An Active Learning Approach to Teaching Undergraduate Introduction to MIS Course

Naveen Gudigantala
University of Portland
gudigant@up.edu

ABSTRACT

The undergraduate Introduction to MIS course is generally taught as a core course in business schools to introduce information systems concepts. In addition, the course serves as an important entry point to recruit MIS majors. For instructors wanting to do well in the MIS course, use of traditional lecturing alone may not be entirely effective. This paper proposes an active learning approach to supplement traditional lecturing for teaching the MIS course. The use of various active learning techniques and their implementation in the classroom is discussed. Qualitative and quantitative feedback from students suggests that students like the active learning-based approach and report increased levels of subject matter understanding and ability to apply the material in real world contexts.

Keywords
Active learning, Introduction to MIS, IS pedagogy

INTRODUCTION

Introduction to MIS (or Foundations of information systems, called the MIS course hereafter) is an important course for several reasons. First, it is a standard introductory course in many business schools to introduce information systems concepts and application software skills to all business majors. Second, it is a pre-requisite course for all MIS electives. Third, when offered at the sophomore level, it is the entry-level course that most undeclared business majors rely upon to decide whether or not to major in MIS. The stakes are very high for MIS instructors to: (1) convince all business majors about the importance of information systems in business, and hence motivating them to learn the material well, and (2) showcase opportunities in the information systems (IS) industry and create excitement to persuade undeclared business majors to enroll in the MIS major. Dwindling student enrollments in MIS programs make it all the more important for MIS instructors to excel when teaching this course.

What is the most effective teaching method for teaching the MIS course? Prior research based on an analysis of 37 online course syllabi of introduction to MIS courses offered in AACSB accredited schools found that 100% of instructors use lecture, 33% use case analysis, 47% use essay writing, and 47% use team projects. In addition, technical hands-on assignments and projects are used by many schools (Wang, 2007). However, this research did not examine how many instructors use a combination of techniques. Past research shows many examples of innovative techniques used in teaching the MIS course. In one instance, the instructor used an experiential learning approach at the MBA level to teach the MIS capstone course. In this approach student teams identify IS management issues, use a questionnaire to interview CIOs, and analyze and present their findings to the class (Astani, 2006). Drake (2012) used Assimilation Learning Theory (ALT) to design active learning exercises to teach a module within Introduction to Information Systems course. Another example includes an innovation in pedagogy design in which non-traditional MIS students were taught algorithm development before they learned to program (Rollins, 2003). In another instance, students were taught systems development life cycle (SDLC) and, in turn, applied the technique to a series of information systems projects (Frost and Pike, 2004). Furthermore, use of mini-cases to enhance co-operative learning in the MIS course is well-documented (Fellers, 1996; Sirias, 2002, 2005). However, as far as this author is aware, none of the prior research provides a pedagogical approach that integrates the use of active learning techniques throughout the duration of the course. This work attempts to fill the gap. This paper proposes a set of active learning techniques used in combination with traditional lecture to teach the MIS course. As traditional lecture is still the dominant mode of delivery, the approach presented in this work provides some insight for instructors to modify their curriculum design to improve learning outcomes.

The paper is organized as follows. First, background literature on active learning is proposed. Second, design and implementation of active learning techniques in the MIS course is discussed. Third, qualitative and quantitative feedback from students is examined. Finally, conclusions are provided.
BACKGROUND ON ACTIVE LEARNING APPROACH

Prior IS research is consistent with research in educational psychology that traditional lecture is the dominant method used by MIS instructors (Bonwell and Eison, 1991; Wang, 2007). Traditional lecturing has both advantages and disadvantages. An enthusiastic lecturer can convey material differently compared to other resources, cover latest material not yet available in the textbook, and efficiently deliver a large amount of information in a given amount of time. However, prior research suggests that exclusive use of lecture limits student learning (Bonwell and Eison, 1991). The problem is that student attention span during lectures is approximately 15 minutes, a time beyond which the number of students paying attention decreases fast (Wankat, 2002). In addition, past research found that while 70% of information presented in the first ten minutes is retained by students, only 20% presented in the last ten minutes is retained (Hartley and Davies, 1978). Consistent with this research, our own experience suggests that a majority of undergraduate students take five to six courses during a semester and it is not an easy task to deliver a spellbinding lecture that captivates students for an entire duration of an hour or more. In conclusion, lecture-based teaching poses serious difficulty in engaging students and making them retain material for a longer duration.

