & Muscle Mechanics of Human Motion [4 Lessons]
Students will be given a mini-project to describe the anatomy, muscle mechanics, effects/location of center of mass, and common injuries for a selected human motion. They will be asked to focus on the primary joints/muscles responsible for the motion. Students will be provided a list of possible topics; these topics are selected for the more extreme examples of human motion:

- Vertical Jump
- Baseball Pitch
- Golf Swing
- Yoga Pose
- Karate Kick

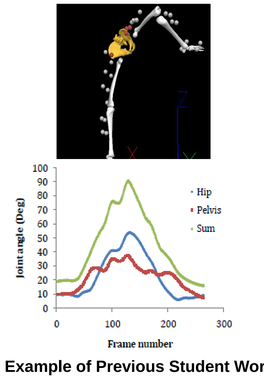


Lesson [1]: This lesson will open with a presentation of the anatomy, muscle mechanics and effects of center of mass of human gait. Prior to receiving their project, students will break into groups and select a topic to research.

Self-Directed Learning[2]: Students will have two classes to meet as a group and ask questions of me and utilize resources e.g. textbooks and the library. One to two journal articles will be required to supplement their resources along with references from one textbook.

Presentation[1]: Students will present their findings to the class. They will be assessed on the level of information provided in their presentation, the ability of their peers to learn and engage in the topic, and the team’s ability to answer questions based on possible physical limitations or changes in body types.

Semester Projects (Old format)
This “semester” project was conducted since the course began but was never truly integrated with previous lesson content. In the past students were teamed with physical therapy doctoral students for real world research problems, with the undergrads developing the model and participating in data collection. Many times students continued the project and processed all the data for the PT students. While the projects were intriguing, students rarely understood the mechanics behind the software and failed to fully appreciate the data and motion graphs. They were caught up in the process of data collection.



Example of Previous Student Work

Module 5 - Analysis of Human Motion [10 Lessons]
Projects will be simplified to better integrate previous course content with new skills learned in this module. Students will be asked to address specific points from each module, e.g. calculate the angular velocity of the knee during mid-swing phase, along with data provided from the analysis. Students will be asked to describe the mechanics of (or differences between):

- Running and walking
- Standing vs. waling lunges
- Skipping
- Walking in platform or high-heeled shoes
- Other topics allow upon approval of professor

Data collection set-up

Major Issues to Resolve

- **What is the appropriate level of information provided to students during Self-Direct Learning sessions**: Should deliverables be set to keep students on track? Should each day be scheduled as a topic, e.g. collecting data or understanding the data?
- **How to help students appreciate the format of the course and recognize the significance of self-directed learning**: How do we help students to overcome the common frustrations with PBL? Students do not understand the purpose of the class if you are not “teaching” them. How do you help them appreciate learning how to learn?
- **How to develop appropriate rubrics for each activity**: to keep the students focused on their learning rather than the grade they receive on assignments, I would prefer to assess them with mid-module rubrics that improve their final work and final assessment rubrics that emphasizes the quality of work.
- **How to assess their understanding of a topic without testing them:** Can the learning be assessed without testing especially in a group project?
- **How students will assess their learning and understanding**:
- **How to assess if the module format and mini-projects help to prepare students for PBL and self-directed learning**: do the mini-projects remove the growing pains associated with PBL?

Discussion

Benefits of Participation: Through my participation at FOEE I hope to better understand how to assist my students in becoming self-directed learners and how to assess gains in student learning (as well as students assess their own knowledge). On a larger scale, I would also like to learn more about and strengthen my skills in assessment of student learning and engineering education in general.

Research Endeavors: I am collaborating with a colleague to research ways to transition students to become self-directed learners and reducing the growing pains that students often experience in PBL courses. We are working with a colleague in education to submit a NSF RIGEE grant in spring 2012.

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