

# Classroom Configuration And Instructional Technology Impact Teaching Methods

Betty A. Kleen, (E-mail: is-bak@nich-nsunet.nich.edu), Nicholls State University  
L. Wayne Shell, (E-mail: mnmk-lws@nich-nsunet.nich.edu), Nicholls State University  
Benny Zachry, (E-mail: acbl-bz@nich-nsunet.nich.edu), Nicholls State University

## Abstract

*This paper reports the results of a survey of Accounting Information Systems (AIS) faculty in U.S. universities. The purpose of the survey was to identify the impact of information technology on the AIS instructor's classroom delivery method. The data concern the extent of use of ten information technology (IT) instructor tasks, nine technology tools (hardware items), and six IT-based student classroom activities within AIS classroom settings. The respondents' identification of new technology-related tasks and high-intensity use of some of these tools point to a dramatic, perhaps revolutionary, change in AIS classroom instructional delivery.*

## Introduction

The purpose of this study was to determine how classroom configuration (layout and facilities) impacts the use of information technologies by Accounting Information Systems (AIS) faculty and students. The researchers defined classroom delivery systems as incorporating both the instructor's teaching techniques and the instructional technology used to support the techniques. Since the researchers' primary concern was interaction of instruction, technology, and classroom layout, a complete investigation of the actual teaching methods (delivery methods) is beyond the scope of this project.

At many universities the AIS courses still lack the definition and standardization that time tends to bring to a given course syllabus.

*Readers with comments or questions are encouraged to contact the authors via e-mail.*

Compared to traditional accounting courses such as Intermediate or Auditing, the AIS course lacks tradition with respect to "how one expects it to be taught." Because of this, the AIS instructor is able to experiment with new and different and non-traditional teaching methods, including but not limited to group projects, educational partnerships, multimedia presentations, and distance learning. Moreover, while the AIS course lacks tradition, it is a technology-oriented course. Its core subject, Information Systems, is a discipline undergoing dramatic change. Likewise, it has the most intensive use of PCs of any typical accounting course. Thus, linking AIS to information technology (IT) use is appropriate.

This research concerns IT-based activities only within the classroom; it is *not* concerned with out-of-class labs, CAI, homework, e-mail, and other technology-related activities that take place outside the classroom. The study concerns ex-

tent of use, and differentials in use, of IT across different physical classroom settings. The specific classroom layouts examined included the following: (1) Conventional classroom (lecture room) with no teaching/demonstration computer, (2) Conventional classroom (lecture room) with a single teaching/demonstration computer, (3) Lab with no teaching/demonstration computer, (4) Lab with a teaching/demonstration computer, (5) Combination of two or more of the above, and (6) Other.

As old instructional methods are being replaced by new, the “received doctrine” of what methods work in what settings loses relevance. There is much less knowledge about the *use* of these new tools, much less their usefulness.

In order to determine how classroom configuration impacts the use of IT by AIS faculty, the researchers designed and implemented a survey of AIS faculty. This survey identified IT-related instructor tasks, IT instructor tools (hardware), and student-centered activities that are most used and least used in the classroom, in conjunction with various classification questions and questions regarding classroom layout. The following research questions were included in this study. First, what *IT-related instructor tasks* are in use in AIS classrooms, and does classroom layout influence the usage rates of these *instructor tasks*? Second, what *IT-related tools (hardware items)* are in use in AIS classrooms, and does classroom layout influence the usage rates of these *IT tools*? Third, what *IT-related student activities* are in use in AIS classrooms, and does classroom layout influence the usage rates of these *student activities*? Fourth, does accounting accreditation status or college accreditation status, through its indirect influence on the balance of research versus teaching, influence the usage rates of specific IT-related instructor tasks, IT-related tools, and IT-related student activities? Fifth, does faculty rank or experience impact the usage rates of specific IT-related instructor tasks, IT-related tools, and IT-

related student activities? Sixth, does the course’s classification as an AIS course (versus “other”) impact the usage rates of specific IT-related instructor tasks, IT-related tools, and IT-related student activities? Seventh, how do AIS instructors perceive information technology is impacting their teaching?