To remedy problems with traditional lecture, two suggestions have been provided. One is to provide periodic pauses during lecture to introduce student activities and the second is to introduce meaningful student activities. For instance, a 45-minute lecture which had three 2-minute pauses for student activity improved student retention of material in the short-term by 30% and test performance by 10% in the long-run compared to another class that did not have breaks (Ruhl, Hughes, and Schloss, 1987). However, it is a mistake to presume that improvements in student retention rates and test performance are solely because of the pauses. The activities themselves must make sense and should be centered on learning outcomes (Redish, Saul, and Steinbert, 1997).

How should instructors go about designing activities? Active learning approach (Bonwell and Eison, 1991, p.2) suggests the following:

- Students should be engaged in activities more than listening (e.g., reading, discussing, writing)
- Emphasis should be placed more on developing students’ higher order thinking skills (analysis, synthesis, and evaluation) than transmitting information

Does active learning work? Instructors across many disciplines such as life sciences, engineering, and statistics (Barak and Dori, 2005; Dolinsky, 2001; Prince, 2004) reported that active learning enabled positive student outcomes. A number of empirical studies showed the effectiveness of active learning techniques. Some of the findings include: students prefer active learning to traditional lectures (Bonwell and Eison, 1991); use of active learning increased students’ involvement and motivation (Sivan, Leung, Woon, and Kember, 2000); and students developed deeper conceptual understanding of the material (Udovic, Dickman, Postlethwait, and Wetherwax, 2002). The findings of a meta-analysis on the effectiveness of active learning show that active learning enhances academic achievement, student attitudes, and student retention (Prince, 2004).

The evidence of active learning benefits in IS literature is mostly positive with some exceptions. While a number of studies showed an improvement in student learning, classroom excitement, and teamwork (Astani, 2006; Mukherjee, 2005; Van Slyke, Timmer, and Kittner, 1999), some studies using co-operative based active learning technique failed to show any positive effect on student learning (Fellers, 1996; Wehrs, 2002).

In summary, traditional lecture-based teaching alone is not effective in teaching the MIS course. Use of active learning-based activities, which enable students to do more than listening in the classroom and work on developing higher order thinking skills outside the classroom are posited to influence student learning outcomes. Given this premise, the next section discusses the development and implementation of number of active learning techniques when teaching MIS course.

DESIGN AND IMPLEMENTATION OF ACTIVE LEARNING TECHNIQUES

A number of active learning techniques were selected and used to teach the MIS course. The course was taught in a small private Northwest university. The class sizes vary between 22 and 30 students. The instructor used the book entitled Using MIS (3rd ed.) authored by David Kroenke and a majority of the active learning exercises were developed from the content of the textbook (Kroenke, 2011). When preparing active learning exercises, the following definition of active learning is considered: “any activity that substantially involves students with the course content through talking and listening, writing, reading, and reflecting counts as active learning” (Meyers and Jones, 1993, p.13). It is important to note that the traditional
lecture format was not completely abandoned. Rather, a number of activities were designed to complement lectures, aid with student note taking, and for students to work outside the class. The next section describes the purpose of each technique and implementation details.

