Razfar, A. (2008). Developing technological literacy: A case study of technology integration in a Latina liberal arts college. *AACE Journal, 16*(3), 327-345.

Developing Technological Literacy: A Case Study of Technology Integration in a Latina Liberal Arts College

ARIA RAZFAR
University of Illinois at Chicago
Chicago, IL USA
arazfar@uic.edu

Over the last 10 years, information technology has been the fastest growing sector in the global economy. Nevertheless, technology and computer-based instruction have not been sufficiently integrated into the curriculum especially at institutions that serve primarily language minority, low income, and first generation, female college populations. Through student surveys and faculty interviews, this study examined how faculty and students in such an institution evaluated the effects of integrating various technologies on their classroom experiences. Through a federally funded Title V grant, faculty participated in professional development workshops aimed at developing their ability to use technologically mediated practices to enhance learning opportunities through interaction and communication in cyberspace as well as face-to-face interaction. Faculty members from various disciplines participated in hands-on workshops on the use of various technologies such as Blackboard, power-point, and general internet and email uses.

Over the last 10 years, information technology has been the fastest growing sector in the global economy. This development has fundamentally transformed classroom discourse and literacy practices; thus, computer literacy for both students and faculty alike has received growing attention from scholars and practitioners. In May, 1996 the American Association of

Colleges of Education and the National Council for Accreditation of Teacher Education (NCATE) surveyed their 744 member institutions (Zehr, 1997). Survey results showed that only 45% of faculty in schools of education used multimedia technologies as interactive instructional tools during class periods, while 53% occasionally used some electronic technology to present information in class. Fifty-eight percent (58%) of schools of education didn't have any classrooms wired for the Internet, and 19% had no World Wide Web site. This picture has dramatically shifted over the last 10 years at both institutions of higher education as well as public schools. More recently (2004), a National Center for Education Statistics (NCES) report stated that nearly 100% of public schools had internet access compared to 35% in 1994.

While the amount of technology and access has dramatically shifted over the last decade, technology integration in the curriculum and its effects on faculty instruction and pedagogy has lagged behind. Johnson and Liu (2000) conducted a review of technological integration in both K-12 and higher education settings where they examined a total of 102 cases (67 cases from the K-12 environment, 24 from higher education teacher training settings, and 11 from inservice training settings). All grade levels and curricular topics were included. They found six instructional components common to all 102 case studies: (a) use of software, (b) use of web-based instruction, (c) use of web information resources, (d) use of problem-based learning, (e) instructional design choice, and (f) tailoring multimedia courseware (Johnson & Liu, 2000). In terms of the greatest challenges for technology integration they concluded:

> Everybody is talking about technology integration, but few practicing teachers profess to know exactly how to proceed. The fact is that real integration requires change....However, what seems to be lacking is a model that teachers can use to guide them through the necessary changes they will need to make to be successful in integrating new technology into their classroom (Johnson & Liu, p. 4).

Technology and computer-mediated instruction have not been sufficiently integrated into the curriculum, especially in institutions and classrooms that serve primarily language and cultural minorities from low income populations. The site for this study is a small, liberal arts college in Southern California with a predominant Latina population who are first generation college students. A January, 1998 survey of the College's faculty indicated that a great majority of the faculty (92%) said that increased computer

technology would improve the quality of classroom instruction, improve the quality of student work (50%), and that computer support for classroom instruction was not adequate (56%). With the support of Title V funds, the college set out to systematically increase and improve technology integration over a four-year period. Thirteen instructors were selected to participate in the program. In this article, we will discuss the results of the second-year cohort participating in the program.

