Planning and Developing an Online Course

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Introduction

- At Daytona State College located in Daytona Beach, FL, a new course for engineering is under development.

- The course itself is a classical course among the engineering foundation courses: Dynamics.

- Dynamics is planned to be launched as an upper level required course in the engineering technology curriculum at the College.
The process involves steps that are provided here.

- First, based on a set of required skills acquired by the graduates of the course, the student outcomes must be developed for the new course that fits within the program of study outcomes.

- Detailed course outcomes for dynamics as provided below help with developing the learning objectives more effectively.
This course that is new to our program and it will be a part of the sequence of two separate but closely related statics and dynamics courses that is to be taken in two consecutive semesters by both the engineering and engineering technology students.

Both statics and dynamics courses are planned to be offered as online courses. Based on the successes of statics, we expect that dynamics to be well received by the students.

Statics is a prerequisite for dynamics, and it has been developed as an engineering course back in 2012.
The following observations apply to the currently offered online statics course.

- On average, the current overall passing rate of the statics is 90% and above, among 50 students with at least 70% or more of the students scored 80% or higher as their overall passing score.

- Both engineering and engineering technology students have taken the course with no observable difference by major in students’ passing or failing rate in the course.
There have been no significant noticeable differences by major in the grade distribution between engineering and engineering technology students.

Using the results of quizzes and exams, there are also no notable difference distinguished by major in problem-solving abilities of the students, whether engineering majors or engineering technology majors.

Both engineering students from other engineering programs at other institutions and students at DSC can take statics. Nothing could be hypothesized in this case.
It has been the consensus of department faculty expressed during faculty meetings that dividing the currently offered applied mechanics single course into two separate but closely related courses of statics and dynamics will serve our student population more effectively, and they would help them to acquire a more in-depth knowledge of the subjects.
The current 3-credit hours applied mechanics course due to its credit hours limitations allows only limited coverage of both statics and dynamics topics\(^1\).

The course is currently awaiting the approval of the college curriculum committee. The approval is expected by the college curriculum committee.
The course outcomes are the major framework for a course. The course outcomes basically provide a road-map for the course, its focus and what materials should be covered.

They also help with prioritizing the course resources and efforts.
This course is designed to help students achieve the following outcomes:

1. Ability to analyze kinematics of the particle motion in various coordinate systems including Cartesian, polar, and cylindrical.

2. Understanding of the concepts of displacement, velocity and acceleration as vectors and how to determine them (also covered in mechanics).

3. Understanding of the notion of a force as a vector (also covered in statics).
4. Ability to understand concepts of kinetic, potential and mechanical energies and the concept of a conservative force.

5. Understanding of the concepts of power and mechanical efficiency.

6. Ability to analyze particle dynamics
   - Ability to make a right decision related to a choice of the system of particles whose motion is to be studied.
   - Ability to correctly draw the free-body diagram (FBD) for the system.
   - Ability to write and solve Newton equations of motion for the system.
   - Ability to use principles derived from Newton’s second law, including Work & Energy, and Momentum.
7. [Major Outcome] Ability to analyze the kinematics of two-dimensional (planar) rigid-body motion.
   - Ability to use concepts of angular displacement, angular velocity and angular acceleration.
   - Ability to draw a FBD for a system of rigid bodies.
   - Ability to determine mass moment of inertia for some simple body geometries.
   - Ability to use principles derived from Newton’s second law, including Work & Energy, and Momentum, to derive equations of motion for a general rigid-body planar motion.
8. Ability to use both SEI and English system of units in all mechanical quantities (linear and angular displacement, velocity and acceleration, mass, force, torque, work/energy, power, momentum, mass moment of inertia).
The course uses a modular based system of instructions.

In this system, several modules are developed according to the topics where each module provides a set of instructions.
Course modules make the e-learning environment guided, structured, robust and yet agile in both content delivery and instructional methods.
Each course module provides the students with the topics, tasks, and activities as appropriate including reading and homework assignment, discussion assignment, short quizzes, and exams if applicable.

A module can be provided as a separate text document for students to download, or it can be embedded into the course as an html text.
The course modular-based methodology may also be applicable to a “live” class where students attend the lectures, read the textbook and other reading assignments, solve the practice problems, the assignments and other required course material, and take quizzes and examinations, as applicable.
The anecdotal feedbacks from the students taking statics and seven other courses that use a similar modular-based approach of instructions suggest that this modular-based system work very well in keeping the students on track.

Modular-based instructions in its current context used here also help students, especially those that take an online course for the first time to feel less alienated with taking online courses.
Offering Dynamics Online continued

- Needless to say that in an online learning environment one must not discount the quality of the lectures, lecture notes, and the faculty response time in answering the students’ questions.

- This also helps with an effective e-learning experience by:
  - Increasing clarity of the subjects
  - The instructor’s expectations in the course
  - Communications
  - Transparencies
  - Ease-of-access, and
  - Guided repetition.
Course: EGNXXXX Dynamics
Sample Module

Module topics:
1. Force Vectors
2. Applications of Dot Products in Force Vector Calculation
3. SI and US Customary Systems of Units
4. Practice Problems

Module Activities and Tasks:
1. Study the followings in details:
   a. Ch. 2 of the textbook
   b. Ch. 3 of the textbook
   c. Handout on vector calculus available under instructional resources
2. Download the lecture notes for the L02 lectures below.
3. Watch all L02 lectures i.e., numbered as L02-1, L02-2, and so on found on the course website under course content.
4. As practice, solve all the problems and answer all the questions found at the end of the chapters 2 and 3.
5. Complete assignment 1 according to the instructions and submit it by the deadline.
6. Post a short paragraph about what you have learned from assignment 1 by the given deadline on the discussion board of the website under Assignment 1.
7. This module relates to:
   a. Assignment 1
   b. Quiz 1
   c. Mid-term exam 1
   d. The final comprehensive exam
Discussion

- Intuitively, the goal of innovation inherently blended in distance learning is:

The innovation is to make the e-learning more effective, efficient, guided, structured, and robust in both content delivery and in the instructional methods.
For a more effective as opposed to a less-effective e-learning in engineering and technology, e-learners should have access to instructional guiding and mentoring throughout the duration of the course at the time and places of their choosing via the web.

That can be viewed as more accessible in comparison to a student taking a “live” class in which he or she attends the lectures, reads the textbook and other reading assignments, solves the practice problems, the assignments and other required course material, and taking the quizzes and the examinations, as applicable.
So the question here would be if e-learning would be more effective if there were guidance and mentoring available throughout the course. And the anecdotal answer would be:

Effective e-learning in engineering and technology is best achieved by a structured approach to learning in which each and every step leads to the next more concrete step, and so on.
Effective e-learning may maximize the learning experience by increasing clarity, transparencies, ease-of-access, and guided repetition. It will make the learning environment less confusing and more agile, and it should help with attracting and retaining more students to the online course.

Effective e-learning is also greatly affected by the faculty response time of answering the student’s questions, providing encouraging feedbacks in a timely manner, and helping the students to make that connection with the faculty.
Conclusion

- Stages in planning and developing of dynamics as an online course offered in engineering and engineering technology curriculum is presented.

- An online modular-based system within the context described herein is considered as effective and agile.

- The course will be the second required course in a two-course sequence of statics and dynamics where statics is a prerequisite for dynamics.
Related pedagogical focuses of the course are identified and the student learning objectives are developed accordingly.

The authors rely on their collective previous experiences of many years of developing curriculum and online courses.

The added innovation is to apply this technology to make the e-learning more guided, structured, agile, and robust in both content delivery and in instructional methods.
References


