LITRE Report on First Wave Projects 2004-2006
(October 2006)
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Executive Summary

LITRE's purpose is to improve student learning through a collection of projects in which faculty systematically investigate the effectiveness of incorporating technology into their curriculum and pedagogical practices and assess its impact on student learning. Through ongoing investigation focusing on student learning, highlighting successes, and sharing information, LITRE aims to foster an environment of innovation, encourage the repetition of successes, shape future investigations, and inform campus decision-making.

This report synthesizes findings about the LITRE activities defined as First Wave Projects: G-108, Flyspace, and ClassTech and is based on the available reports from the PIs of the projects for 2004-2005 and 2005-2006 assessments. Additionally, based on 2004-2005 LITRE findings and endorsed by the LITRE Advisory Council, an additional observational study of the ClassTech Project, was added to the assessment methodology for this project and conducted during 2005-2006.

During 2004-2005, much of the investigators' initial effort of the First Wave projects (G-108, Flyspace/Collaboratory, and ClassTech) was on installing the technology and developing the infrastructure. The PIs of the First Wave projects made tremendous progress with implementing their projects, developing the technology infrastructure including equipment and technical support for faculty. During 2004-2006 much of the research consisted of usage information and user surveys. Not surprisingly, projects that are driven by technology experts or focused on infrastructure tend to be focused more on equipment than teaching and learning. The PIs of these projects tried to find faculty who would help with assessment activities, but were mostly unsuccessful.

The First Wave project G-108 illustrated the importance of technology support staff in ensuring successful teaching and learning in sophisticated classrooms. This project resulted in a recommendation that a clear policy or service level agreement be approved by all those involved in using and supporting these classrooms, including faculty, IT support, department heads and deans. G-108 project was a LITRE project only during 2004-2005.

Even though student learning was not directly assessed, all involved consider the Flyspace/Collaboratory spaces a valuable service for students. Those involve recommend that more similar spaces be developed. This project has elicited enough interest to affect the design of new buildings on campus. The College of Natural Resources has adopted the design for a similar space for their use. These spaces are an exciting innovation but should not be continued as LITRE projects after 2006 because of inability to find faculty to help investigate the impact on student learning.

The development and assessment of the ClassTech classrooms was the most emphasized of the First Wave Projects. The number of ClassTech designed classrooms increased from 0 rooms in Fall 2003 to 12 in spring 2004, to 20 for fall 2004, to 54 in fall 2005 to 70 by spring 2007, to

anticipated unknown numbers in the future. The assessment results from surveys showed that most faculty found the equipment essential or important for their teaching. The computer/projection was used most frequently, followed by the document camera, laptop input, DVD/VCR player and overhead transparency projector. There was an increase in the use of the computer since the spring 2004 survey, from 41% up to 64% in spring 2006. The importance faculty place on a particular type of technology was highly correlated to how often that equipment was used. The assessment showed many important points, but in summary the top three issues are:

- The faculty in the ClassTech classrooms used technology primarily to communicate information to students using non-static multimedia, and secondly to access data from the Internet or faculty's own websites. In the opinion of the Classtech Assessment Team, faculty are not exhibiting teaching or learning methods that reflect best use of this space. The learning examples and observations seem to indicate that students are learning at least the basics. The faculty are facilitating learning by increasing student involvement, covering material in greater depth, accommodating different learning styles, and enhancing visualization of concepts.
- There seems to be reluctance on the part of some faculty to invest time and energy in preparing material for use in multimedia classrooms because of uncertainty about whether these spaces or similar technology would consistently be available for their use.
- Researcher in the areas of technology conclude that preparing faculty to understand the pedagogical theories surrounding successful use of learning technologies in higher education classrooms needs to be the highest priority for institutions attempting to technologize their instructional settings. As more faculty incorporate these theories into their use of the ClassTech classroom, this space should be re-assessed.

