

Factors Affecting the Adoption of Faculty-Developed Academic Software:

A Study of Five iCampus Projects

Stephen C. Ehrmann, Steven W. Gilbert, and Flora McMartin



The TLT Group
Teaching, Learning, and Technology
A Non-Profit Corporation

Factors Affecting the Adoption of Faculty-Developed Academic Software: A Study of Five iCampus Projects

Stephen C. Ehrmann, Steven W. Gilbert, and Flora McMartin, The TLT Group

The theme of this conference is “Learning without borders/technology without boundaries.” But everyone knows how slowly good new teaching and learning practices spread, nationally and internationally, even when pilot tests with new technology achieve spectacular success.

This Executive Summary of a study of five iCampus projects summarizes provocative findings and important recommendations for how to accelerate the dissemination and adoption of important educational innovations. The Executive Summary includes only a few of those findings and recommendations. The full report, including, “Chapter 10: Recommendations for Fostering Future Improvements in Education with Technology,” elaborates in detail these and the complete set of findings from this study. The Executive Summary is available in electronic form at the iCampus and TLT Group websites.¹

Executive Summary of Findings and Recommendations

“Initiated in 1999, iCampus is a research collaboration between Microsoft Research and MIT whose goal is to create and demonstrate technologies with the potential for revolutionary change throughout the university curriculum.”² The program was made possible by a \$25 million research grant from Microsoft to MIT and involves extensive collaboration between MIT and Microsoft staff.

The TLT Group has been asked, “In light of the experience of iCampus, especially those projects selected by MIT and Microsoft for close study, what can be learned about priorities for educational technology initiatives in the future and about how the spread of such innovations can be more effectively supported?”

In the past, many large-scale faculty-developed content-specific projects had had great success as pilot tests, but had failed to be widely used. So The TLT Group and iCampus decided to focus this study on five quite different projects that had already achieved some degree of institutionalization and wider use. Over 150 interviews were conducted with faculty members, staff and students at MIT and other institutions, and project documents were studied. The five projects are:

- iLabs – students can use web browsers to design experiments and collect data from distant laboratory equipment;
- iMOAT – the web is used to manage the process of large-scale assessment of student writing;
- TEAL – two terms of introductory physics have been redesigned around inquiry, discussion, experimentation, and visualization;

¹ The URL for the Executive Summary can be found at http://icampus.mit.edu/reports/exec_sum_icampus_assessment.pdf and on http://www.tlgroup.org/iCampus/exec_sum_icampus_assessment.pdf. The full report will be available from the <http://icampus.mit.edu/reports/> and <http://www.tlgroup.org/iCampus/> websites by January 2007.

² From the iCampus web site, <http://icampus.mit.edu>, November 10, 2006.

- XMAS – students can ‘quote’ video legally in their online discussions, presentations, and projects about films in courses such as Shakespeare;
- xTutor is to be a tool kit for creating online courses; its strength is checking computer programming homework and providing feedback.

We have concluded that:

- A. These five projects have improved important elements of an MIT education by making learning more authentic, active, collaborative, and feedback-rich. For example, they have been institutionalized in a two-term physics sequence required of most MIT students, three of the four core courses required by MIT’s largest undergraduate major, and in the writing assessment used for incoming MIT students. For all five projects, ideas and materials have also been adopted by additional faculty at MIT and by faculty at other institutions. These adoptions, along with evaluative evidence, demonstrate the value of these projects.
- B. Nonetheless, wider adoption has been extremely difficult to promote, despite the fact that the materials are free and that over \$2.5 million has been allocated for outreach. Because there is little incentive or support at most institutions to seek out and adopt innovations from other institutions, the burden falls almost entirely on the innovator and iCampus to seek out, persuade, and assist the innovator’s peers to use the innovations. This was made even more difficult by gaps in communications channels as well as a lack of supports and incentives at both ends of the adoption channel.
- C. Adoptions did occur, however. They were aided, first, by certain project features (e.g., the ability to try out software freely over the Web; development procedures that engaged potential adopters from the start).
- D. Second, adoption was easier when innovators could take advantage of existing ‘coalitions for instructional improvement’ to attract the attention of potential adopters without seeming to tell them how to teach, and then assist them with adoption.
- E. Third, adoption was easier when the adopting institution was unusually motivated to adopt iCampus innovations and then to disseminate them further. Distance seemed to help institutions work with MIT; many of these motivated institutions were in other countries.

Innovations rarely prosper for long at any one institution unless they also spread among many institutions; if wide use is achieved, the various users can support each other and long term survival of the innovation is far more likely. So widespread adoption for expensive R&D projects is a virtual necessity for getting full value for the original investment.

Our full report contains actionable recommendations for universities, government funding programs and foundations, and corporations. This executive summary includes only the headings of those recommendations. Our first recommendation draws on Finding A and on wider experiences in the field:

1. Improve education widely so that it becomes more authentic, active, collaborative, and feedback-rich. iCampus software and ideas provide useful elements for such a campaign.