**Student Projects**

Collaborative student projects are used by 47% of instructors for teaching MIS courses (Wang, 2007). However, in most cases teams work only on a certain portion of course content, such as to create a database. The student project used for this course requires students to work in teams both inside and outside the classroom and for the entire duration of the semester on almost 70% of the course content. The following procedure describes the implementation:

1. The instructor prepares teams of three to four students after the first week of class. Students belonging to different majors are usually grouped together. This information is gathered from student information sheets collected during the second class meeting.
2. During the second week, instructor introduces teams, conducts an icebreaker session for students to get familiar with each other, and requires them to select a fictitious business.
3. Students upload the first deliverable to the course management system. Only one student per team should upload the deliverable. Late submissions incur a penalty.
4. Each chapter is divided into several modules which are followed by questions for teams to work on. For instance, after covering communication systems for collaboration, teams work on the following question: “Identify a situation for your business that requires the use of a communication tool. What tool will you use? Why?” Teams work for a few minutes and make some notes. The instructor randomly asks teams about their decisions. Once this activity, which takes about five minutes, is over the instructor moves on to the next part.
5. Seven out of ten chapters covered by the instructor have a team deliverable. The students work outside of class to complete the deliverable and upload it to the course management system. In essence, students immediately apply the concepts learned in class to a business setting, which provides a context for learning. This application of concepts in different chapters to a business setting teaches students the interconnection between different chapters.
6. As part of collaboration information systems, teams are taught to work on Google Docs, a free online collaboration system. Many student teams use Google Docs to minimize the frequency of physical meetings.
7. During the semester, each team uploads seven project deliverables and receives feedback from the instructor. The final deliverable includes the compilation of individual deliverables revised with feedback from the instructor and a fully functional Access database (tables, forms, queries, and reports).
8. The project requires teams to: (1) describe their business, (2) select and rationalize collaboration systems for managing operations, (3) select hardware and software for their business and provide price quotes and specifications, (4) perform industry analysis, choose competitive strategy, analyze value chain and business processes, and specify the use of information systems to create competitive advantage, (5) perform conceptual database development (ERD) and physical database development in Access to create a fully-functional database, (6) identify the scope of business process management, use of functional systems, and cross-functional systems such as ERP and CRM systems, and (7) use E-Commerce models and technology for their business. A final report and fully functional database is due at the end of the project.
9. Peer ratings are instituted to discourage free-loaders. Extra credit is instituted to motivate students to go the extra mile. Project grade contributes heavily to overall course grade (25%).
10. A sample student project can be found online at [https://sites.google.com/site/misactivelearning1/supplemental](https://sites.google.com/site/misactivelearning1/supplemental) (please see activity 1 file for a final project report). Please see activity 2 file for sample database project. All author identification information is removed to aid double-blind review.

**Individual Student Presentation**

In-class presentations give students the opportunity to tie the concepts learned in class to real world examples. Each class period, there will be time set aside for these presentations. The students take anywhere from one to three minutes to present chosen examples. Over the semester, each student is responsible for finding and informally presenting one example that is relevant to the concepts learned in the class. They could use work experience, newspaper articles, online articles, photographs, video clips, or just about anything else to illustrate concepts pertaining to information systems. In addition to presentation, students are required to write a one page report, which constitutes three components: 1) define the topic pertaining to information systems, 2) describe your example and presentation, and 3) explain how these two are linked.
Students typically find engaging and interesting topics to present. For instance, after the instructor presented Moore’s law (the number of transistors per square inch of an integrated circuit doubles every 18 months), a student created a small electrical circuit and illustrated the operation of a transistor to operate a small bulb for his presentation. The students are free to choose any topic but present before a deadline set by the instructor. A sample presentation report is included as activity 3 document in the supplemental material.

**Formative Quizzes**

For every chapter, students are provided with an in-class quiz with a number of questions pertaining to the material to be covered. The students are told that these are ungraded quizzes, which primarily help students with note-taking, and if students are unclear about any answer, they could discuss them with the instructor. A number of students use formative quizzes to make notes at the time the lecture is delivered. Research suggests that note-taking improves information encoding, comprehension, and long-term retention of material (Kiewra, 1991). A similar technique is used by Mukherjee (2005) to maximize student interest in MIS courses. A sample formative quiz is included as activity 4 document in the supplemental material.