Summary of Assessment of First Wave Projects

G-108

Purpose: Improve speed, reliability, flexibility, and instructor control through a new software environment tailored to computing in the Harrelson G-108 experimental classroom. This project was designed to improve student learning by reducing distractions associated with machine failures and missing software.
Strategy: Develop specifications for software solutions and develop a new load for the computers with attendant installation and testing. Tasks completed on schedule.
Assessment Methods: Faculty and IT focus groups, student survey over two years
Results 2004-2005:
Impact on student learning: The direct impact on student learning was not assessed. Student survey results indicated continuing sources of distraction, including machine failures, missing software, and distractions from other students unable to access the network. Faculty and IT staff agreed that the reliability of the software had improved but they continued to experience failures that impacted teaching.
Project Recommendations: Provide additional IT support. Improve communication between faculty and IT support personnel through meetings, training, and policy. Continued frustration of both faculty and IT staff indicates a need, on an administrative level, for a clear policy (or service level agreement) that both faculty and IT staff help create and follow. This policy must be established at the departmental level and approved at the dean's level, if more than one department uses a classroom. This project did not continue as a LITRE First Wave Project after spring 2005.

Flyspace/Collaboratory

Purpose: These two spaces were technology-equipped, shared workspaces for students to work. Flyspace is located in the student center; Collaboratory is located in DH Hill Libraries.
Strategy: Equip and support these spaces. Work with faculty members who use or assign these spaces to their students, where student learning will be assessed.
Assessment methods: tracking usage; usage and student opinion surveys
Results 2004-2005:
Impact on student learning: The direct impact on student learning was not assessed.
Flyspace began to function starting April 2005. Student usage data on Flyspace between April and May 2005 showed that the11 student groups surveyed used the room for classwork/class projects including chemistry and English courses, for non-school tasks, for homework, including a web page redesign, and for committee work.
Collaboratory: During 2004/05, there were 383 unique reservations made for the Collaboratory. These included 73 unique courses, from all Colleges. Survey results of users during April 2005, showed that groups used the space to worked on PowerPoint presentations, on homework, used WEBASSIGN, and used video capabilities of the equipment The PIs recognize the need to find faculty willing to assess student learning in theses space.
Project recommendations: Develop more similar spaces. Need to find faculty who are willing to work with the PIs to assess the space.
Results 2005-2006:

Impact on student learning: The direct impact on student learning was not assessed.
Flyspace PIs did not provide a report for 2005-2006.
Collaboratory: The PIs and Joni Spurlin spent considerable time and effort trying to find faculty who were willing to assign the Collaboratory space and help with assessment of student learning with the use of the Collaboratory, but were unsuccessful. However, the PIs were able to conduct survey assessments throughout 2005-2006: 1) a survey administered to users during three different weeks; and 2) a web survey administered to users who had registered for the space during 2004/05. See posted report: http://litre.ncsu.edu/dfiles/flyspace.html. For method 1) The Libraries has established specific weeks as sampling periods for gathering usage statistics. Collaboratory users were surveyed during these same periods. Eleven users groups responded to the survey. For method 2) Of the 78 users of the Collaboratory space in 2004-2005 who were contacted during 2005-2006, only 12 responded to a survey. Overall, Students said reasons for using the Collaboratory in the D.H. Hill Library included studying, conducting research, and preparing for presentations. Users consulted the web and used PowerPoint and other Microsoft Office applications; one mentioned using bioinformatics software. Of the 12 who used the space in 2004-2005, most students' agreed or strongly agreed with the statements that:

- This technology helps me visualize the concepts;
- Use of the technology in the Collaboratory facilitates teamwork;
- This technology accommodates my needs and learning styles; and
- The technology helps me to understand real-world examples.

Respondents were more neutral on the following statement:

- Use of technology in the Collaboratory contributes to my understanding of content in my courses.

