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Online Lessons to Help Engineering Students Transition

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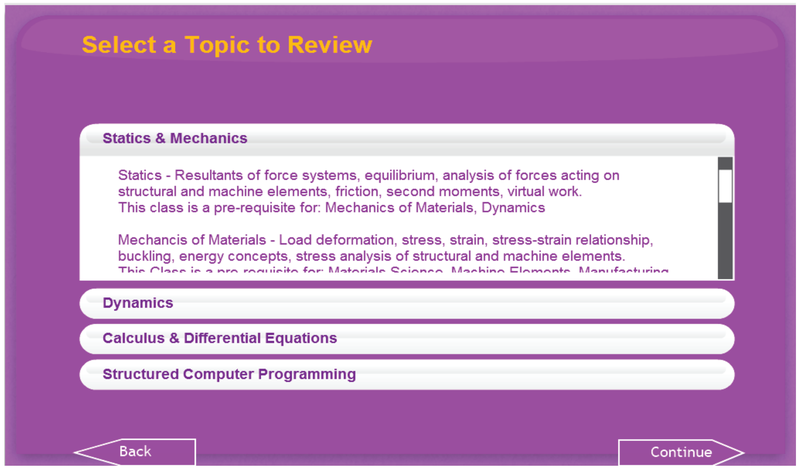
Background

Students in engineering programs take a number of pre-requisite courses that develop the needed skills and knowledge for upper division courses. Weaknesses in these pre-requisites occur due to differences in curriculums, instruction, and individual student performance. When there are weaknesses the student's performance in later courses suffers, sometimes to the point where they cannot successfully complete the major. This project seeks to improve retention and successful completion of mechanical and civil engineering degrees by helping smooth this transition.

Description

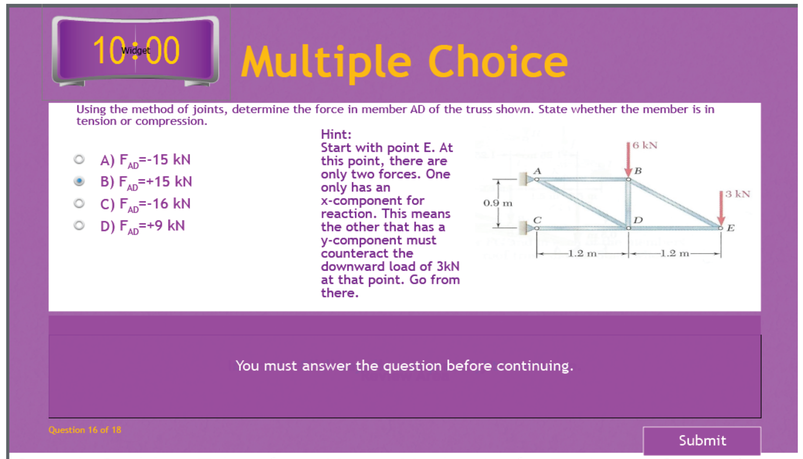
When completed, this tool will be a set of online corrective lessons to help at-risk students transition successfully into upper division courses. The lessons will be developed for key pre-requisites in mechanical and civil engineering; integral calculus, differential equations, statics, dynamics, and computer programming. The lessons will be modular so they can be customized for individual student needs and will provide interactive feedback to help students master concepts. This material is not intended to replace existing courses in these areas. Rather, it will help students correct specific weaknesses in terms of knowledge and skills that will be required in later courses.



Software Solution

For this project Adobe Captivate 9 has been selected for material generation. This software was chosen for the following reasons:

- The ability to structure different types of quizzes and questions (see example below).
- Scaffolding of information can be done. Scaffolding allows support structures to be embedded in the lesson (e.g. hints, concept reviews, and student modeled solutions).
- Allows leveling, or different types of lessons and quizzes based on pre-knowledge and difficulty.
- A wide range of "widgets" are available that allow appearance and operation to be tailored.
- Ability to be ported to multiple platforms including mobile devices.



Sample Problem Taken from *Vector Mechanics for Engineers: Statics (8th Edition, 2007)* by Beer, Johnston, and Eisenberg.

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Current Progress

Initial efforts are being focused on the Statics and Structured Programming modules. These have been identified as the highest priorities. Other researchers' work on concept inventories and common misconceptions is helping guide the development of the quiz questions. Examples of conceptual errors to be addressed are:

- Trouble constructing a correct free-body diagram.
- Difficulty selecting body or collection of parts to analyze for equilibrium.
- Identifying too many or too few possible forces.
- Assuming MATLAB will interpret meaning and correct syntax.
- Misunderstanding of operation and order of programming structures.
- Challenges using array variables.

References

Steif, P. S., Dantzler, J. A., "A Statics Concept Inventory: Development and Psychometric Analysis," *Journal of Engineering Education*, Vol. 94, 2005, p. 363-371.