Comparing Student Acceptance and Performance of Online Activities to Classroom Activities

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ABSTRACT
Students in a computer science survey course for non-majors experienced a blend of online activities with traditional classroom activities. While the majority of the course involved face-to-face meetings, online modules involving two disparate topics were inserted into the course. Students in two sections of the course participated alternately in the online modules in order to compare their performance and acceptance of the same material presented online versus in the classroom.

Overall, the course presents a broad view of computing and its implications for society so incorporating online learning into the class is a perfect match with the course content. Students taking this course typically exhibit a broad range of technical ability. The module topics included a technical topic, computer programming with JavaScript, and a "softer" topic, computer mediated communication. One section received classroom instruction in JavaScript and online instruction in computer mediated communication while the other section received online instruction in JavaScript and classroom instruction in computer mediated communication.

At the conclusion of each module, students completed a survey intended to measure their acceptance and opinions of each type of instruction. This paper describes student acceptance of combining online learning with classroom instruction and presents a comparison of student performance for the same topics completed online versus in the classroom.

Categories and Subject Descriptors
K.3.1 [**Computers and Education**]: *Computer-assisted instruction, Computer-managed instruction, Distance learning.*

General Terms
Experimentation, Human Factors, Theory.

Keywords
online learning, active learning, traditional instruction, teamwork

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1. INTRODUCTION
Many educators are experimenting with a blend of online and classroom learning in order to enrich the learning experience. For instance, Herrmann, Popyack, Char, and Zozki [3] describe a hybrid computer programming course which combined extensive online materials and support with in-class time. Proponents of hybrid courses generally cite convenience, lessened expense, increased computer literary, and appeal to a range of learning styles as reasons to incorporate online activities into conventional courses. As cited by Young [9], *...many students learn better online than face-to-face, and therefore a mixture is the best way*.

However, using online activities in lieu of classroom instruction is not without pitfalls. As Hermann et al. [1] discovered, such hybrid courses can be a balancing act in order to make sure that students, particularly those with more passive learning habits, do not feel abandoned by faculty. In a critique of such courses, Reasons [6] notes that it appears that hybrid courses require more work from the student and that students may require more coaching and interaction with faculty, indicating the students can be *continually confused about expectations* and that *students who know how to look for cues [in the face-to-face classroom] may be thrown off balance*.

In order to determine the effectiveness of blending limited online modules with classroom instruction, students in a computer science survey course participated in online modules which delivered content generally taught in a classroom setting. Two modules with different types of content were used, specifically a technical topic (JavaScript) and a non-technical topic (computer-mediated communication or CMC). Two sections of the course participated, with one section receiving instruction in JavaScript online and CMC in the classroom while the other received instruction in CMC online and JavaScript in the classroom. At the conclusion of each module, students took a voluntary survey to determine their satisfaction with the learning experience.

2. EXISTING RESEARCH
There is no scarcity of publications regarding the effectiveness of instruction delivered via various technological means; however there is a scarcity of consensus. As Shen, Chung, Challis, and Cheung [2] point out, researchers have been interested in comparing alternative forms of instructional delivery at least since the 1970s when print, audio, and video means were used to bring education to remote students. For a time, the "no significant difference phenomenon" described by Thomas Russell [7] was used to support the notion that technology-driven instruction was as effective as classroom-driven instruction. More recent studies seem to show that online learning has a negative impact on learning for many students. For instance, Carnevale [1] found

that economics students did less well online than students in the classroom.

It is common for researchers to cite shortcomings in distance education research. For instance, in a review of several publications, Ramage [5] notes others that have cited concerns of lack of control of variables, lack of randomness, validity of instruments, and under-weighting the importance of student and faculty perceptions. Ramage concludes that *no evidence of any kind categorically proves that technology does not impact learning in some way, positively or negatively*.

Concerns with wholly online course have led educators to blend online learning with classroom instruction, hoping perhaps to have the best of two worlds. For instance, Woodworth and Applin [8] describe an introductory course that uses the classroom for team-based active learning exercises and the web for lab modules and quizzes. As with all educational experiences, the effectiveness of any approach is influenced by a number of uncontrolled variables such as the motivation, skills, and attitudes of both the students and instructors. These variables seem particularly important when relying on students to maintain the motivation for self-guided learning. However, as Reasons [6] notes, all courses are becoming hybrids in some sense, simply because educators are utilizing more technological tools and online elements into their courses. This paper reports on one attempt to blend online elements into a more traditional course.

3. METHOD

Participants were 33 students in two sections of an introductory computing class in the fall of 2006. All students were undergraduates enrolled in an introductory computer science non-majors course at a commuter campus of a medium-sized, mid-western university. None of the students were computing majors nor had any intent to further study computing. The class satisfies a logical reasoning requirement for a liberal education program of study, so students from a variety of disciplines and academic backgrounds were represented. Most of the students participating were freshmen or sophomores, and many were non-traditional students.

