CREATING TECHNOLOGY RICH LEARNING ENVIRONMENTS FOR THE CLASSROOM

NYSETA
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PRESENTATION OUTLINE

• **OUTLINE**
  • Review education problem being addressed,
  • The learning theory used as a lens to focus specific active learning pedagogical techniques to address the educational problem.
  • The features desired in a technology rich learning environment.
  • Examples from the classroom
  • Assessment measures.
OBJECTIVE

The approach is shared to allow others to implement technology rich learning environments with active learning pedagogical approaches to address specific education problems in their institution.
EDUCATION PROBLEM BEING ADDRESSED

% DFW grades

Pre - Technology Rich Interactive Learning Environment (TRiLE)
THEORETICAL BASIS

Technological Pedagogical and Content Knowledge (TPACK) (Koehler, 2012)
LEARNING - THEORETICAL BASIS

From the How People Learn knowledge, assessment, learner, and community areas we outlined the following key pedagogical design principles for creating the technology rich learning environment.

- The ability to direct the learner’s attention to the critical components in the new content to be learned
- Sufficient amount of student invention and practice with the new content to allow successful linkage and retrieval
- Timely, anonymous, and complete formative assessment feedback to both the instructor and student on their understanding of the content
- The ability to show concurrently different approaches, applications, and linkages to allow the student to make connections to the new content
- The ability to match the amount of content presented to not exceed the working memory load of the student with an ability of the student proceed at their own pace
- A learning environment that emphasizes collaboration and values peer instruction
# Classroom Features

<table>
<thead>
<tr>
<th>Pedagogical Component</th>
<th>Technology Rich Learning Environment Feature</th>
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<tbody>
<tr>
<td><strong>Ability to direct learner’s attention to critical components</strong></td>
<td>- Digital inking of instructor projected live on student tablets</td>
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<td></td>
<td>- Summary video lectures delivered prior to class and available after class</td>
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<td>- Back-lit projection screens</td>
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<td>- Ability to serve single slide, page at a time to students</td>
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<td></td>
<td>- Students able to playback instructor digital inking</td>
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<tr>
<td><strong>Sufficient amount of student invention and practice</strong></td>
<td>- Summary video lectures delivered prior to class to allow additional time for active learning activities (inverted or flipped classroom structure)</td>
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<td></td>
<td>- Stylus digital inking interface for students</td>
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<td></td>
<td>- Ability for individual or grouping of shared workspace</td>
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</table>
| Timely, anonymous, and complete formative assessment feedback | Ability to retrieve and project student work (solved engineering problems/diagrams) anonymously live in class  
Ability to return student work electronically |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The ability to show concurrently different approaches, applications, and linkages | Multiple (three) back-lit projection screens  
Ability to review and retrieve student solved problems that illustrate different approaches |
| The ability to match the amount of content presented to not exceed the working memory load of the student with an ability of the student proceed at their own pace | Summary video lectures delivered prior to class and available after class to allow students to view, pause, rewind or advance as needed  
Ability for students to save digitally inked notes and playback the digital inking as needed. |
| A learning environment that emphasizes collaboration and values peer instruction | Cooperative learning pedagogical approach, group problem solving with the ability for students to work in a common digital environment. |
TRADITIONAL CLASS DELIVERY METHOD OR “POUR IT IN”

100% MULTIPLE INSTRUCTORS ONE METHOD

PASSIVE ROLE

“PERPETUATING THE CYCLE”

17% POOR RETENTION

modeled after Lila Smith (1975)(Karl A. Smith, et al., 2005b)
The course has been redesigned with the following goals in mind:

- Increase the availability of content to the students outside of the classroom via My Courses Management System.
- Present and embed video links of real applications within the context of the material presented in the classroom.
- Increase the use of interactive activities taking advantage of the technology available in the classroom to promote student participation, individual and group work and student-student interactions.
- Create and administer immediate feedback assessment tools to better manage student-learning outcomes and encourage students to come prepared to class.
- Introduce activities that promote cooperative, collaborative and problem/project based learning. Instead of lecture or lecture-practice utilize discover-guide-practice.
WHAT DOES THIS CLASS LOOK LIKE?
IMMERSIVE VISUAL ENVIRONMENT

- Support Screen
- Videos & More
- Current Slide (Primary)
- Previous Slide (Secondary)
- Secondary PC Screen
- Primary Laptop
- Main Display & Audio Control
HARDWARE 1:1 TABLET ENVIRONMENT
BACK LIT PROJECTION
SOFTWARE ENVIRONMENT

- Personalized Toolbar
- Main Screen
- Previous Screen (filmstrip)
- Chat Feature
- Monitor Feature
0610-305 Pneumatics and Hydraulics

DyKnow Test Drive
Where I will write; where you should write

Polling test

I think DyKnow may be able to help me in the class in the following ways
A) Take notes on the presentation AND have all of the professor notes
B) Be able to absorb the material rather than just copying the material
C) Use the chat feature to ask the professor to review a point
D) Prepare for tests using my electronic notes I can access from any location
E) All of the above
"SEEING" STUDENT LEARNING PROGRESS

ENERGY & POWER IN HYDRAULIC SYSTEMS
3.3 FORCE MULTIPLICATION (cont.)

Pascal's Law

Recall

\[ P = \frac{F}{A} \]

Click on the correct answer.

What is the amount of force produced by the output piston?