Tests were conducted to identify and test differences in task and tool use by faculty and students (and intensity of use) in classrooms of different configurations. Specifically, tests were conducted to identify and test differences in task use (and intensity of use) among various sub-populations: (1) classrooms of differing configurations, (2) accreditation status of college and accounting program, (3) faculty of differing ranks and experience levels, and (4) course classifications (AIS courses and “other”). The researchers assumed that greater rates of use are evidence of greater effectiveness.

### Literature Review

While there is considerable literature regarding how computers and information technology have impacted education, very little is available regarding how computers and information technology have impacted classroom delivery systems (systems that incorporate both the instructor’s teaching techniques and the instructional technology to support the techniques). Much of the available literature concerns how PCs and multimedia systems that are used in classrooms and labs *enhance student learning*. For example, Sandall and McGowan (1995) reported that Internet usage enhanced writing skills. Similarly, active learning was enhanced by the use of interactive courseware, thus encouraging students to become more active critical thinkers, according to Miketta and Ludford (1995). Chen (1995) reported on development of team skills and communication skills while Osborn (1995) reported on an experiment that used groupware. Khalifa and Limayem (1994) found enhanced student performance when they had access to hypercourseware. Ganci *et. al* (1994)

wrote that students tested better when exposed to automated lecture presentations. Pea and Gomez (1992) and Drook (1994) also reported successful uses of multimedia. Willoughby and Stocker (1998) found that gained Lotus 1-2-3 knowledge in a teacher demonstration method and a hands-on method was comparable.

In literature specifically related to accounting education, Bettinger and Zachry (1989) reported that the Accounting Information Systems course made the highest *use of microcomputers* of any course in the typical accounting curriculum. This supported Cronan and Fries' 1986 research in which they found the highest *use of information technology* of all accounting courses to be in the systems course. Landry, Case, and Francisco (1996), however, reported a minimal use of multimedia by accounting faculty, based in part on lack of access to software and hardware and lack of time for faculty to educate themselves.

Another segment of the literature has dealt with examples of how technology, particularly multimedia technology, is specifically used in the classroom (Landry, Case, and Francisco, 1996). Schank (1995) reported on approaches to incorporating learning theories and multimedia in the classroom. Others such as Pea and Gomez (1992), Drook (1994), Roberts (1994), and Leibowitz and Letsky (1996) have all developed successful uses of multimedia. A dozen years ago Armitage and Boritz (1986) recommended that business schools bring faculty "up to speed" by providing in-house training programs regarding IT usage in the accounting classroom.

Amid all the aforementioned positive aspects of integrating technology into the classroom, downside issues have been reported by Cushman, Mann, and Strickland (1995), Osborn (1995), and Kenyon (1997). Orr, Poindexter, and Allen (1998) found that sole and mandated use of multimedia (no hard copy text available to students) has a detrimental impact on knowledge learning. Yet, Rutherford and Grana (1995) have

suggested that "...instructors who wait for institutional norms to change before they incorporate technology into their teaching and learning will have waited too long."

Since the available literature is lacking of substantive research regarding *how* computers and IT have impacted classroom delivery systems, it seems appropriate that this research focus upon delivery systems, rather than other topics.

### Methodology

The researchers developed an instrument to gather data from AIS faculty on changes in instructional delivery system caused by IT. The current instrument was based on previous work by Kleen and Shell, who studied the impact of IT on MIS classroom delivery (1996). In that earlier instrument, the list of IT-related instructor tasks, IT tools (hardware), and student in-class activities was created, modified, and validated. The validity is mostly in the forms of internal content validity and to a lesser extent convergent construct validity—lesser because this is a relatively new research area.