THEORETICAL FRAMEWORK

Given the proliferation of information technology, it has become imperative to improve faculty skills and student learning through technology integration in the curriculum. Technology is viewed by many in the general public, students, parents, as well as faculty to be a vital and key instrument toward improving learning and outcomes (Kook, 1997). Furthermore, advances in technology will inevitably cause educators at all levels to reconsider how they fundamentally organize learning opportunities both in the classrooms and beyond. Much of the research on the impact and integration of technologies in classrooms has primarily focused on how individual students interact with the targeted technological software or hardware (De Corte, 1996; Andrews, 1999). As a result, the use of technologies to enhance pedagogy and student learning, especially in language minority and low SES environments, has for the most part been an unfulfilled expectation (Bottino & Chiappini, 1998). However, drawing on sociocultural perspectives of learning and Cultural Historical Activity Theory (Vygotsky, 1978; Lave, 1988; Cole & Engstrom, 1991; Engstrom, 1991), it is important to focus on how these technologies enhance interaction between faculty and students as well as between peers. Thus, the survey and interview questions chosen were based on this premise. While this article does not examine *how* the technologies mediate learning in real time, face to face interactions, the ex post-facto evaluations provided by students and faculty provide a valuable baseline from which to anchor more appropriate ethnographic methods for understanding these learning processes as they unfold in subsequent years.

Mills College, one of the pioneers in computer literacy, reported that “the fastest way to achieve the integration of information technology into the curriculum…was through a strong faculty development program in the uses of information technology” (Ringle, 1992, p. 303). In short, it has become a

truism that for a curriculum to be truly transformed there must be an infusion of technology that is used to change the nature of the interaction between students and faculty. Doucette (1993) has argued that technology can greatly enhance communication between students and faculty, students and students, and all participants in the learning process. Technology can provide access to rich and recent sources of information and can also provide a special support function for students. Many students lack confidence in their academic abilities (especially those who are first generation college students). In traditional higher educational contexts, the pace of instruction is geared to average to above-average students. Under-prepared students fall behind early and poor self-image often further thwarts their accomplishments. Instructional technology, however, allows students to proceed at their own pace. They advance when they understand a concept, not when the rest of the class or the teacher is ready to move on. If it is interactive, good instructional technology also encourages students to be active learners. Online discussion increases a sense of one's "voice" and supports our commitment to students' educational empowerment (Schwalm, 1994). Technology integration also fosters community of learners where faculty and students benefit from increased opportunities for interaction (McLaughlin, 1997).

METHODS

Previous research convinces us of the benefits of technology usage for college students (Thomas & Hofmeister, 2002; Milliken & Barnes, 2002; Winer & Cooperstock, 2002). However, little has been done in this arena with traditionally underrepresented students and further research pertaining to technology use and Latina/o students in higher education is especially needed (Valencia, 2003; Hess & Leal, 2001). Hess and Leal argued that while the digital divide has decreased for traditionally underrepresented students, inequalities in technological access still remain. At the college, opportunities were created for the faculty, through a Title V grant to give faculty the hands-on experience with the educational technology they need to be able to incorporate it into their teaching. Part of the effort focused on helping faculty understand and prepare lessons using the technology itself and part focused on helping the faculty understand the benefits students can derive from this experience. Thirteen faculty members from various disciplines participated in hands-on workshops on the use of various technologies.

This article focuses on the uses of Blackboard for instructional enhancement. In our efforts to help faculty understand the benefits our students could derive from the use of technology, students completed surveys to evaluate the impact of the technology in their course. This self-assessment instrument was designed using items from the Flashlight Current Student inventory. Students participating in these classes (N=386) were asked to complete this questionnaire designed to measure the effectiveness of the technology in an academic setting. The Inventory items were selected by participating instructors and members of the Title V research team and were administered at the end of the spring semester.

In addition to the surveys administered to students, we asked selected faculty to respond to the same questions to determine whether the faculty and student perspective mirrored one another. Semi-structured interviews were also conducted with faculty in an effort to acquire more detailed information about the areas where discrepancies existed and for the purposes of understanding any variation between sections.

FINDINGS

Students were asked to evaluate how technology affected three domains of interest: (a) *communication with the instructor;* (b) *communication with other students;* and (c) *advancement of skills such as critical thinking and writing*. Students answered questions using a four point Likert-scale with responses ranging from "Strongly Agree" to "Strongly Disagree." The overall results were remarkably positive and statistically significant ($p< .05$) with the average responses ranging from 2.48-2.98, which can be interpreted as falling closest to "agree" (see Table 1 later).