The course is taught in a computer classroom and active learning exercises are generally a daily event. A typical day in the classroom includes one or more mini-lectures followed by laboratory exercises or small group discussion. During the sixth and eighth weeks of the semester, modules in JavaScript and computer-mediated communication (CMC) were presented to the students. The materials and assignments used were identical for both sections and only the delivery differed, as the sections participated alternately online or face-to-face in the classroom.

Both modules included short lectures, multiple exercises, and a follow-up reflection paper. The primary exercise for the CMC module also required students to interact in a group to complete it, with students in the classroom being required to give a brief presentation on their findings. The materials had been developed and used previously for online instruction by multiple instructors for the same course. The modules were designed to cover the amount of material covered in 2 normal class periods of 75 minutes.

When delivered online, materials were available on Blackboard, on sites separate from the normal class site. Lecture materials were conveyed through one or more PowerPoint presentations with integrated audio. When the module was delivered in the classroom, the instructor presented the same PowerPoint presentation without the integrated audio, providing a lecture in the "normal" manner. Students in the classroom then completed the exercises as part of the usual laboratory portion of the class. The instructor was present in the classroom for assistance during the exercises while the online participants could get assistance through an online forum, email, or normal office hours. The types of modules were assigned to each section randomly before the semester began. In total, 18 students participated in CMC face-to-face and JavaScript online while 15 students participated in JavaScript face-to-face and CMC online.

3.1 JavaScript module

JavaScript was selected for one of the topics in order to evaluate the effectiveness of teaching a technical topic online to non-majors. The materials consisted of several mini-lectures on programming terms, functions, objects, variables, and other related topics. The laboratories included existing JavaScript programs to run, analyze, and modify, as well as requiring the students to construct a simple JavaScript program from scratch. All students had previously had instruction in HTML and were accustomed to creating and running simple web pages. Much of the laboratory work for this module is exploratory in nature, as students are exposed to several flavors of programming languages during the course. Typical laboratory questions were

- Describe exactly and in detail step by step what this program appears to do when it runs (is displayed in the browser). Enter data when you are prompted. For instance, does it display any dialogs? Do you enter any data? Describe everything that you see happening on the browser.
- Are there any variables in the JavaScript source? If so, identify them by name.
- Are there any calls to built-in JavaScript functions? If so, identify them by name.
- Explain what the '+' sign does in the line of code: alert("Welcome " + name + ".");

3.2 Computer-mediated communication module

CMC was selected as a non-technical topic in contrast to JavaScript. The lecture materials presented some largely psychological research and issues related to online communications. Sub topics included

- Internet versus Face-to-Face Interactions
- On-line Friendships
- Altruism on the Net (acts of kindness)
- Gender Issues on the Net
- Group Dynamics on the Net
- Flaming and Fighting on the Net

Students were placed into groups by the instructor via Blackboard groups and assigned one of the topics for their group to investigate further and produce a report regarding web sites, forums, or other online communities that were relevant to their topic.

4. RESULTS

At the conclusion of each module, students were asked to fill out a brief survey regarding their experience. The survey was taken online, and consisted of demographic information (unit and how completed, gender, age group), 14 questions answered on a 5 point scale (Strongly agree, Agree, Disagree, Strongly disagree, Neutral or not applicable), and 2 open ended questions regarding the best and worst parts of the module. Participation in the survey was relatively poor, averaging 59%. Responses to selected questions are shown below.

When asked to respond to *I had no problems using any of the course materials for this unit* (Table 1), the results were a little surprising. Even though the materials were identical, most students receiving CMC instruction online did not agree, with only 38% reporting no problems. This contrasts sharply to students using the materials in the classroom, with 90% reporting no problems. The answers were more similar when JavaScript face-to-face vs. online was concerned, with 67% and 58% respectively reporting no problems. As both modules had similar structure, the mechanics of using the technology were likely not responsible.

Table 1 I had no problems using any of the course materials for this unit

Topic	Delivery	N	% Strongly agree or agree
CMC	face-to-face	10	90
	online	8	38
JavaScript	face-to-face	9	67
	online	12	58

When asked *This unit helped my understanding of the subject material* (Table 2), all students agreed that the CMC face-to-face unit was helpful compared to 75% for the online version. Students taking JavaScript felt that the unit was equally helpful in any mode. Lower numbers for the more technical topic would be expected here, as many students in taking this class often struggle with programming concepts or find them to be uninteresting.

Table 2 This unit helped my understanding of the subject material

Topic	Delivery	N	% Strongly agree or agree
CMC	face-to-face	10	100
	online	8	75
JavaScript	face-to-face	9	67
	online	12	67

When asked *I found this unit interesting* (Table 3), most students felt that CMC was an interesting topic, despite the delivery mode. However, fewer students felt that JavaScript was interesting, and only about half as many felt that way after receiving online instruction.

