SCALE-UP Classroom in 208 Phillips
Fall 2010 Summary of Findings

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BACKGROUND

SCALE-UP stands for Student-Centered Active Learning Environment for Undergraduate Programs. It is an active learning approach to introductory science that was developed by physics Professor Robert Beichner at NC State University in 1997. It has since been implemented at dozens of other higher education institutions. In most implementations, it combines separate lecture and lab sections into one integrated experience. Classroom activities emphasize team-based problem solving activities. Classroom design is an important aspect of this model, as students must be able to work effectively in groups of three and instructors must be able to move freely about the classroom to interact with student teams. Labs designed around the traditional bench model do not typically facilitate this level of interaction (Figure 1). Additional SCALE-UP resources are available online (http://scaleup.ncsu.edu/).

Figure 1 - Traditional lab

With support from the College of Arts and Sciences and Information Technology Services, our own Physics and Astronomy Department established the University's first SCALE-UP classroom during the summer of 2010 in 208 Phillips (Figure 2). The Center for Faculty Excellence and ITS-Teaching and Learning worked with the Department to assess the Fall 2010 semester pilot implementation.

Figure 2 - SCALE-UP classroom (208 Phillips)

Four physics courses, two astronomy labs, and two recitations were taught in the SCALE-UP classroom during the Fall 2010 semester. Only one course, Physics 116 (Mechanics), was taught using SCALE-UP methodology. Assessment activities focused on this particular section of the course. It was team-taught by Dr. Alice Churukian and Dr. Duane Deardorff and enrolled 36 students. Students self-selected to enroll in the SCALE-UP section as described in the course catalog. A 60-student section of Physics 116 taught by Dr. Laurie McNeil was used as a control for the pilot. This section was taught in the traditional manner, with lecture, lab, and recitation components offered in separate rooms and times, and taught by different instructors.

Findings – Student attitudes

Students in the SCALE-UP section and the traditional section were asked to complete an online survey at the end of the Fall 2010 semester. 81% of students in the SCALE-UP section (n=29) and 75% of students in the control section (n=45) completed the survey. The survey included questions taken from a Sense of Classroom Community questionnaire (McKinney, 2006), as well as questions taken from the National Survey of Student Engagement. The following differences between the two sections were found to be *statistically significant*:

- SCALE-UP students were more likely to identify class attendance, conceptual questions discussed in class, and examples worked in class as important to furthering their understanding of course materials.
- SCALE-UP students were more likely to ask a question or make a comment that contributed to class discussion.
- SCALE-UP students were more likely to agree that students in this class help one another.
- SCALE-UP students were more likely to disagree that it is possible to do well in this course without attending class regularly.
- SCALE-UP students were more likely to disagree that their coursework emphasized memorizing factors, ideas and methods.
- SCALE-UP students were more likely to feel that this class was less challenging than other classes.

Students in each section were also given the opportunity to comment on the course in an open-ended format. When SCALE-UP students were asked what aspects of the course they *liked the most*, their responses most often mapped to one of three primary categories (frequency noted in parentheses)

- Working in groups (13)
- Demonstrations / Examples / Real-world applications (7)
- Professors – Intellect and enthusiasm (6)

Said one SCALE-UP student,

> **"I like the set up of the SCALE-UP version, because it allows me to get to know my professors and classmates really well; which facilitates learning and gives a good vibe and relationship in the classroom."**

When students in the traditional section were asked what they liked most about the course, the majority of responses could be grouped under the following categories:

- Lab (13)
- Recitation (11)
- In-class demonstrations (6)

Note that the top response categories for students in the traditional section are all associated with the more active learning components of the course. When asked what improvements to the course they would recommend, 1 in 4 students in the traditional section said they would like to see more examples and problems during the lecture component of the course.

Most of the student concerns about the SCALE-UP section reflected both students' and instructors' challenges adjusting to the new format. Several students said they thought that class was often disorganized, and they missed the structure of the lecture. At least two of the ten students who dropped the SCALE-UP section cited "inefficiencies" with the way the course was taught as a factor in their decisions.

Findings – Faculty Experience

Dr. Churukian and Dr. Deardorff noted several aspects of the SCALE-UP format that they found more appealing than the traditional classroom. Both liked the close interaction with students and the sense of community that it fostered. Both thought the emphasis on active learning was an effective way to engage students. Dr. Churukian noted that the high level of student feedback made it easier for her to gauge student understanding of course concepts.

Among the challenges noted was adjusting to an environment in which the instructor always has his/her back to some students. Both instructors mentioned the difficulty of learning to adapt lesson plans quickly and to trouble-shoot student questions in an immersive, problem-based environment.

Dr. Deardorff had experience teaching in the SCALE-UP format as a graduate student at NCSU working with Dr. Beichner, but that was over ten years ago. Dr. Churukian also had some prior experience teaching in a studio environment, also nearly ten years ago. Both said they thought teaching the course in subsequent semesters would be easier as they became more familiar with the learning space and worked out some rough edges with their lesson plans. As mentioned earlier, several students mentioned classroom management and planning as areas for improvement.

The findings do underscore the importance of preparing faculty members and other instructors to teach effectively using SCALE-UP methods. Teaching in the SCALE-UP environment is very different than the traditional lecture format,

especially for instructors with limited experience teaching in a lab setting. A sustainable professional development plan will likely be an important part of the Department's efforts to prepare instructors new to the SCALE-UP format.

Findings – Student learning outcomes

As part of its standard instructional improvement program and as a part of a requirement of a current NSF grant, the Physics and Astronomy Department administers a standardized pre- and post-test called the Force Concept Inventory (FCI) to all students enrolled in the Department's introductory-level physics courses. The FCI is widely used as a measure of student understanding of introductory mechanics. The assessment team compared both the average gain and normalized gain between pre- and post-test scores for the SCALE-UP and control sections. There was *no significant difference* in performance between students in the SCALE-UP section and the control section.

The Department conducted a similar analysis of final exam scores across the two sections. Again, there was *no statistically significant difference* in performance between the two groups.

The instructors were pleased with these initial results, noting that first-time implementations of new teaching methodologies often result in reduced learning gains. They expect SCALE-UP to yield improved learning gains as it becomes more firmly established over the next two years.

Next steps

Overall, the initial findings suggest that the Physics and Astronomy Department's SCALE-UP implementation is off to a positive start. A more comprehensive analysis will be possible after the same data has been collected for the Spring 2011 semester. During the spring 2011 semester, the assessment team will also look at the use of the room by instructors who are not using the SCALE-UP methodology, but may be drawn to the room design for other reasons.

References

McKinney, J. P., McKinney, K. G., Franuik, R. & Schweitzer, J. (2006). The college classroom as a community. *College Teaching, 54(3),* 281-284.