In the first two domains, we see that students attributed greater interaction with their faculty and peers to the technology that was added to the course. Specifically, 77% of respondents felt that the use of technology in their course encouraged them to interact with their peers and/or their instructor (Figure 1).

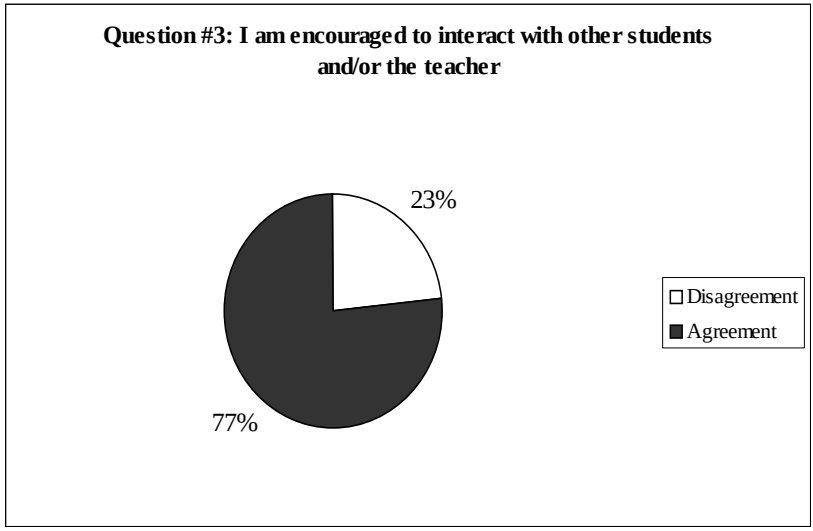

Figure 1. Student interaction

While that first item asks about general interaction, it is clear that the technologies in these courses also encourage students to discuss the ideas and concepts with their peers. Eighty percent of respondents agreed with this item (Figure 2).

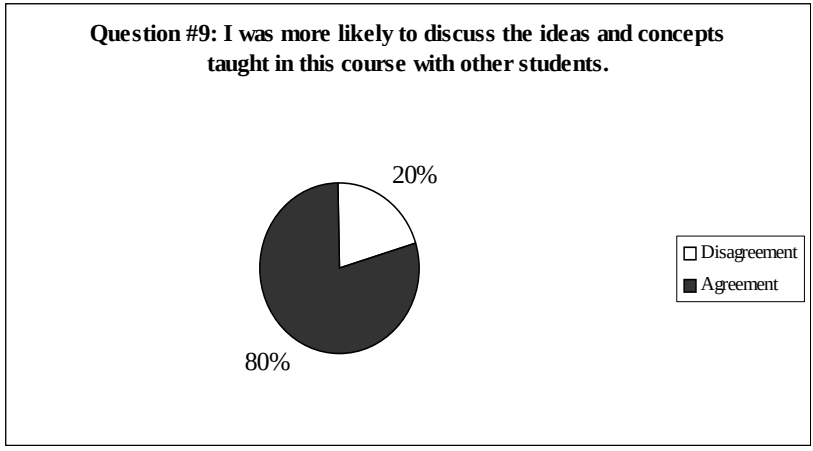

Figure 2. Discussion and interaction

In the third domain, 72% of respondents reported that the technology helped them think critically about course materials (Figure 3) and helped them analyze written course materials more effectively (Figure 4).