Project recommendations about Collaboratory: Responses indicate those who have discovered the room and were satisfied with the area and what it offers and that the Collaboratory is meeting LITRE's project goals of establishing a group work environment that is inexpensive, easy to use, and requires minimal support.

ClassTech

Purpose: Facilitate teaching and improve student learning by providing classrooms equipped with a consistent set of improved multi-media technology with IT support.
Strategy: Equip and support additional classrooms. Work with faculty members to develop new pedagogies in specific classes, where student learning will be assessed.
2004-2005
Assessment methods: Faculty and student surveys, usage logs, interviews with faculty and IT support staff; methods conducted from spring 2004 through spring 2005
Impact on student learning: In general, faculty and students believed that classroom technology improved learning by increasing student involvement, covering material in greater depth, accommodating different learning styles, and enhancing visualization of concepts. 81% of student survey respondents said the use of technology positively affected their learning, and 92% of students prefer classes with moderate or extensive use of instructional technology. There is no evidence from the surveys or interviews that course or program outcomes changed as a result of the availability of these basic technology tools. As a first step, the PIs asked faculty to give examples of how they were using the technology. The analyses showed a wide range of uses from PowerPoint to use of Internet/course lockers to simulations. ClassTech

surveys suggest that faculty and students believe that classroom technology increased student involvement, accommodated different learning styles, and enhanced visualization of concepts. See reports on URL: http://www.ncsu.edu/classtech/survey_results/
Project Recommendations: The project team planned to mine existing data more thoroughly and to develop stronger assessment methods.
2005-2006**:**
Assessment methods: Continue with similar faculty surveys, usage logs, interviews with faculty and IT support staff. Professor Brad Mehlenbacher joined the team as a researcher on classroom technology, as a LITRE associate. Dianne Raubenheimer was added to the assessment team for this project based on her knowledge. The PIs recognize the need to find faculty willing to assess student learning in their classrooms. Therefore, the assessment team of Joni Spurlin, Stan North Martin, Dianne Raubenheimer and Brad Mehlenbacher developed an observation study that was implemented in spring 2006.
Impact on Student Learning: Because of the extensive nature of the assessment conducted, it is important that readers consult the extensive reports at the following URL: http://www.ncsu.edu/classtech/survey_results/

What follows is a few major highlights based on what the ClassTech assessment team found after reviewing ClassTech research and assessment activities during 2005-2006. The LITRE Assessment Committee agreed with most of the findings. The most important issues are listed below.
1)Finding:
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The Classtech assessment studies indicate that the majority of faculty in the ClassTech classrooms used technology primarily to communicate information to students using non-static multimedia, and secondly to access data from the Internet or faculty's own websites. They did not seem to incorporate some of the other more active methodologies. In the observation study, cross-case analysis identified themes and trends across the 15 cases studied. Faculty reasons for using technology included the following:

- Technology is a tool to organize teaching and make it easier for students.
- It makes it easier to teach the course the next time around.
- It assists student efficiency because they can access materials.
- Presentations are more accurate because of visual aids.
- Makes teaching more enjoyable.
- Pedagogy should drive the use of technology, and not technology for its own sake.

In general, the ClassTech assessment team felt that the faculty were not making the best use of the technology. Faculty do know how to use the technology from a technical perspective—it's easy to use—but they are not exhibiting (or discussing on survey questions) teaching methods that would reflect best use of this space.