After the AIS instrument was pre-tested on a small number of accounting and AIS faculty, it was mailed to 766 AIS faculty in the United States. The target population was self-identified AIS instructors, in that they contributed to their own listings in Hasselback's *Directory of Accounting Faculty* (1996). Business reply envelopes were provided for respondents. Respondents were asked to complete the questionnaire in relation to an AIS course if they had taught the course any time within the previous year. Those not teaching the course in over a year were asked to return the questionnaire without answering any additional questions.

Classification questions included school accreditation, accountancy accreditation, respondent rank, years' experience, and course classification. Target data were the answers to ques-

tions regarding classroom configuration (closed-response) and usage rates for (1) ten technology-related tasks performed by an instructor in class, (2) nine technology tools (hardware) used by the instructor in class, and (3) six activities for which students used PCs during class. Respondents marked usage rates ranging from “always,” “routinely,” “occasionally,” “rarely,” and “never.” The response scale was not presumed to be an interval scale, only ordinal. There was no presumption of equally spaced intervals. The technology-related tasks performed by an instructor in class, technology tools used by the instructor in class, and student in-class IT activities are detailed in Table 1.

The researchers’ interest is whether these usage rates are (1) independent of classroom layout (configuration), or (2) dependent on classroom layout. An example of dependence would be “Use of Internet in the classroom is more frequent when the layout is a classroom or lab which includes demonstration equipment.” For this level of testing, the Chi-square test of independence is appropriate. The researchers used  $\alpha = 0.10$  as the threshold of significance. The following hypotheses illustrate this example.

**H<sub>0</sub>:** Internet use in the classroom is independent of classroom layout.

**H<sub>a</sub>:** Internet use in the classroom is dependent on classroom layout.

The six physical configurations included the following: (1) conventional classroom (lecture room) with no teaching/demonstration computer (2) conventional classroom (lecture room) with a single teaching/demonstration computer (3) lab with no teaching/demonstration computer (4) lab with a teaching/demonstration computer (5) combination of two or more of the above, and (6) other.

While the Chi-square test of independence helps to reveal how classroom layout impacts usage rates of the various IT instructor tasks, IT tools, and student activities, it does not reveal which, if any, of the classroom layouts has a significantly different usage for any of the twenty-five variables. In order to test these specific relationships, a standard test of equality of proportions was used, in conjunction with the concept of minimum significant difference. As the Chi-square shows dependence, the test of proportions reveals that not all proportions are

**Table 1**  
**Use of Information Technology in the AIS Classroom**

Technology-Related Tasks Performed by Instructor in Class	Technology Tools (hardware) Used by Instructor in Class	PC Usage by Students in Class
Present electronic slide shows	LCD imagers/projection devices	Taking notes
Present instructor-prepared multimedia	Electronic slates/electronic copyboards	Taking exams
Use content from CD-ROM or video disk materials	Local area networks	Collaborative work/Teamwork
Use Internet/Gopher/World Wide Web	Overhead projectors	Data gathering, research, or Web search
Use self-developed web pages	Response pads	Problem solving
Send/receive e-mail transmissions	Wireless input devices	Experiential activities
Demonstrate software (live demonstration)	Wireless LANs	
Originate teleconferencing content	Video cameras	
Use Web-based distance learning materials	Printers	
Bring satellite feed (teleconferencing) into class		

equal. The next stage in testing is to identify specific combinations of tools and configurations that stand apart from the others. To this end, the researchers employed the concept of minimum significant difference, now using  $\alpha = .05$  to reduce false positives.

Finally, respondents were given the following open ended questions to elaborate on how IT is impacting their teaching to validate the presumption of high usage = high usefulness. Do you now teach to a different level of student learning as a result of your use of different delivery technologies? (greater breadth of coverage, greater depth of coverage, etc.). Describe. Which of the items in the survey instrument are the newest additions to your teaching "arsenal"? What do you foresee as your greatest need for additional information technology in your AIS classroom a year from now? Have you used a specific task or technology tool in the AIS classroom that you will not use again? Describe.