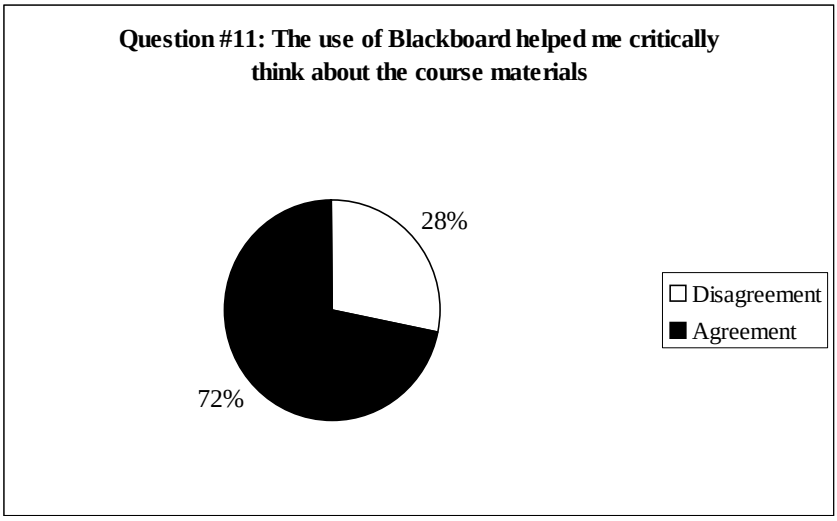

Figure 3. Critical/analytic skills

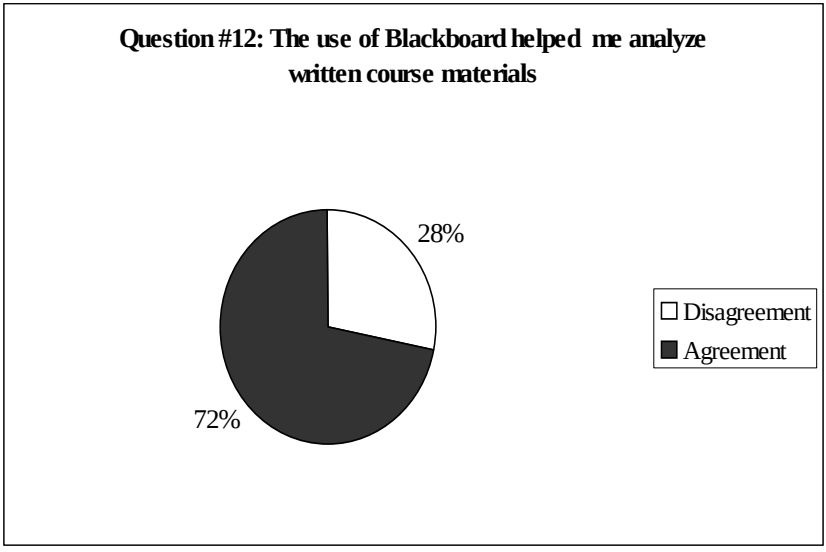

Figure 4. Analysis of written course materials

Sixty-six percent (66%) of respondents also reported that the technology helped them communicate their ideas more effectively in writing (Figure 5).

