FIE 2006 - Session S3D, Paper 1208

WIP: Replacing "Traditional Lectures" with Face-to-Face Directed Problem Solving Sessions and On-Line Content Delivery

Work-in-Progress

Replacing "Traditional Lectures" with Face-to-Face Directed Problem Solving Sessions and On-Line Content Delivery

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Session S3D - Paper 1208

Outline

- Why I chose a "hybrid" course format
- The targeted course
- Experimental course format
- Preliminary results
- Advantages and challenges
- Current work
- Tips for potential adopters

Why I Chose A "Hybrid" Format

- To address two basic instructional problems:
  - the general ineffectiveness of the "large lecture" format in conveying course content
    - inherent "group paced" nature
    - sporadic attendance
  - the general ineffectiveness of "handed in" homework in helping students learn the course material
    - widespread "cheating" (students copying one another's work)
    - difficulty with providing timely feedback
    - observations from attempts to use on-line discussion groups to promote homework collaboration

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The Targeted Course

- ECE 362 – junior-level course on embedded microcontroller system design
- Three learning outcomes:
  - an ability to write programs for a computer in assembly language
  - an ability to interface a microprocessor to various devices
  - an ability to effectively utilize the wide variety of peripherals integrated into a contemporary microcontroller
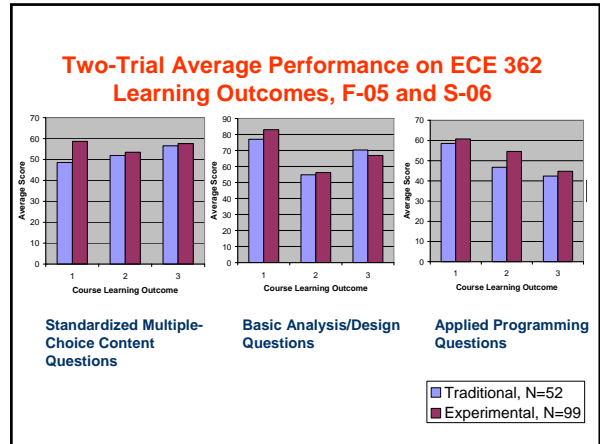

The Targeted Course

- Each outcome is assessed using a comprehensive, in-lab practical exam consisting of:
  - standardized multiple-choice questions that gauge understanding of content
  - analysis/design questions that gauge basic skills
  - application programming questions that gauge more advanced (synthesis) skills
- Standardized examination questions and procedures facilitate meaningful comparisons among cohort groups

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Experimental Course Format (DPS)

- Lecture content delivered via video streaming
- Contact hours used for collaborative problem solving in small-group settings (multiple sections)
- Conducted in lab so that a variety of hands-on exercises could be completed (DPS page)
- Instructor walk-through of solution (via Net Meeting) once sufficient time given to work each problem
- Students' "homework" score based on attendance and participation in DPS sessions
- Traditional lecture division run in parallel with experimental division (students were given choice of course format)

Preliminary Results (F-05 / S-06)

- For each trial, approximately 2/3 of the students selected the experimental course format
- Based on survey results, a significant majority (78% F05, 93% S06) believed that the on-line lecture and directed problem solving combination *helped them learn the course material better*
- A majority (67% F05, 79% S06) also said they *would choose the experimental format in another ECE course*
- An adjustment made for the S-06 trial was to schedule the DPS sessions prior to students' lab periods
- The directed problem solving cohort exam average was generally higher than that of the traditional lecture cohort (most notably for higher-order problem solving skills)

Two-Trial Average Performance on ECE 362 Learning Outcomes, F-05 and S-06

Standardized Multiple-Choice Content Questions

Basic Analysis/Design Questions

Applied Programming Questions

☐ Traditional, N=52
☐ Experimental, N=99

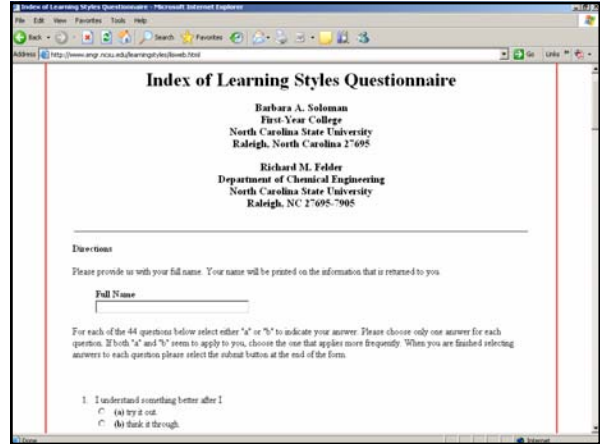## Advantages and Challenges

- Advantages
  - direct, immediate feedback on problem solving methodology ("bi-directional")
  - ability of students to employ "cognitive rehearsal" (talking through how to solve a problem with their partner)
  - significantly less day-to-day overhead (handling homework and giving lecture)
  - students have more control over their education (can attend "virtual lecture" when best for them)

Advantages and Challenges

- Challenges
  - ensuring students "keep up" with virtual lecture
    - on-line quizzes and/or resource utilization tracking tools are often easy for students to circumvent
    - in-class quizzes to track progress take time away from problem solving ("useful work") and incur additional overhead
  - ensuring students use the collaborative problem solving sessions "wisely"
    - coming to class with their annotated notes
    - not just "sitting there" and attempting to learn by osmosis

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Current Work

- Third trial in ECE 362 currently underway, again with parallel divisions
- Similar model developed for sophomore-level pre-requisite course (ECE 270 *Introduction to Digital System Design*) – first trial with parallel divisions currently underway
- Used on-line ILS Questionnaire to help students decide which course format might be best for them

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Index of Learning Styles Questionnaire

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Directions

Please provide us with your full name. Your name will be printed on the information that is returned to you.

Full Name

For each of the 44 questions below select either "a" or "b" to indicate your answer. Please choose only one answer for each question. If both "a" and "b" seem to apply to you, choose the one that applies more frequently. When you are finished selecting answers to each question please select the submit button at the end of the form.

1. I understand something better after I
   ○ (a) try it out.
   ○ (b) think it through.

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How ILS Survey Results Utilized

- On-line 44-item questionnaire that assesses preferences on four dimensions
  - Active / Reflective
  - Sensing / Intuitive
  - Visual / Verbal
  - Sequential / Global
- The traditional lecture division was recommended for students with some combination of reflective, verbal, and/or sequential preferences
- The directed problem solving division was recommended for students with some combination of active, visual, and/or global preferences

Tips for Potential Adopters

- On-line lecture content doesn't need to be "super fancy" to be reasonably effective
- Employ some mechanism to help ensure students "keep current" with on-line content
- Give students a choice of course format if possible – this will give them perhaps their first opportunity to think about (and hopefully discover) how they best learn