### Findings

This study covers relatively unexplored ground; thus descriptive data have some value. First, descriptive percentages of classification data and classroom configurations are presented. Next, respondent data in each of the three categories (1) technology-related tasks performed by instructor in class, (2) technology tools used by instructor in class, and (3) activities for which students used PCs during class, are reported descriptively, followed by Chi-square hypothesis tests. Next, hypothesis tests of remaining sub-populations from the research questions are addressed. Finally, responses to the open-ended perception-related questions are presented.

A response rate of 25% was achieved--a total of 192 usable responses were received. Fifty respondents indicated they had not taught an AIS course within the last year. Descriptive statistics for other questions, therefore, were based on the remaining 142 responses.

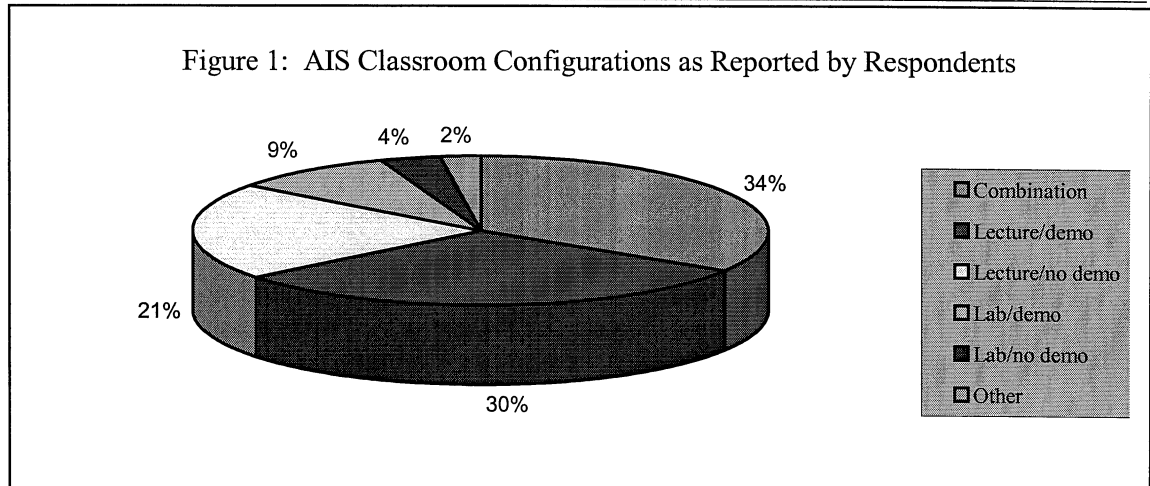
Eighty-nine percent of respondents taught in schools with (or seeking) AACSB accreditation. Forty-seven percent of the 142 respondents taught in schools with separate Accounting accreditation. Over two-thirds (70.4%) of the respondents were at either the assistant professor or associate professor rank. Thirty-one percent reported 6-10 years of teaching; 38% reported 11-20 years' experience; 17.6% reported over 20 years' experience; only 13.4% of respondents reported less than 6 years' experience. Over 90% of the courses were reported in the accounting discipline; 93.7% of the courses were titled Accounting Information Systems. Junior and senior students typically dominated the course enrollment.

### Classroom Configurations

Many different classroom configurations are used for the AIS course. These are illustrated in Figure 1. Twenty-one percent reported teaching in a lecture room with no teacher demonstration computer; another 30.3% taught in a lecture room *with* a teacher demonstration machine. Nine percent taught in a lab with a teacher demonstration machine; 3.5% taught in a lab with *no* teacher demonstration computer. One third (33.8%) reported some combination, such as moving between lecture rooms and labs. Approximately 2% of respondents marked "other" with no explanation.