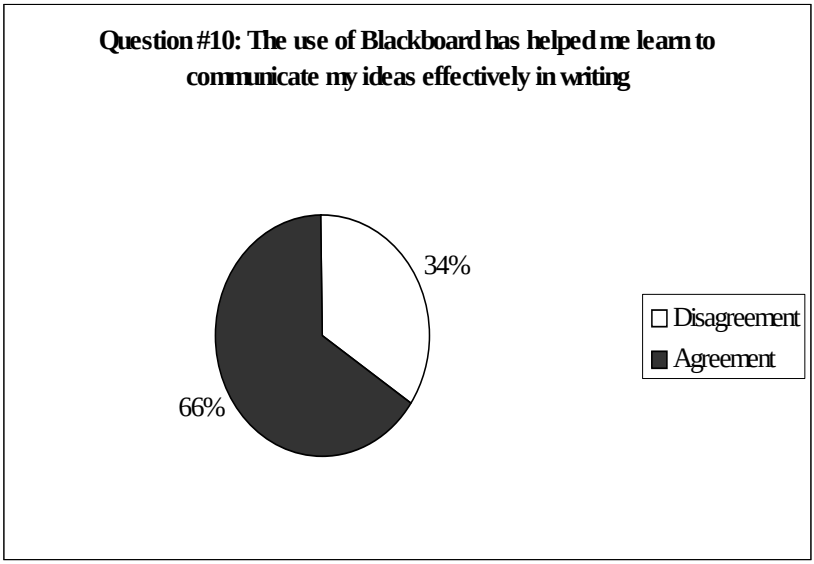

Figure 5. Writing

While the overall responses were positive, a closer look at the results suggest quite a bit of variation between courses/instructors. This kind of variation is to be expected; however, several instructors with multiple sections also exhibited significant variation between different sections using the same technology. Semi-structured interviews were arranged with several instructors for the purposes of understanding the variation between sections. We chose two instructors whose student responses were in the highest tier (well above the overall mean for each question) and one instructor in the lower tier whose student responses were the lowest (well below the overall means for each question). This qualitative comparison of contrasting experiences provided valuable insight into some of the variation we observed statistically. Another interesting finding, though not surprising, was that students whose teachers had more experience in the technology workshops were more likely to give favorable responses than students whose teachers were novices in the program. Since the majority of the technology use involved the use of Blackboard, this article focuses on the data collected about the integration of Blackboard as a tool to mediate academic literacy practices.

Blackboard

Blackboard is a web-based application used to make and host course web sites. Instructors can use Blackboard for multiple purposes such as bulletin boards, chat rooms, online quizzes and surveys, grading, calendar, and other tools that are difficult to implement on a regular web site. Students receive individual accounts and the site is password protected so that only students in the course can access what the instructor has created (for more information see www.blackboard.com). While the participating instructors were trained to use this application for the multitude of functions it provides, there was a heavy emphasis on utilizing Blackboard for its interactive features. Table 1 shows how respondents answered each question on the self-assessment with the vast majority of students across 13 sections "agreeing" that the use of Blackboard in the curriculum made assignments "more interesting" (Question 1), encouraged "creativity" (Question 2), and encouraged "interaction with other students and/or the teacher" (Question 3). However, most students did not feel that the use of Blackboard lead to more time "studying" (Question 4). Although Blackboard activity was primarily engaged outside of the classroom students did not appear to define their participation in these activities as "studying" (based on their response to Question 4). We were also pleasantly surprised to find that most students did not feel that they spent too much time learning the technology (Question 5), which may suggest two things: (a) that the students are comfortable using technology and (b) that it does not take them long to become technologically literate in the use of applications such as Blackboard. Responses to questions 6-12, which dealt with the cognitive and pedagogical dimensions of Blackboard use as they related to course materials, suggested higher levels of agreement in facilitating "understanding" of ideas and concepts (Question 6) and "visualizing" ideas and concepts (Question 7). Pedagogically, most students felt that they were more likely to ask for "clarification" (Question 8) when they didn't understand a course-related concept and they more likely to "discuss" ideas (Question 9) related to the course. One of the reasons students may be more likely to ask for clarification is the nature of the medium; Blackboard creates a safer context to take social risks especially when one doesn't understand something which was alluded to by one of our "higher tier" instructors who told us "anonymous chats are some of the Blackboard benefits I make use of." With respect to writing effectiveness (Question 10) and critically analyzing written course materials (Questions 11 and 12), most students agreed that Blackboard helped them develop critical thinking and writing skills.

Table 1
Responses to Survey Questions (*N*=386)

Questions ***Because of the way this course uses*** Blackboard***:***	**Mean/Median** **4=Strongly Agree** **3=Agree** **2=Disagree** **1=Strongly Disagree**	***SD***
1) assignments were more interesting.	2.81/3.00	.74
2) I am encouraged to exercise my creativity.	2.72/3.00	.72
3) I am encouraged to interact with other students and/or the teacher.	2.95/3.00	.72
4) I spend more time studying.	2.48/2.00	.83
5) I spent too much time learning to use the program.	2.26/2.00	.84
6) I was better able to understand the ideas and concepts taught in the course.	2.84/3.00	.79
7) I am better able to visualize the ideas and concepts taught in this course.	2.87/3.00	.78
8) more likely to ask for clarification when I didn't understand something.	2.89/3.00	.75
9) more likely to discuss the ideas and concepts taught in this course with other students.	2.98/3.00	.71
10) has helped me learn to communicate my ideas effectively in writing.	2.70/3.00	.71
11) helped me critically think about the course materials.	2.81/3.00	.73
12) helped me analyze written course materials more.	2.82/3.00	.76