Selected specific sector recommendations for implementation include:

1.1.5 *Colleges and universities:* Academic computing, the teaching and learning center, distance learning, the library and any other units responsible for professional development and course improvement should coordinate and organize their collective efforts around these goals.

1.2.2 *Government/Foundations*: Support development of appropriate methods for assessing these teaching/learning activities and outcomes in the disciplines.

1.4.2 *MIT-specific*: MIT should systematically review all educational innovations supported with major grants from sources such as iCampus in order to determine which deserve internal support for wider deployment or further development.

(see pgs. 107-110 for complete discussion of Recommendation 1)

As described in our findings, however, it has been difficult for higher education to make such improvements and to respond to societal needs and technological change, because it is so difficult for ideas and materials to spread and evolve through use across many institutions. Therefore, to encourage and assist faculty not only to create innovations but also to search widely for innovations to adopt, we make these additional recommendations:

2. Create demand for adoption of new ideas by rewarding faculty members for continually and cumulatively improving teaching in their programs.

Selected specific sector recommendations to implement this general statement include:

2.1.1 *Colleges and universities*: Assist and reward *all* faculty members who discover, adapt and share practices and findings from other institutions as part of the process of improving their academic programs.

2.1.4 *Colleges and universities*: Specialists, such as reference librarians, staff in information technology, and staff in teaching and learning centers, should work together to help faculty seek out relevant ideas and materials in their disciplines.

2.2.1 *Government/Foundations*: Explore ways of providing faculty development opportunities in which *all* interested instructors nationally can participate.

2.3.1 *Corporations*: When funding faculty to apply new technology to educational problems, insist their proposals build on relevant improvements from other institutions, especially developments in their own disciplines.

2.4.1 *MIT-specific*: Requests for discretionary funding for faculty to improve their teaching should be assessed against best practices worldwide.

(see pgs. 112-114 for complete recommendations)

3. Nurture coalitions for instructional improvement, within and across institutions, in order to create better channels for sharing and improving innovations.

Selected specific sector recommendations to implement this general statement include:

3.1.1 *Colleges and universities*: Develop and improve ways in which faculty members and students routinely discuss improvements in courses in their disciplines, within and across institutions.

3.2.1 *Government/Foundations*: Fund well-staffed, long-term, content-specific coalitions with the responsibility for reaching out to all faculty members nationally who teach that course or small group of courses.

3.3.2 *Corporations*: Investigate the feasibility of a service to help faculty members who teach comparable courses to share information on how they teach and assess, share materials, and even collaborate in teaching.

3.4.1 *MIT-specific*: Study how various departments teach multi-section courses and the impact of various teaching practices on the testing and sharing of ideas for teaching the course.

(see pgs. 114-116 for complete recommendations)

4. Create more higher education-corporate alliances in order to support the development and dissemination of new educational technology materials and practices.

Selected specific sector recommendations to implement this general statement include:

4.1.1 *Colleges and universities*: Host corporate staff on campus to help make the alliance work.

4.2.1 *Government/Foundations*: Fund more R&D projects with higher education and corporate partners.

4.3.2 *Corporations*: Fund more collaborative R&D projects that involve faculty at multiple institutions working with corporate staff.

4.3.3 *Corporations*: Take responsibility for promoting adoption of ideas and materials emerging from the collaboration by allocating corporate staff and budget to the task.

(see pgs. 116-120 for complete recommendations)

5. Supply faculty innovators with central services in educational design, software development, assessment methods, formative evaluation, and/or in sharing ideas with others who teach comparable courses.

Selected specific sector recommendations to implement this general statement include:

5.1.5 *Colleges and universities*: Provide dissemination/adoption support for innovative ideas and materials.

5.2.1 *Government/Foundations*: Insist that faculty developing innovative uses of technology get all the kinds of help they need: educational design, programming, assessment, program evaluation, and dissemination; budget funds for these services where necessary.

5.3.2 *MIT-specific*: Provide more support for units that can provide innovative faculty with assistance in educational design, programming, assessment, program evaluation, and dissemination.

(see pgs. 120-124 for complete recommendations)

Table of Contents

Factors Affecting the Adoption of Faculty-Developed Academic Software: A Study of Five iCampus Projects Executive Summary of Findings and Recommendations.....	i
Chapter 1: Prologue and Methodology	1
1. Appropriate Use of Technology Can Improve Educational Outcomes	1
2. Widespread Dissemination of Such Activities is Very Difficult	2
Methodology	4
References	5
Chapter 2: A Brief History of the iCampus Program and Descriptions of the Projects Highlighted in this Report	6
Foundations	6
The iCampus Grant	7
Structures for Support	12
Brief Profiles of the Projects Under Study	13
References	16
Chapter 3: iLabs - Experiments in Education	17
Introduction and Summary	17
Genesis	17
iCampus – initial grant and early cohort of separate labs	18
Initial Experiences with the Microelectronics Device Characterization Laboratory, including Evaluation Results	20
Heat Transfer	23
iLabs Shared Architecture	24
Efforts to Promote Adoption of iLabs and the Shared Architecture	25
Analysis	29
Three Visions for the Future of iLabs	30
Recommendations: Next Steps for Research and Action on iLabs	31
References	32
Chapter 4: iMOAT – Using a Coalition to Build a Consortium	33
Groping Forward – Step 1	33
Writing Program Administrators – A Consortium for Instructional Improvement	34
Round 2: iCampus	35
The iMOAT Consortium	42
Conclusions	42
References	43