### IT-Related Instructor Tasks

Respondents were asked to report frequency of classroom use of ten *IT-related instructor tasks* such as presenting a computer slide show, using Internet/Gopher/WWW, conducting software demonstrations and/or tutorials, using distance learning, etc. Four information-technology-related *instructor tasks* were reported being used much more frequently than the other items listed. As shown in Table 2, conducting software demonstrations, using Internet/Gopher/WWW, transmitting e-mail, and presenting computer slide shows were identified



more often.

Three IT-related instructor tasks with intermediate usage rates were using self-developed web pages, using off-the-shelf multimedia, and using instructor-prepared multimedia. Three IT-related instructor tasks were used by very few of the respondents. Bringing satellite feed (teleconferencing) into class was not used by 93.7% of the respondents, with 33.8% of respondents indicating they had no access. Using Web-based distance learning was not used by 91.5% of respondents; 26% had no access. Originating teleconferencing content was not used by 89.4% of the respondents; 23.9% reported no access. For each of these three IT tasks used in the classroom, over one third of respondents noted each was not used because it was not relevant. The researchers recognized that the response "never, not relevant" may also have been concealing "not available" scenarios.

Does the classroom configuration influence the *IT tasks performed by the instructor*? Use of electronic slide shows was dependent upon classroom configuration (probability = .0203). When the classroom configuration was a lecture setting with *no* demonstration computer, electronic slide shows were reported used by only 37.7% of the respondents. When the classroom configuration was a lecture setting *with* a demonstration computer, electronic slide shows

were used by 81.4% of the respondents. When lab settings included a demonstration computer, electronic slide shows were more frequently used also. These results derived from a Chi square test of independence followed by a parametric test of two proportions.

Conducting Internet tasks in the classroom was also more frequent when the classroom or lab configuration included demonstration equipment (probability value = .045). The intensity of software demonstrations in class was also considerably higher when the setting, lab or classroom, included a demonstration machine. For example, 36.5% of all respondents conducted software demonstrations "routinely" when a demonstration computer was in the room; only 5.8% of respondents using other room configurations rated their intensity of use as "routine." The percentage change was equally striking in a lab setting.

*IT-Related Instructor Tools (Hardware)*

Table 3 illustrates that the most used *IT tool* in the AIS classroom is the conventional overhead projector, which has the highest incidence of "always" and "at any level." (This is the result of merging columns of the cross tab to reduce the percentage of "small cells.") The use of LANs and LCD imagers follows not far behind. Only 5 of 142 respondents indicated even

occasional use of response pads or wireless LANs.

Hypothesis testing identified use of LCD imagers, overhead projectors, and local area networks is dependent upon classroom layout. Use of electronic slates is not dependent upon classroom configuration, but use of video cameras and printers is. Wireless LANs, wireless input devices, and response pads were so little used that no tests were conducted.

The technique of minimum significant difference (alpha = .05 or less) further tests which *tools* stand out in which classroom configurations. The researchers, of course, found the obvious: for example, classrooms *without* instructor computers had use of LCD imagers significantly below average. Another relatively ob-

vious finding is that both lab configurations made use of LANs at a much higher rate than average. These two results were the only cases where usage rate was significantly above or below the group average. LAN use was only average for the lab configuration without a demonstrating computer.

*Student PC-Related Activities*

Table 4 below illustrates that the most frequent *in-class student activities involving PCs* are teamwork and problem solving, both of which have “always” rates above 10% and “at any level” rates above 60%. All the student tasks had collective usage rates above 25%.

Of the six student-centered activities, frequency of taking notes, taking exams, teamwork, problem solving, and experiential usage are dependent upon classroom layout or configuration. Only student PC use for research is not dependent upon layout. When the concept of minimum significant difference was employed, (alpha = .05 or less), student use of PCs for note taking and for taking exams was significantly above average in both of the laboratory configurations and in no other. Student use of PCs for teamwork, research, problem solving and experiential activities was below average in both of the lecture configurations whether measured by “al-