In particular, we were most interested in questions that would measure how the use of Blackboard affected (a) *student interest (Question 1),* (b) *discussion and interaction (Questions 3 & 9),* (c) *out of class studying (Question 4),* (d) *writing (Question 10),* and (e) *critical analytic skills (Questions 11 & 12).*

Findings from a Biology Course

We discussed the results of these surveys with the two "higher tier" instructors and our "lowest tier" instructor. Ms. Penny, a long-time Biology instructor, strongly agreed that the use of Blackboard helped increase student interest, interaction and discussion, outside study time, as well as critical analytical skills (Table 2). However, she disagreed that the use of Blackboard helped improve student writing. This may in part be due to the nature of the course, which is a life science course with a relatively low writing load. Therefore, writing is not a skill that Ms. Penny emphasizes much. In one of the semi-structured interviews, Ms. Penny suggested that perhaps the students felt that Blackboard gave them an opportunity to write, which is less common in life science courses. Therefore, the sheer fact that they spent some time writing might have made them feel that their writing had improved. Ms. Penny also noted that the question about writing assumes that she looked at her students' writing at some "starting point and then looked at the same person later and saw improvement." She had not been thinking about Blackboard as an assessment tool, but mentioned that she may use it as such in the future. She also mentioned that she thought of the discussion opportunities on Blackboard similarly to email communication in that grammatical errors are "okay."

Ms. Penny did emphasize the use of Blackboard as a communication tool. She says,

> Blackboard is one of the best additions I've made to my classes. It opens up communication between myself and the students. Announcements, grade availability, lecture notes, and anonymous chats are some of the Blackboard benefits I make use of.

She really believed that the anonymous chat function, in particular, gave students a place to say things they might not feel comfortable saying directly to the instructor. She viewed this experience as an opportunity to "get people to open up." The use of Blackboard helped Ms. Penny realize that "more communication and availability to students improves learning."

Table 2

Student Responses in Ms. Penny's Biology Course (*N*=34)

Questions ***Because of the way this course uses*** Blackboard***:***	**Classroom Mean/ Overall Mean** **4=Strongly Agree** **3=Agree** **2=Disagree** **1=Strongly Disagree**	**Difference/ *SD***
1) assignments were more interesting.	3.24/2.81	+.43/.74
2) I am encouraged to exercise my creativity.	3.12/2.72	+.40/.72
3) I am encouraged to interact with other students and/or the teacher.	3.21/2.95	+.26/.72
4) I spend more time studying.	3.41/2.48	+.93/.83
5) I spent too much time learning to use the program.	2.11/2.26	-.15/.84
6) I was better able to understand the ideas and concepts taught in the course.	3.54/2.84	+.70/.79
7) I am better able to visualize the ideas and concepts taught in this course.	3.60/2.87	+.83/.78
8) more likely to ask for clarification when I didn't understand something.	2.97/2.89	+.08/.75
9) more likely to discuss the ideas and concepts taught in this course with other students.	3.23/2.98	+.40/.71
10) has helped me learn to communicate my ideas effectively in writing.	3.02/2.70	+.32/.71
11) helped me critically think about the course materials.	3.29/2.81	+.48/.73
12) helped me analyze written course materials more.	3.26/2.82	+.44/.76

Findings From a Psychology Course

Ms. Seal's psychology course also received high marks in student satisfaction with the integration of Blackboard into the curriculum (Table 3). The students in Ms. Seal's Psychology course "agreed" that assignments were more interesting, there was more discussion and interaction, their writing improved, and the use of Blackboard helped improve their critical thinking and analytical skills.