Project Recommendations
Faculty use technology in ways that are familiar to them, based on prior knowledge and exposure to ways others have used technology. They tend to model on others' behaviors and their own experiences as students. Faculty can take a whiteboard or multimedia classroom and use it as effectively or as ineffectively based upon what they know or have been exposed to. It is naïve to assume faculty will explore alternative ways of using technology without prompting. The National Academy of Science book, *How People Learn*, written by a panel of

national scholars, includes discussions about how cognitive principles of knowledge organization can be combined with knowledge about the nature of learning environments and teaching strategies. These scholars advocate that instructors should employ students' preexisting knowledge, provide examples, teach subject matter in depth, and help students develop self-monitoring skills. In discussing the impact of technology, the authors suggest that technology can help establish effective learning environments by bringing real-world problems into the classroom, providing learners a way to participate in complex learning, and providing ways for learners to receive feedback on how to improve their reasoning skills. In assessing the results of ClassTech over the past two years, it seems clear that faculty using some of these methods, but most are not making the best use of this space, pedagogically. It is recommended that FCTL, LTS, and the D.H. Hill Libraries develop a systematic plan for providing faculty development for faculty. Resources exist, at least in ClassTech classrooms, to provide technical support. However, it is also essential to provide resources for supporting pedagogy and assessment of student learning. Having faculty work together in groups, mentoring, and modeling methods/pedagogies are effective strategies for faculty development. Researcher in the areas of technology conclude that preparing faculty to understand the pedagogical theories surrounding successful use of learning technologies in higher education classrooms needs to be the highest priority for institutions attempting to technologize their instructional settings.

2)

Finding:

The spring survey asked faculty to provide their best example of how they used instructional technology in the course and what impact it had on student learning. When asked what impact their use of the technology had on student learning, by far the greatest number of open ended responses examples cited the ability the technology provided for students to be able to **visualize the material** being covered. When coded, almost 43% of respondents mentioned something about visualization. Rather than just lecturing or discussing the material, illustrations could be provided. In some cases these were static representations of concepts, theories, models or physical items. In other cases the visualizations came through animations or recordings of the phenomena being considered. Some of the comments regarding visualization were merely that it would be impossible to show some things in larger class sections without the aid of the projection system. Less often, but still a significant number of times (about 34%) faculty mentioned something about the students' **ability to comprehend the material**. Most of these comments indicated the perception that students got a better grasp of the material through the use of technology. The following quotes are illustrative: "Students [were] better able to understand material and see examples of discussion material." And, "I hope they gained deeper understanding of how scientific ideas are received in society." Almost 18 percent of the respondents included something about how the **technology helped them (faculty) organize the material or course work**. One example: "I provide 80% of the lecture notes to the students before each class. Then, during class they [students] 'fill-in' the remaining 20%. This allows them more time to listen and hopefully learn the material." Another example regarding an instructor demonstrating the use of an online virtual lab applet: "Since the students were able to see what they'd be doing out-of-class, many student questions were addressed right away in class prior to them attempting the exercise on their own." Very few of the open-ended responses provided a direct connection to improved student achievement. One exception was the following, "On exams, students did better on questions that had been

illustrated than on those that were not." This example says more concretely what many faculty likely hoped was taking place through their use of visualizations.

For the observation study, the faculty chose student work that was used to assess students' performance on the specific outcome related to the observation day. The researchers determined the SOLO level for that outcome and for the student work (referred to as the assessment of student learning). The level of the work task was determined, not the level of performance. Many of the outcomes and individual work tasks were at several levels for a single course. *As a group*, 8 out of 13 cases had a student task for the class at a **logically related** level, which means that the task was related to real life application. In contrast, 7 out of 13 assessed students at a **single** level, which means that faculty were essentially giving tasks that asked for recall of knowledge and information without reference to context. The research team took the performance of those specific tasks (most were tests) and averaged the student performance on this work for each SOLO category. In general, the lower cognitive level of the task, the better the performance. In attempting to relate technology to student performance, it was found that the student performance reflects the level of the work (SOLO level) more than any relationship to technology or pedagogical use of the technology. In general, the more technology used with more active pedagogy, the higher the faculty expectation were of the level of student work. Although these cases can not be generalized, these findings seem to indicate that just because faculty use a wider variety of technology with more active pedagogy, along with teaching to a higher cognitive level, it doesn't mean that faculty are going to get a higher level of student performance as assessed using higher level tasks. This is not entirely surprising since, in general, students have more difficulty doing higher cognitive work and because they are not exposed to this in all class meeting times. In addition, even when faculty reflect higher-level outcomes in their instruction, they tend to assess student learning at lower levels. Faculty assess less frequently at higher cognitive levels.