**Table 2**  
Most Frequently Reported IT- Related Tasks  
Performed by Instructor in the AIS Classroom

IT-Related Task Performed by Instructor	Always	At any Level of Use
Demonstrate software (live)	11.3%	90.8%
Use Internet/Gopher/WWW	7.0%	69.7%
Transmit e-mail	13.4%	64.8%
Present electronic slide show	10.6%	63.4%

**Table 3**  
Most Frequently Reported IT- Related Tools  
Used by Faculty in the AIS Classroom

IT-Related Tools Used by the Instructor	Always	At any Level of Use
LCD imagers	16.9%	76.8%
LANs	21.1%	76.1%
Overhead projectors	21.1%	93.7%
Printers	4.9%	40.9%

**Table 4**  
Student Activities Using PCs in the AIS Classroom

Student PC Usage in Class	Always	At any level of Use
Taking notes	3.5%	27.2%
Taking exams	6.3%	26.8%
Teamwork	11.3%	62.0%
Research	8.5%	55.0%
Problem solving	12.7%	61.3%
Experiential activities	9.2%	57.8%

ways” or “at any level.” In contrast, student use of PCs for teamwork was above average in both of the lab configurations and in the combination configuration.

#### *Sub-population Tests*

The final three research questions are addressed in this section. The researchers also designed the experiment in order to test for differences in instructor task, tool, and student activity use among various sub-populations including when the course was last taught, school accreditation status, course discipline, and faculty of differing ranks and different experience levels. Hypotheses were tested with Chi-square. The researchers used  $\alpha = .10$  for the threshold of significance.

Does when the course was taught influence IT instructor task, tool, and student activity use? Within the *IT instructor task* tests, none were significant. The researchers concluded that whether the AIS course was taught in the immediately preceding semester or a semester earlier had no bearing on which *IT-related instructor tasks* were used or at what intensity. Within the *IT tool* tests, only overhead projector use was dependent upon when the course was taught. When the hypotheses concerning *student activities* were tested, there were no significant findings.

Does the school’s accreditation status influence IT instructor task, tool, and student activity use? There was no statistical evidence that accreditation status (AACSB, ACBSP, or neither) influenced the rate of *IT instructor task* use; that is, none of the ten tests concerning *IT instructor tasks* was significant. Similarly, when the hypotheses concerning accounting accreditation to *IT tool* and *IT student activity* use were tested, there were no significant findings. The researchers had intended to test whether type of college accreditation was an influence over classroom configuration, but almost 90% of respondents were in AACSB settings, leaving Chi-

square an unreliable tool.

“Does years of experience influence the rate at which various instructor tasks, tools, or student tasks are used?” framed a set of ten hypotheses for testing. Of the ten *instructor tasks*, only transmitting e-mail was dependent upon years of experience. The proportion of faculty who use e-mail in class routinely rises with years of experience. The proportion of faculty who “never” use e-mail transmissions in class similarly declines with years of experience. There were no significant findings when the hypotheses concerning *IT tool* and *IT student activities* were tested.

Does the course discipline (accounting, business, IS, or other) influence IT instructor task, tool, and student activity use? The respondents’ data was overwhelmingly in the accounting area, leaving numbers too small and making Chi-square an unreliable method for testing the hypotheses.

The researchers tested whether years of experience and rank were independent. As expected, years of experience and rank were dependent at .0000 (more years of experience equate to higher rank).

#### *Open-Ended Responses: Instructor Perception of IT Task and Tool Usefulness in the Classroom*

When asked whether he or she taught to a different level of student learning (greater depth and/or greater breadth) as a result of the use of different delivery technologies, 99 faculty provided some type of response. Thirty-nine respondents answered, “no change.” Fourteen responded with a generic “yes” answer. Sixteen more respondents rated either greater depth or breadth—9 greater depth of student understanding and 7 greater breadth of coverage. Four respondents commented on a change of focus to more group learning and more active learning. Some single response categories included concern for trying to balance depth and breadth,



teaching faster because of delivery efficiency, and demonstrations of software preceding labs.