Table 3

Student Responses in Ms. Seal's Psychology Course (*N*=34)

Questions ***Because of the way this course uses*** Blackboard***:***	**Classroom Mean/Overall Mean** **4=Strongly Agree** **3=Agree** **2=Disagree** **1=Strongly Disagree**	**Difference/ *SD***
1) assignments were more interesting.	3.20/2.81	+.39/.74
2) I am encouraged to exercise my creativity.	2.85/2.72	+.13/.72
3) I am encouraged to interact with other students and/or the teacher.	3.25/2.95	+.30/.72
4) I spend more time studying.	2.90/2.48	+.42/.83
5) I spent too much time learning to use the program.	2.00/2.26	-.26/.84
6) I was better able to understand the ideas and concepts taught in the course.	3.40/2.84	+.56/.79
7) I am better able to visualize the ideas and concepts taught in this course.	3.35/2.87	+.48/.78
8) more likely to ask for clarification when I didn't understand something.	2.93/2.89	+.04/.75
9) more likely to discuss the ideas and concepts taught in this course with other students.	3.07/2.98	+.08/.71
10) has helped me learn to communicate my ideas effectively in writing.	3.05/2.70	+.35/.71
11) helped me critically think about the course materials.	3.35/2.81	+..54/73
12) helped me analyze written course materials more.	3.24/2.82	+.42/.76

In contrast, Ms. Seal disagreed with respect to other items. She did not feel that the use of Blackboard improved student interest, discussion and interaction, studying, writing, or their critical analytic skills. Ms. Seal says,

> I use a variety of teaching methods, which is something that students always praise in end-of-term evaluations. I see Blackboard as fitting nicely into my overall teaching philosophy of using varied teaching methods to reach more students.

While Ms. Seal certainly values the use of technology as part of her courses, she does not see the use of Blackboard as fundamentally altering her pedagogical practices. The use of Blackboard is simply another instructional "tool" to be used at the discretion of the instructor.

There were questions where Ms. Seal's responses differed from her students' responses. In synch with her teaching philosophy, the use of Blackboard did not alter the types of assignments, the content of exams, or the amount or type of writing in which her students were engaged. Yet, her students believed that assignments were more interesting due to the use of the technology. Ms. Seal suggested that perhaps the assignments were more easily retrieved because they were readily accessible on Blackboard, but the technology itself had not changed the nature of the assignments.

Perhaps her students did indeed spend more time studying for this course as compared to other courses they took. But, Ms. Seal did not see any evidence of this in students' test scores, so she assumed that they had not spent more time studying.

Ms. Seal agreed with her students about spending more time interacting with their peers due to the use of the technology, but she felt that most of the interaction was about whether or not students had completed assignments rather than actual course content. Yet, her students report agreement with the statement that they are more likely to spend time discussing ideas and concepts taught in the class with their peers. This may be a definitional disagreement. Students may have believed that discussing the assignments themselves fell into this category, while Ms. Seal is a bit more discriminating about to what "ideas and course content" refer. Ms. Seal also indicated that she viewed discussion of ideas and course content in a more holistic manner in that students may have discussed these things, but not necessarily because of the technology employed.

Ms. Seal posted writing tips on Blackboard, which may have influenced students' response about their writing. However, she did not feel that students' writing was any better than in courses without Blackboard.

Students also had available to them a link to the publisher's site for their course textbook. This tool may have led students to believe that they were better able to analyze course materials. But, similar to students' writing, Ms. Seal did not see a marked difference in students' exam scores to indicate that they had a better grasp of the material as compared to the times she taught this course without Blackboard.

Findings from a Nursing Course

Clearly the class with the most difficulty integrating Blackboard into the curriculum was Ms. Edgar's nursing class (Table 4). With respect to every question, the students in Ms. Edgar's course displayed a negative or opposing trend in relation to the other 12 sections. The students in this course, in contrast to the rest of the respondents, tended to disagree that the use of Blackboard improved their interest, increased discussion and interaction, improved their amount of outside study, improved their writing, or improved their critical analytic skills. In some cases they were nearly one standard deviation away from the overall mean. Unsurprisingly, Ms. Edgar confirmed many of the student sentiments by "strongly disagreeing" with nearly every question the students were asked especially with respect to those areas previously mentioned.