**Visual Demonstrations**

Visual demonstrations are done in two ways. For systems that can be demonstrated live in the classroom such as Google Docs, Microsoft Live SkyDrive, and Wikis, the instructor demonstrates them to all students in the computer lab with students following on their computers. For instance, the instructor creates a Google document, shares with a student in class, and performs concurrent editing with the student. This live interaction creates a very positive impression about the use of such systems. However, this is possible only if the class is taught in a computer lab setting.

Second, a number of videos are shown in the classroom to demonstrate key concepts. Short videos provide a way to pause the lecture for a short activity. For instance, one could explain the inside functioning of a hard drive, or simply demonstrate it using a video. Once the explanation is provided by the instructor, the use of video strengthens the learning. In addition, students generally find it difficult to visualize different information systems. A number of systems, such as collaboration systems, functional systems, enterprise systems, and business intelligence systems are covered by instructors. However, without a visual to relate these systems to, it becomes difficult for students to readily grasp the differences. In the MIS course, the students are shown a number of short video clips which demonstrate the functioning of information systems such as Google Docs, Microsoft LiveSky Drive, SharePoint, Salesforce’s CRM, and Microsoft Dynamics. These clips are available on YouTube. Once students watch the video, a short follow-up discussion enables better student retention. Research suggests that the use of video materials should be followed up with interactive activities to improve learning outcomes (Joy, 1988). Videos shown for the collaboration information systems chapter are included as activity 5 document in the supplemental material.

**Instant Feedback**

The slides used for delivering content for every chapter are divided into modules, and at the end of every module, a few multiple choice and true or false questions are presented to students. After covering a module, the instructor presents students with questions and elicits responses. This active learning technique enables students to receive instant feedback on their understanding.

**Out-of-class exercises**

Out-of-class exercises are typical homework assignments that require students to work on essays, Excel homework, and Access homework individually. The exercises are provided on course websites, and students download the exercises, read the instructions, complete the exercises, and upload them to the course website. A sample out-of-class individual assignment on creating a database is included as activity 6 document in the supplemental material.

**Case Study**

Case studies used in the MIS course require students to read assigned case, complete a written case report, and come prepared to participate in class discussion. An example of a case study used in class requires students to read the “ERP Implementation Gone Terribly Wrong: The Case of Natural Springs” (Krotov, Serguei, and Ives, 2011) article, complete a case analysis, and
participate in class discussions. Case studies provide a nice extension to the important concepts discussed in class. A sample case study assignment is included as *activity 7 document* in the supplemental material.

The topics covered in class, learning outcomes, and active learning techniques used for each topic are described in Table 1.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning Outcome</th>
<th>Active Learning Techniques Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Importance of MIS</td>
<td>Understand importance of MIS for all business majors and learn how to apply the five-component IS framework (hardware, software, data, procedures, people)</td>
<td>Formative Quiz, Visual Demonstration, Individual presentations, Instant feedback, Project deliverable -1 (fictitious business).</td>
</tr>
<tr>
<td>2. Collaboration Information Systems</td>
<td>Understand the use of collaboration tools used by businesses for communication, content management, workflow automation, and decision-making</td>
<td>Formative Quiz, Visual Demonstration, Individual presentations, In-class team exercise, Instant feedback, Out-of-class exercise, project deliverable -2 (covers topic 2).</td>
</tr>
<tr>
<td>3. Hardware and Software</td>
<td>Understand hardware and software and their relevance to meeting business needs</td>
<td>Formative Quiz, Visual Demonstration, Individual presentations, Instant feedback, In-class team exercise, Project deliverable -3 (covers topic 3).</td>
</tr>
<tr>
<td>4. Information Systems for Competitive Advantage</td>
<td>Understand how information systems enable businesses to create and sustain competitive advantage</td>
<td>Formative Quiz, Visual Demonstration, Individual presentations, Instant feedback, In-class team exercise, project deliverable- 4 (covers topic 4).</td>
</tr>
<tr>
<td>5. Database Processing</td>
<td>Understand how organizations process data, learn database design and implementation using Access</td>
<td>In-class individual exercise, Individual presentations, Instant feedback, Project deliverable - 5 (covers Entity Relationship Diagram).</td>
</tr>
<tr>
<td>6. Data Communication</td>
<td>Understand fundamentals of computer networks and data communication</td>
<td>Formative Quiz, Visual Demonstration, Instant feedback, Individual presentations</td>
</tr>
<tr>
<td>8. E-Commerce and Web 2.0</td>
<td>Understand e-commerce categories, technologies used to support e-commerce, and supply chain management systems</td>
<td>Formative Quiz, Visual Demonstration, Individual presentations, In-class team exercise, Instant feedback, Project deliverable- 7 (covers topic 8).</td>
</tr>
<tr>
<td>9. Business Intelligence Systems</td>
<td>Understand how business intelligence systems help organizations gather data, analyze, and make decisions</td>
<td>Formative Quiz, Visual Demonstration, instant feedback, Individual presentations</td>
</tr>
<tr>
<td>10. Systems Development and Security Management</td>
<td>Understand different systems development methods and the need for organization information security</td>
<td>Formative Quiz, Visual Demonstration, Individual presentations, Instant feedback, Final Project Deliverable due</td>
</tr>
</tbody>
</table>