Project Recommendation:
The learning examples and observations seem to indicate that student are learning at least the basics. Because learning and teaching are so closely related, the "cause" of this learning is still difficult to assess. More, careful, assessment is needed. Some suggestions include: A)Study the perception of both sides of PowerPoint: from the students' perspective and the faculty's perspective. How does that impact students' learning. Since PowerPoint is the dominant software tool being used, what are key factors that allow it to be used to enhance cognition rather than dull it? B) Identify ways students say they do learn through the use of technology and gather assessment data to support or refute their theories of learning. C) Further use of the tools developed by this team: the developed observation rubric, the use of SOLO taxonomy as a means to assess level of instruction and student learning, and use of the technology taxonomy were found to be very useful tools for assessment.

The interviews and observations showed that technology, learning outcomes and assessment are not seen in relationship to each other. Faculty are generally not able to articulate this relationship, even with prompting. They do not articulate that technology is a particular tool for teaching that should be used to teach a particular learning outcome, and that an assessment task should assess that student learning outcome. As faculty development efforts are

considered, faculty understanding of how the interrelationship of teaching, learning, student outcomes and technology need to be strengthened.

In addition, the ClassTech classrooms are designed to allow a presentation format of one to many and so reinforce this methodology. This "space" invites a more traditional lecture-style pedagogy versus SCALE-UP or other student-centered learning spaces that more readily encourage active learning. Currently we are building a lot of classrooms as part of the 2000 Higher Education Bond projects that are based upon relatively traditional teaching methods rather than more blended learning environments. Can we get to a different way of looking at space needs, so that the first question is even beyond "What do faculty want to be able to do in this space?" to "What should students be able to know and do at the end of the course/curriculum?"

3)
Finding:
In the fall faculty survey about half of the respondents (76 out of 149) said they had not specifically requested use of a room with instructional technology; however, it was clear from the results that most of the respondents made significant use of the technology. The question was changed in the spring to ask, "Did you *or your scheduling officer* request a classroom with instructional technology for your course?" and the number of faculty who responded negatively shrank to below 25 percent (41 out of 168). Comparisons were made between responses of those who said they asked for a room with instructional technology and those who had not. Both the fall and spring survey results indicated those who requested technology rooms were more likely to use the technology to access data and to communicate information than those who did not request a room. Reports on the impact classroom technology had on teaching their course also showed a statistical difference between who had and had not requested technology. In both fall and spring, faculty requesting technology said the depth of material covered was greater, and students were more involved when using technology in the classroom. Fall results showed a difference in the perceived pace of the course. In the spring, there was a perceived difference in the variety of topics covered in the course. Those in the spring who said they or their scheduling officer *had* asked for a room with technology were significantly more likely to feel having a computer in the room was important than those who had *not* specifically requested technology. Interestingly, in the fall survey, those who had *not* requested technology were more likely to say having an overhead transparency projector was important, than those who had requested technology

Not surprisingly, those who requested use of the technology prior to the semester were more likely to use the equipment and to say that it is important for their teaching. This has implications for better scheduling processes, so that faculty can know that they will have such technology available. In interviews and other discussions with faculty, the faculty implied that there is still reluctance on the part of some to invest time and energy in preparing material for use in multimedia classrooms because of uncertainty about whether these spaces would consistently be available for their use.

Project Recommendation:

It is clear that improving the scheduling process for classrooms with technology (ClassTech or other) is a critical issue for faculty. The management system of scheduling classrooms within each college and with Registration and Records is improving, but still needs further refinement. Faculty need to know they will have access to equipment on a consistent basis, prior to making commitment to use technology in the classroom. At this time, it seems that classroom space assignment is determined on issues other than how much faculty need the technology for teaching and learning. Faculty also report that they can not count on the same space for the same course *every* semester.