A. 100 lb
   \[ F = P \cdot A \]
   \[ F_2 = P \cdot A_2 \]

B. 250 lb
   \[ F_2 = \frac{F_1}{A_1} \cdot A_2 \]

C. 2500 lb
   \[ F_2 = \text{?} \]
   \[ 100 \text{ lb} \cdot 2 \text{ in}^2 \]

Possible Answers: A-C

\[ F_2 = 2500 \text{ lb} \]

R・I・T APPLIED FLUID MECHANICS
FLUID FLOW and BERNOULLI’S EQUATION (Chapter 6)

APPLICATIONS of BERNOULLI’S EQUATION... (6.8)
...general procedure on example problems...EXAMPLE 6-10

Students

\[ \left( \frac{v_1^2}{2g} + Z_1 + \frac{P}{\rho} \right) = \left( \frac{v_2^2}{2g} + Z_2 + \frac{P}{\rho} \right) \]

Ref from Bottom

\[ 3 = \frac{v_2^2}{2(9.81)} \]
\[ v_2 = \sqrt{3(2 \times 9.81)} = 7.67 \text{ m/s} \]

\[ A_2 = \frac{0.25 m^2 \times 4}{4} = 0.91 \times 10^{-4} \text{ m}^2 \]

\[ Q = A_2 v_2 \]
\[ = 4.91 \times 10^{-4} \text{ m}^2 (2.67 \text{ m/s}) = 0.0037 \text{ m}^3 \]
"SEEING" STUDENT LEARNING PROGRESS

0610-305 Hydraulics and Pneumatics

How do I connect this circuit? (use a different color for each line)
0610-305 Hydraulics and Pneumatics

QUIZ (complete and submit)

Fully describe what the component symbol represents

Example:

Recall every line/shape/detail in an ISO symbol has a specific meaning related to a feature of that component.

1. 4:2 Valve
2. w/2 silencers on both exhausts
3. spring return
4. Solenoid Actuator


"SEEING" STUDENT LEARNING PROGRESS

**Chapters 1 and 2**

**RED TEAM GROUP 1**

If a body has a weight of 169 lb, and has a volume of 1.85 ft³, find the specific weight, density, and specific gravity. (The acceleration of gravity is 32.2 ft/s². The specific weight of water is 62.4 lb/ft³).

\[
\frac{m}{V} = \frac{5.25}{1.85} = 2.84 \text{ lb/ft}^3
\]

\[
S.W. = 91.35 \text{ lb/ft}^3
\]

\[
y = \frac{W}{V} = 169 \text{ lb} / 1.85 \text{ ft}^3 = 91.35
\]

\[
p = \frac{169 \text{ lb} / 32.2 \text{ ft/s}^2 / 1.85 \text{ ft}^3 = \text{slugs/ft}^3}{2.84}
\]

\[
SG = \frac{y}{y_{ref}} = 91.35 / 62.4 = 1.46
\]

**BLUE TEAM GROUP 4**

If a body has a weight of 169 lb, and has a volume of 1.85 ft³, find the specific weight, density, and specific gravity. (The acceleration of gravity is 32.2 ft/s². The specific weight of water is 62.4 lb/ft³).

\[
S.W. = \frac{W}{V} = \frac{169 \text{ lb}}{1.85 \text{ ft}^3} = 91.35 \text{ lb/ft}^3
\]

**Density**

\[
= \frac{m}{V} = \frac{169 \text{ lb}}{32.2 \text{ ft/s}^2 / 1.85 \text{ ft}^3 = \text{slug/ft}^3}{2.84}
\]

**Specific Gravity**

\[
= \frac{y}{y_{ref}} = \frac{91.35 \text{ lb/ft}^3}{62.4 \text{ lb/ft}^3} = 1.46
\]
BUILDING VIRTUAL EXPERIMENTS
ASSESSMENT MEASURES.

% DFW grades

Pre - Technology Rich Interactive Learning Environment (TRiLE)

Post - TRiLE
## TECHNOLOGY RICH INTERACTIVE LEARNING ENVIRONMENT (TRiLE) VS. CONTROL CLASSES

### Grades for Low versus High GPA students in the TRiLE versus control classes

<table>
<thead>
<tr>
<th>GPA Level</th>
<th>TRiLE</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low GPA (&lt;3.0)</td>
<td>2.507 (0.8259)</td>
<td>1.904 (0.8687)</td>
</tr>
<tr>
<td>High GPA (&gt;3.0)</td>
<td>3.607 (0.5407)</td>
<td>3.263 (0.5833)</td>
</tr>
</tbody>
</table>

### Grades for men versus women in the TRiLE versus control classes

<table>
<thead>
<tr>
<th>Gender</th>
<th>TRiLE</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>3.160 (0.8684)</td>
<td>2.568 (0.9966)</td>
</tr>
<tr>
<td>Female</td>
<td>3.474 (0.6118)</td>
<td>2.105 (1.0485)</td>
</tr>
</tbody>
</table>
The students from the TRiLE group preferred or strongly preferred lecture environments that involved the following features: (% of preferred/strongly preferred)

- Instructor’s notes directly over the presented PowerPoint during lecture (77%)
- Animations or videos incorporated into the PowerPoint lecture (73%)
- The technology rich learning environment features (tablets, collaboration, multi-screen projection) (66%)
- Real time integration of lecture notes and student’s personal notes into one document (71%)

Students from both the treatment and control groups indicated that they preferred/strongly preferred:

- Group problem solving work (74%)
- Example problems completed by the instructor (74%)
VIDEO
CONCLUSION

• The TRiLE approach in the classroom helps students succeed in engineering technology classes.
• The traditional lecture ‘stand and deliver’ or ‘teaching by telling’ approach, while commonly used in engineering technology classes, needs to be re-examined as a method for introductory technology engineering courses.
• Overall, the students with a lower GPA entering the courses perceived a greater benefit from this learning environment and recommended using the technology rich lecture environment.
• The technology rich environment allows the instructor to implement an interactive and engaging learning environment within the digital media of Tablet PCs and collaborative (DyKnow) software. This environment also increases student likelihood of note taking and using these notes especially for the attrition vulnerable population with lower GPAs.