Eighty respondents noted the newest additions to their teaching "arsenals." A number of respondents listed more than one newest addition. Thirty respondents made reference to the Internet, World Wide Web, or Web pages. Eleven respondents noted presentation graphics software; another 16 noted LCD projection imagers. Eight respondents noted their newest addition as LAN access and/or use. Two noted live software demonstrations, two mentioned video cameras, two noted use of the computer for flowcharting and problem solving, and two noted e-mail. All other responses such as groupware, teamwork, and Java received one mention each.

When asked to comment concerning their greatest need for additional IT in the classroom "a year from now," respondents provided a wide variety of responses. Fifteen specifically related to providing enough space and hands-on lab. Another 11 related to classrooms with demonstration and multimedia support. Ten related to upgrades in hardware. Six wanted more WWW access in class. Six respondents noted a need for more database software and real-time access to databases. Four related to laptops for students—one specifically for laptops to go on-site. Two commented on time to learn new technology, and one related a need for groupware integrated with accounting software.

Seventy respondents commented concerning any technology they had used but would not use again. Fifty simply responded, "No." Responses of the twenty who listed a particular technology were quite varied. Eight respondents made reference to particular software choices with which they had less than 100% successful experiences. Two respondents noted they planned to avoid using printers during class time. Only one respondent commented on LCD projection unit brightness problems. One respondent noted that students did not like electronic slide

shows because instructors then basically read to them.

This study of AIS faculty corroborated the findings of the 1996 MIS study by Kleen and Shell in part by finding only modest differences among the sub-groups. The same instructor tasks that were widely used by MIS faculty were widely used by AIS faculty, with virtually no differences in rank. The same technology tasks that went unused in the 1996 MIS study were also unused by the AIS faculty

### Conclusions

Literature indicates that higher education is being revolutionized, that information technology in classrooms is impacting delivery. The AIS classroom is no exception. As reported by survey respondents, the most used IT-related instructor tasks in the AIS classroom included demonstrating software, using Internet/Gopher/WWW, transmitting e-mail, and using electronic slide shows. The IT-related tools most often used by instructors included overhead projectors, LCD imagers, and LANs. The most frequent in-class student activities involving PCs included teamwork, problem solving, and experiential activities.


The impact of classroom configuration on use of IT showed modest but interesting results. Over one-third of respondents reported teaching their AIS class in some combination of configurations. The most common simple configuration was a lecture room with an instructor computer. The researchers found that usage rates of several of the IT-related instructor tasks and technology tools were dependent upon the classroom configuration. Technology use was below average if there was no instructor computer in the classroom. Students made the most use of PCs in their classroom for purposes of teamwork, problem solving, and experiential activities. Student use of PCs in class was much more common in lab configurations than in traditional lecture configurations.

There was insufficient evidence that IT usage rates were affected by how recently AIS was taught, by whether the accounting program or the college of business was accredited, or by faculty years' experience or rank.

On that part of the survey instrument where faculty were given open-ended questions to gauge other impacts on their teaching, 30 respondents indicated either greater depth or breadth of coverage as a result of the use of different delivery technologies; 39 indicated no change. Newest additions to instructor teaching "arsenals" most often reflected Internet or WWW. Numerous respondents reported the need for hands-on labs and/or classrooms with multimedia support and demonstration computers.

The researchers speculate that the dominance of the combination classroom configuration (one-third of all respondents) indicates equipment sharing among instructors. Scarcity of facilities and equipment forces many instructors to rotate classrooms, using a lecture for some tasks and trading with an instructor to use the lab for other tasks. Accounting program administrators can use these findings as a guide in developing equipment budgets, training plans, and facilities plans.

#### Suggestions For Future Research

Future research could include the following: (1) replicated studies in other disciplines, (2) longitudinal studies to identify changes in the list, and (3) studies of PC use by students in the classroom. This research is not longitudinal; a longitudinal study might identify changes over time. Nor does this research reach into levels of student learning or into classroom configuration versus types of exams and assessment. 

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