Table 1. Course contents, Learning Outcomes, and Active Learning Techniques Used
QUANTITATIVE AND QUALITATIVE EVALUATION

This section presents a summary of qualitative and quantitative feedback received from students.

Sample comments on student projects:

- “We studied a wide variety of topics and applied them to a fictitious business which really helped to learn the material and apply them to real life.”
- “Group project was very effective in causing students to apply ERD knowledge. Even provided a sense of accomplishment when finished.”

Some students provided the following comments on improving the project:

- “Have groups of 3 instead of 4. Four is a little too much and I feel like there is always one person who does not contribute as much as they really can”
- “I think it will be better if people could present their project in front of class.”

Sample comments on other active learning exercises:

- “The strengths of the course are In-class exercises, organization, multimedia.”
- “Useful Powerpoints, in-class exercises correlate with Powerpoint, breakdown of team project throughout semester, learned about many websites and different hardware devices.”
- “Seemed like a lot of homework assignments, essays, etc. Overwhelming amount of assignments at times.”

Overall feedback on course and teaching style:

- “It was always a pleasure coming to this class because the instructor was organized and maintained a very stimulated learning environment. We both listened and were able to do hands on work which is helpful when learning material.”
- “I gained a stronger sense of the importance of MIS in any kind of business whether small or big businesses. No topics were repeated more than necessary. Skills learned from course help with current and future situations.”
- “Great way to learn about technology. Fun approach to do it.”

In summary, these sample comments represent student excitement about learning the subject matter and participating in classroom activities. The next section provides quantitative evaluations of techniques and statistical comparisons between traditional versus active learning based teaching method.

Quantitative Evaluation

Student ratings of different techniques

Students were asked to rate the effectiveness of the use of active learning techniques in their learning. A total of 44 students responded to this survey. The responses were provided on a scale of 1 to 5 (5-excellent and 1-poor). The averages are provided in Figure 1. In general, all the active learning techniques are rated highly. There was not much difference in the way group projects (average of 4.34), formative quizzes (4.47), in-class team work (4.32), and instant feedback (4.32) were evaluated. However, unsurprisingly, a more hands-on activity such as database in-class exercise (4.77) was rated slightly higher than other techniques. This analysis suggests that students evaluate the use of active learning techniques favorably.
Figure 1. Student ratings of effectiveness of some active learning techniques

Statistical comparison of traditional lecture vs. lecture with active learning techniques