4)
Finding:
The ClassTech surveys showed that there was a jump between fall and spring in the percentage of faculty reporting that they used the in-room computer in most or all of their classes (51% in the fall, 64% in the spring). Overall, at least 50% of faculty responding indicated that the computer, document camera and laptop inputs were either essential or important to the teaching of their course. While the DVD/VCR player was considered essential or important for 43% of the respondents in the fall, that percentage climbed to 51% in the spring. The overhead transparency projector continues to decline in relative importance, likely in large part because the document camera can also be used for transparencies but also provides much more flexibility with the materials that can be used with it. One respondent stated, "The document camera opens vast new opportunities to make learning visual." The ClassTech survey also showed that the faculty were satisfied that the equipment worked in the ClassTech Classroom. The faculty stated they know how to technically use the equipment, but they sometimes had issues with it working and needed just-in-time help.

Recommendation:
Generally, the equipment provided in the classrooms worked. The faculty knew how to use it, even though they sometimes had issues with it and needed just-in-time help. Overall they feel it's important for their teaching. Conversations with the ClassTech support staff show a strong desire to continually refine procedures to provide the best service and support as efficiently as possible.

First Wave projects fits emergent themes

Merging the findings from the grantees with first wave, the first wave also support the emergent themes seen in the grantees' reports. (see…..report).

- Enrichment Of Content Led To Increased Depth Of Knowledge: The ClassTech survey (Fall 2005: 151 faculty responded -28% response rate; spring 2006: 175 faculty responded - 34% response rate) indicated that more than half of the faculty respondents felt that they cover course material in greater depth and at a quicker pace when using technology than when not. Very nearly half felt that a greater variety of topics that could be covered and about 45% felt students were more involved in the learning process when using technology than when not. (ClassTech surveys)

- Visualization Of Material Facilitated Student Learning Of The Material: In the surveys from ClassTech (Fall 2005: 151 faculty responded -28% response rate; spring 2006:

175 faculty responded - 34% response rate) the faculty were asked to give examples of student learning. The greatest number of responses cited the ability of technology to enable students to visualize the material being covered. In some cases these were static representations of concepts, theories, models or physical items. In other cases it was visualizing animations or recordings of relevant data. (ClassTech surveys)

- Of the 78 users of the Collaboratory space in 2004-2005 who were contacted during 2005-2006, only 12 responded to a survey. Students said reasons for using the Collaboratory in the D.H. Hill Library included studying, conducting research, and preparing for presentations. Users consulted the web and used PowerPoint and other Microsoft Office applications; one mentioned using bioinformatics software. Most of these 12 students agreed or strongly agreed with the statements about "visualization" that "This technology helps me visualize the concepts" and "The technology helps me to understand real-world examples." These respondents were more neutral about the statement: "Use of technology in the Collaboratory contributes to my understanding of content in my courses." (Collaboratory report)

- Communication/Collaboration Among Peers And Experts Increased Feedback On Student Learning:During the 2005/06 academic year, 571 groups registered to use the Collaboratory. The size of the groups ranged from 2 to 10 people. Of the 78 users of the Collaboratory space in 2004-2005 who were contacted during 2005-2006, only 12 responded to a survey. These students said the reasons for selecting the Collaboratory instead of other rooms on campus included its central location, the ability to reserve the room, its size, its privacy and quietness, and the equipment and applications (large screens, high speed computers). Most of these 12 students agreed or strongly agreed with the statements about "collaboration" that "Use of the technology in the Collaboratory facilitates teamwork." (Collaboratory report)

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[i] Joni E. Spurlin, Ph.D., University Director of Assessment, University Planning & Analysis, consulted with the PIs and others on the First Wave projects from January 2005 through September 2006.