Chapter 5: TEAL: A Campaign to Improve Conceptual Learning in First Year Physics at MIT	44
Problems Facing Physics	44
MIT Encounters Physics Education Research	46
The TEAL Pilot in 8.02 and the Evaluation Results	48
Resistance to TEAL	52
Impacts of TEAL Outside MIT, Alone and via SCALE-UP	54
Summary of Factors Affecting Adoption of Studio Physics Models.....	58
Recommendations for TEAL	59
Attachment to Chapter V – Brief Sketches of Several Other Innovative Physics Programs	61
References	63
Chapter 6: XMAS - Spreading the Word Through an Invisible College	65
Before iCampus Funding.....	65
Initial Grant - Purposes and Execution	66
How XMAS Works – The Basics	67
Selected Adoption Case Studies.....	68
Analysis.....	73
Recommendation for XMAS.....	77
References.....	78
Attachment 1. Chronology of SVAS/XMAS versions.....	78
Chapter 7: xTutor – Online Lectures and Interactive Homework.....	80
From the Beginning: Before iCampus Funding.....	80
Part I: Early Efforts.....	81
Part II: Changing the Focus from Course Solutions to a Generalizable Software Framework	82
Selected Adoption Case Studies.....	87
Analysis.....	90
Recommendations.....	92
References.....	93
Chapter 8: Exploring the Hub Strategy for Adoption - Lessons from the University of Queensland.....	94
History of Engagement.....	94
Analysis of the Hub Strategy for Fostering Adoption.....	97
Chapter 9: Findings: How Were the Five Projects Valuable? What Factors Affected Their Adoption?	99
Finding A: These iCampus projects have improved education at MIT and at some other institutions, making learning more authentic, active, collaborative, and feedback-rich.....	99
Finding B: Achieving adoption of these projects is very important, and extremely difficult.....	100

Finding C: Certain project features make adoption a bit more likely.....	103
Finding D: Some Strategies Helped Promote Adoption Despite These Difficulties. Pre-existing Coalitions for instructional Improvement were Especially Important.....	104
Finding E: Some Institutions are More Likely to Support Adoption of Innovations Like These	105
Chapter 10: Recommendations for Fostering Future Improvements in Education with Technology	106
Recommendation 1. Improve education by making it more authentic, active, collaborative, and feedback-rich. iCampus software and ideas can provide useful elements for such a campaign.	106
1.2 Government Agencies and Foundations – Implementing Recommendation 1	108
1.3 Corporations – Implementing Recommendation 1.....	110
1.4 Additional Implementation Recommendations Specifically for MIT	110
Recommendation 2. Create demand to adopt ideas and materials from other sources by encouraging all faculty members to improve and document learning in their programs, year after year.	111
2.1 Universities – Implementing Recommendation 2	112
2.2 Government Agencies and Foundations – Implementing Recommendation 2.....	113
2.3 Corporations – Implementing Recommendation 2	114
2.4 Additional Recommendations Specifically for MIT.....	114
Recommendation 3. Nurture coalitions for instructional improvement, within and across institutions.....	114
3.1 Universities – Implementing Recommendation 3	115
3.2 Government Agencies and Foundations – Implementing Recommendation 3.....	115
3.3 Corporations – Implementing Recommendation 3.....	116
3.4 Additional Recommendations Specifically for MIT	117
Recommendation 4. Create more higher education-corporate alliances in order to support the development and dissemination of new educational technology materials and practices.	117
4.2 Government Agencies and Foundations – Implementing Recommendation 4.....	119
4.3 Corporations	120
4.4 Additional Recommendations Specifically for MIT.....	120
Recommendation 5. Supply faculty innovators with central services in educational design, software development, assessment methods, formative evaluation, and/or in sharing ideas with others in their disciplines who teach comparable courses.....	121
5.1 Colleges and Universities – Implementing Recommendation 5.....	121
5.2 Government Agencies and Foundations; Corporations Funding Faculty Development Projects – Implementing Recommendation 5.....	123
5.3 Additional Recommendations Specifically for MIT	123

Recommendations in Brief	124
References.....	128
Attachment 1: Glossary of Terms Used in this Report	129
References.....	130
Attachment 2. Educational Technology Explorations and Education/Technology Campaigns	131
A. Educational Technology Explorations.....	131
B. Education/Technology Campaigns.....	132
Selected Recommendations for Education/Technology Campaigns	133
Attachment 3. People Interviewed for this Study	135
Attachment 4: About The TLT Group, The Flashlight Program and the Authors	138
The TLT Group.....	138
The Flashlight Program	138
The Authors.....	138

Z