Table 3 I found this unit interesting

Topic	Delivery	N	% Strongly agree or agree
CMC	face-to-face	10	90
	online	8	88
JavaScript	face-to-face	9	67
	online	12	33

The statement *I am interested in learning more about this topic* (Table 4) produced perhaps the most surprising responses. Many more students felt that they would have further interest in the topic when their learning experience was face-to-face (70% to 13% for CMC and 44% to 17% for JavaScript). When considered in the context of college classes producing lifelong learners, this reflects a fairly negative learning experience for the online participants.

Table 4 I am interested in learning more about this topic

Topic	Delivery	N	% Strongly agree or agree
CMC	face-to-face	10	70
	Online	8	13
JavaScript	face-to-face	9	44
	Online	12	17

Given the previous responses, it is not surprising that a minority of students felt that they would rather learn online (*I would rather learn this unit online,* Table 5). As often reported, online learning is best suited to motivated and self-reliant students. Many students use the regular classroom hours to provide discipline and structure around their learning experiences.

Table 5 I would rather learn this unit online

Topic	Delivery	N	% Strongly agree or agree
CMC	face-to-face	10	20
	Online	8	13
JavaScript	face-to-face	9	11
	online	12	8

4.1 Student observations

Students had 2 formal opportunities to provide feedback, the first through open ended questions on the survey and the second through a reflection paper.

Overall, students were more positive about the face-to-face instruction, and not surprisingly, more positive about CMC, the less technical topic. Most students enjoyed working in teams to construct their CMC report, and appreciated the classroom time for team interaction.

Positive feedback regarding both online modules centered primarily on the ability to work at their own pace and not have to come to campus.

Students who had a negative experience with CMC online reported frustration at trying to communicate with others in their online group. Their groups were set up before the exercise by the instructor, so they knew who was in the group. However, many students felt frustrated when students in their group either did not work at the same pace or appeared to disregard their attempts at contact.

Negative feedback regarding the JavaScript online module included complaints that there was not enough time to complete the exercises. In addition, some students expressed frustration at the lack of instructor proximity for questions, and did not like the turnaround time of email or a discussion forum for questions.

4.2 Instructor observations

There were no differences in student grades between the online and face-to-face versions of the modules for the students who completed the exercises. However, there were several students who did not complete the online modules. For the JavaScript module, 14 of 15 students completed the classroom exercises while only 9 of 18 students completed the same exercises online. The completion rate was better for the non-technical topic, with 12 of 15 students completing the online exercise compared to 17 of 18 students completing it in the classroom. The non-technical topic was likely less intimidating for students to complete online. Additionally, the primary exercise was a group exercise in contrast to the JavaScript individual exercises, which may have led to a better completion rate.

Students completing the online modules also did not ask many questions. A discussion forum was set up for students to post questions, and any questions asked of the instructor via email were also posted to the forum. However, there were almost no questions asked during the course of the week online. In contrast, students completing the exercises in the classroom were very interactive and had many questions, particularly regarding the more technical topic of JavaScript.

5. CONCLUSTIONS

Statistical analysis was not performed due to the small numbers of responses of each category. However, there do appear to be some interesting observations to be made regarding student responses. Overall, these students appeared to be much more comfortable with classroom instruction than online instruction, which is not surprising. To be successful with online instruction, students must be highly self-motivated. Additionally, students must be comfortable with technology and able to easily navigate online materials or else they will easily feel frustrated and unmotivated. This class typically includes students who do not have much experience with computers and sometimes find technology to be a hurdle. This may be somewhat responsible for students reporting having more problems using the course materials in the online versions. Both modules required downloading and manipulating files, actions which can potentially get in the way of learning for unsophisticated computer users.

In terms of differences in receiving technical instruction (JavaScript) online versus receiving non-technical instruction (CMC) online, students reported interest in the non-technical topic in either delivery mode, whereas they reported much less interest in the technical topic online. This is also not surprising, as these are non-major students, many in non-technical fields. For most students this is normally their first exposure to such subjects.

It was very surprising that online learning seemed to discourage students from wanting to learn more about a given topic. Perhaps the presence of the instructor to convey enthusiasm for the topic in the classroom is a factor here, making the experience more personal for the students. It may also be that interaction and discussion with other students in the more immediate setting of the classroom can also increase interest in a topic. It was also interesting that the drop in interest in the topic was greater for the non-technical topic than the technical topic. This would perhaps add credence to the idea that discussion with other students helps to increase interest, as students are generally less likely to have extensive discussion and interaction over technical topics.

Additionally, many students did not complete the online exercises, viewing the exercise as a week off from the course. This may be partly do to the practice of dropping 2 of the lowest exercise grades when calculating final grades – students who had completed all or most of the other exercises in the class could essentially ignore the online exercises with little or no penalty. Overall, student reaction to adding a small number of online modules to a predominately face-to-face class is discouraging in this case, particularly in terms of fostering interest in the subject material. As others have pointed out, blending online with normal instruction can be a balancing act in order to maintain interest and provide students with the proper cues for learning and understanding the material.

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