



Minnesota eLearning Summit

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2016

Jul 27th, 11:00 AM - Jul 28th, 4:00 PM

Online Lessons to Help Engineering Students Transition

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Patrick Tebbe and Aaron Budge, "Online Lessons to Help Engineering Students Transition" (July 27, 2016). *Minnesota eLearning Summit*. Paper 44.

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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.

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.

Select a Topic to Review

Statics & Mechanics

Statics - Resultants of force systems, equilibrium, analysis of forces acting on structural and machine elements, friction, second moments, virtual work. This class is a pre-requisite for: Mechanics of Materials, Dynamics

Mechanics of Materials - Load deformation, stress, strain, stress-strain relationship, buckling, energy concepts, stress analysis of structural and machine elements. This class is a pre-requisite for: Materials Science, Machine Elements, Manufacturing

Dynamics

Calculus & Differential Equations

Structured Computer Programming

Back Continue

10:00 Widget Multiple Choice

Using the method of joints, determine the force in member AD of the truss shown. State whether the member is in tension or compression.

Hint: Start with point E. At this point, there are only two forces. One only has an x-component for reaction. This means the other that has a y-component must counteract the downward load of 3kN at that point. Go from there.

A) $F_{AD} = -15$ kN

B) $F_{AD} = +15$ kN

C) $F_{AD} = -16$ kN

D) $F_{AD} = +9$ kN

You must answer the question before continuing.

Question 16 of 18 Submit

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

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01:00 Widget Fill-In-The-Blank

For the following code, list the output for the variable 'Billy' in the box given below the code.

```
John=3;
Billy=8;
while John<=6
    Billy=Billy+1;
    John=John+1;
    Cat=4;
end
disp(Billy)
Billy: 12
```

Hint: In the case when a variable equals itself plus a constant, it is taking the current value of that variable and adding the constant to it, then saving that new value as the value for the variable. In the case of "John=John+1", if John=3 before this line, John will equal 4 after that line of code, as the constant added is 1.

Review Area

The time to answer this question has expired. Click anywhere or press 'y' to continue.

Question 14 of 18 Clear Hint Submit