In fact, Ms. Edgar said the following,

> First, let me say it was the worst class I have ever taught. I have **never** had students so resistant, angry, and hostile. It was a most unusual group! The students **hated** using the discussion board and viewed it as extra work. They did not feel it added to discussion. However, I must say, the actual discussion on the discussion board was quite good. They loved having materials readily accessible on Blackboard.

Table 4
Student Responses in Ms. Edgar's Course (*N*=32)

Questions ***Because of the way this course uses*** Blackboard***:***	**Classroom Mean/Overall Mean** **4=Strongly Agree** **3=Agree** **2=Disagree** **1=Strongly Disagree**	**Difference/ *SD***
1) assignments were more interesting.	2.18/2.81	-.63/.74
2) I am encouraged to exercise my creativity.	2.33/2.72	-.39/.72
3) I am encouraged to interact with other students and/or the teacher.	2.57/2.95	-.38/.72
4) I spend more time studying.	1.90/2.48	-.58/.83
5) I spent too much time learning to use the program.	2.37/2.26	+.12/.84
6) I was better able to understand the ideas and concepts taught in the course.	2.41/2.84	-43/.79
7) I am better able to visualize the ideas and concepts taught in this course.	2.27/2.87	-.60/.78
8) more likely to ask for clarification when I didn't understand something.	2.67/2.89	-.22/.75
9) more likely to discuss the ideas and concepts taught in this course with other students.	2.48/2.98	-.50/.71
10) has helped me learn to communicate my ideas effectively in writing.	2.48/2.70	-.32/.71
11) helped me critically think about the course materials.	2.33/2.81	-.48/.73
12) helped me analyze written course materials more.	2.42/2.82	-.40/.76

Clearly, Ms. Edgar perceived an intense aversion on the part of the students to the use of Blackboard; however, it appears that there was some transformation. Ms. Edgar later said that initially students felt that the use of Blackboard was just another meaningless task that added to their workload.

Even with this negative experience, she was not ready to give up the potential she saw in the discussions on the discussion boards. She shared with us that she assigned a grade value to Blackboard use in courses she taught after the course in this study. She revealed that this added "value" seemed to make it relevant to students. She said, "the students like the grade value as it increases scores in class." It is also possible that by giving students "credit" for Blackboard discussion participation students viewed the activity as more relevant because Ms. Edgar showed that she valued the exercise. Ms. Edgar mentioned that "the students say it increased their responsibility as I expected they access course materials prior to the class and come prepared for discussion." It is perhaps the transformation from a passive learner and a passive student identity toward an active learner and an active student identity, which is most compelling.

While Ms. Edgar's class seemed to be an outlier in relation to the other participating instructors, her narrative provides a glimpse into faculty and student development through technology integration. In this case both the instructor and the students underwent fundamental shifts in attitude with respect to the use of technology where students move from resistance-to-technology toward utilizing technology as a viable resource.

CONCLUSION

While technology integration and faculty development has become a top priority at institutions of higher education, there remains a dearth of research on how to implement and evaluate the effectiveness of such programs especially in language minority contexts. This study serves as an example of an evaluation method, utilizing the Flashlight Current Student Inventory and teacher interviews, to assess technology usage. These data have significantly enhanced our ability to effectively implement technology integration through faculty development. Furthermore, the collaborative nature of our evaluation methods has allowed us to make the necessary adjustments through program and evaluation in order to enhance the learning experiences of both faculty and students.

This study also adds to the previous research by exemplifying how technologies, when used effectively, can enhance the educational experience for traditionally underserved populations.

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Acknowledgements

I would like to acknowledge the contribution of my colleague Dr. Arianne Walker in conducting and disseminating this research.

Note

1. Title V grants are awarded to Hispanic-Serving Institutions (HSIs) by the U.S. Department of Education to assist eligible Hispanic-serving institutions of higher education to expand their capacity to serve Hispanic and low-income students. This program helps eligible institutions of higher education (IHEs) enhance and expand their capacity to serve Hispanic and low-income students by providing funds to improve and strengthen the academic quality, institutional stability, management, and fiscal capabilities of eligible institutions. (www.ed.gov, accessed September 6, 2007)