To test for statistical evidence that integration of active learning techniques improves student self-reported measures of course effectiveness, one requires an experimental set-up in which one instructor teaches two classes with the same materials but uses active learning techniques integrated with traditional lecture in one class and traditional lecture in other class. This author taught an MIS class in the Spring 2010 semester using traditional lecture and revised the class to include active learning techniques with traditional lecture in the Spring 2011 semester. The material used was the same for both classes. Student self-reported scores are compared between these two classes on three variables: course was a valuable learning experience (course valuable), course improved ability to analyze solutions to business problems (analysis skills), and overall performance of instructor (instructor effectiveness). The average ratings on a scale of 1 to 5 (5-excellent and 1-poor) with standard deviations are presented in parentheses in Table 2.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Number of respondents</th>
<th>Course valuable</th>
<th>Analysis skills</th>
<th>Instructor Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2010 (traditional lecture)</td>
<td>21</td>
<td>4.57 (0.98)</td>
<td>4.67 (0.65)</td>
<td>4.74 (0.62)</td>
</tr>
<tr>
<td>Spring 2011 (traditional lecture integrated with active learning)</td>
<td>21</td>
<td>4.90 (0.3)</td>
<td>4.85 (0.39)</td>
<td>4.90 (0.30)</td>
</tr>
</tbody>
</table>

Table 2. Student self-reported measures on three assessment measures

An independent samples t-test was conducted to compare differences in assessment ratings between the class taught with active learning techniques and the class taught with traditional lecture. There was not a significant difference in the scores for course being valuable for the active learning class (mean=4.9, std.dev=0.3) and the traditional lecture class (mean=4.57, std. dev=0.98); t(24)=1.49, two-tailed p=0.15. In addition, the difference in scores for ability to apply concepts is also not different between the active learning class (mean=4.67, std.dev=0.65) and the traditional lecture class (mean=4.85, std. dev=0.39); t(31)=-1.16, two-tailed p=0.25. Finally, the difference in scores for instructor effectiveness is also not different between the active learning class (mean=4.74, std.dev=0.62) and the traditional lecture class (mean=4.9, std. dev=0.3); t(29)=1.1, two-tailed p=0.28.

While the differences may not be statistically significant between the two teaching methods, all three measures showed positive improvement for the class taught with active learning techniques.
CONCLUSIONS

Despite the lack of statistical evidence of the effectiveness of active learning techniques, this instructor was able to witness many positive changes in student attitudes and behaviors using active learning techniques. First, use of active learning techniques promoted class attendance and involvement. For instance, the instructor told students that some multiple choice questions embedded in slides and articles presented by other students will be part of the examinations. In addition, in-class team exercises ensure that team member participation is highly visible. Students become aware that regular absences hurt team performance and affect peer ratings. All these measures ensured a high degree of attendance and involvement in the course in which attendance is not registered by the instructor.

Second, use of collaboration systems to perform student projects meant that students practiced what they learned. The use of Google Docs also ensured that students could minimize physical meeting time outside the classroom. Third, the use of a number of active learning activities ensured that students were able to involve themselves in higher-order thinking and benefit from increased understanding of the material.

However, there are many lessons learned in the process. Successful execution of active learning methods requires constant reflection and a lot of effort on the part of the instructor to prepare and deliver the material. There are some textbooks that are beginning to emerge with a focus on teaching content with engaging activities (Belanger and Van Slyke, 2011). Instructors are urged to explore a variety of textbooks to test their suitability to their courses. Second, team projects occasionally have the issue of unequal participation among team members. Peer ratings are typically effective in curbing free-loaders. Third, use of active learning offers continuous opportunities for improvement. For instance, to better implement instant feedback, this instructor is contemplating using a web-based polling technology. Finally, use of active learning techniques, if not carefully planned, may impact instructor’s ability to cover all the intended topics.

In conclusion, this paper describes a methodology that recommends the use of active learning techniques to be integrated with traditional lectures. No one size fits all. Instructors planning to use this approach must consider the size of their classes (larger classes may require different active learning techniques), the ability to take risks in the classroom to pause lectures regularly to include student activities, and specific active learning techniques that suit class material and personal teaching style. The use of an active learning method has been very rewarding and creates excitement in the classroom. The increased engagement of students is readily apparent compared to a traditional lecture format. The author hopes that several others will follow this path to make their classes engaging and interesting.

REFERENCES


