



# Evaluation of a Tertiary Studio Physics Implementation in Abu Dhabi

H. Vincent Kuo\*, Patrick B. Kohl\*, Curtis C. Bradley†, Kofi Agyeman†, and Jan Beks†



\*Colorado School of Mines, Department of Physics, 1523 Illinois Street, Golden, CO 80401

†The Petroleum Institute, Department of Physics, Abu Dhabi, United Arab Emirates



## ABSTRACT

As part of an international collaboration on educational dissemination, the Colorado School of Mines (CSM) Physics Department is involved in the evaluation of a tertiary implementation of the Studio Physics environment at the Petroleum Institute (PI) in Abu Dhabi, UAE. This poster will present preliminary results from various evaluation instruments.

## THE PETROLEUM INSTITUTE

- English-speaking university in the city of Abu Dhabi, U.A.E.
- Established under a collaborative effort between CSM and the Abu Dhabi National Oil Company (ADNOC) in 2003
- Separate male and female campuses (3 Academic Divisions each)
  - The Advanced University Placement (AUP) Program: a 1-year sequence intended to prepare high school graduates for entrance into university
  - The Arts and Sciences (A&S) Program: a 2-year sequence covering all core courses
  - The College of Engineering (COE): a 2-year sequence with five ABET accredited departments
- The Physics Department (A&S) is responsible for the calculus-based introductory Mechanics and E&M courses for all students
  - 5 full-time faculty and 4 full-time educational support staff
  - Traditional curriculum: teacher-centered with separate theory lectures and laboratory sections
  - Pilot effort led to the construction (summer 2012) of two dedicated studio classrooms that can accommodate 36 students each
  - All sections of Intro. Mechanics were taught in new classroom (F12)

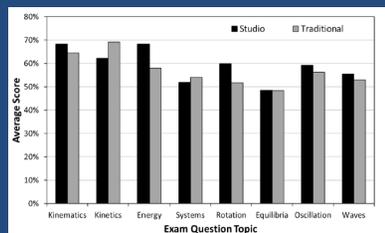
## OBSTACLES

- Prior educational experiences:** student/faculty expectations of the learning environment are of teacher-centered content delivery, explicit provision of examples, and performance assessments rest primarily on what can be considered as direct regurgitation
- Prior academic successes:** make the student-centered, individual ownership and responsibility learning model that underlies the studio philosophy an extremely unfamiliar classroom culture shift for the students
- Faculty initial skepticism are due to this perceived barrier

## FCI

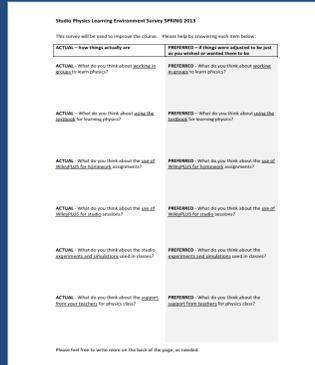
- Traditional:** pre-scores of 20-25% and <g> of 15-20% typical
- Studio:** pre-scores of 27.2% for male and 22.5% for female with <g> of 21.5% and 11.6% for males and females, respectively
- These results provide no evidence of improved conceptual learning

## FINAL EXAM



- A few free-response questions, ranging in difficulty, for each of the eight major topics
- While there are variations, performance trends are similar to that shown in the figure, with students from both traditional and studio approaches performing better on early questions and a bit worse on the later questions.
- Initial conservative interpretation:** format change did not harm student performance
- More detailed look:** (1) For six of the eight topics, the studio group's performance is the same or somewhat better than the traditional group's. (2) For the other two topics, Kinetics and Systems, there is a complication that the more recent exams have placed a greater emphasis on the explicit use of vectors, which students encounter with difficulty, which could have played a role in slightly lowering the studio group averages.

## STUDIO LEARNING ENVIRONMENT SURVEY



- Student perceptions on **Actual** and **Preferred**
- N = 120
- Working in groups to learn physics:** 73% positive, 9% neutral, 18% negative
- Level of teacher support in class:** 65% positive, 15% neutral, 20% negative
- Responses on the other 4 questions are consistent with these
- No significant differences in **Actual** vs. **Preferred**

## INTERVIEWS

- Faculty:**
- Data indicated diverse and varied perceptions on the purposes, philosophy, and effectiveness of the Studio environment and methodology
  - Basic agreement on indicators of student success as manifested in the various measures and assessments in the course, they differ in opinions on how to facilitate student learning to achieve the desired outcomes
    - High value in active engagement → strongly in favor of the interactive environment of the Studio, agree with the large fraction of student contact time being spent in the Studio
    - Concerned about the students' abilities based on perception of students' background → more contact time to demonstrate and model problem solving in traditional lecture formats
- Student:**
- Female: 5 strongly or slightly favorable, 1 neutral and 1 slightly unfavorable
  - Male: 3 (F12) and 1 (S13) strongly favorable, 7 (S13) strongly unfavorable

## DISCUSSION AND CONCLUSION

- Consistent or slightly improved student performance from all assessment
- Student responses to surveys and interviews were mostly positive, with no evidence of barriers to accepting the new pedagogy and culture of learning
- Faculty and staff interviews revealed significant concerns and hesitations that in-adequate student preparation would result in student failure and dissatisfaction under the reformed format
- Dissatisfied students were from sections where reluctant faculty and staff were in charge
- Excited students were from sections where the faculty and staff wholeheartedly embraced and new pedagogy and continually articulated the purposes and benefits of the new approach to the students
- Challenges to effort:**
  - Students' past experiences of a traditional classroom culture and minimal preparation in learning responsibility. Consequently they encounter a seemingly massive shift to a unique and unfamiliar culture of learning
  - Despite this, results indicate that the largest barrier may be faculty and staff perceptions of student capabilities and needs, and thus their reluctance to facilitate such changes

## ACKNOWLEDGEMENTS

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