Active Learning in the Library Instruction Environment: An Exploratory Study

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Abstract: This paper describes an exploratory study investigating the impact of problem-based learning and clicker technology as active learning strategies at the American University of Sharjah Library, United Arab Emirates (UAE). Studies compared traditional and active learning classes. The present article maps the successes and challenges of these unique classroom encounters, and through correlation of findings from a broader educational context, considers the impact of these teaching strategies on student performance in the library instruction environment. Results provide insight into the potential and implications of active learning strategies as a means of engaging students in the learning process and the inherent difficulties associated with measuring impact on student learning. Future studies should consider other variables affecting student learning including student motivation, engagement, and learning styles, and consider a range of alternate assessment models from the education field.

Introduction

There is little doubt that librarians today are faced with a number of challenges influencing decisions related to the design, delivery, and assessment of information literacy instruction programs. The demands of accreditation and international standards reviews have forced institutions to recognize information literacy (IL) more fully within the context of the wider educative community as critical to student learning. As a result, libraries face increasing pressure to demonstrate and quantify their information literacy successes. Indeed, the ACRL Research Planning and Review Committee cites this increasing pressure to quantify impact on student learning outcomes and student engagement as one of the top trends facing academic libraries in 2010.1
For many, and perhaps as a result of accreditation-driven mandates, library instruction is often seen as an “add-on” component to content level or academic writing courses that students must complete to meet course requirements. This has a negative impact on perceptions of information literacy (IL) and the role librarians play as partners in the research process. Librarians must find ways to better contextualize or situate information literacy instruction within the larger framework of courses to ensure that the relevance and importance of IL is understood.

While students’ changing needs and expectations compound the difficulty, librarians have sought to develop more dynamic and diverse approaches to IL instruction. The challenge to engage students is of particular importance. As Stephen Bell so aptly describes, the “I already know this” syndrome – or the “I already know this” syndrome – is a tenacious response to contend with. Students genuinely believe that they already know what the librarian is about to rehash and that they have seen it all before. The pressure is on librarians to employ different pedagogical approaches to ensure students can distinguish between sessions and recognize different features.

How best to teach a class that yields the best student learning outcomes is an iterative process and requires continual reflection on our pedagogical beliefs and practices. Discovering the best methods and experimenting with these takes time, patience, and the courage to fail. It is important that we ground our efforts on the ACRL standards and effective assessment measures to strike a balance and ensure that we do have a lasting impact on students’ approach to information discovery and its application.

Active learning methodologies offer alternate approaches for enhancing instruction and building on student learning experiences. A review of recent literature published in the area of library instruction and IL provides testament to the fact that a range of active learning strategies are being explored and successfully incorporated into library instruction and across different discipline areas. Clicker technology and problem-based learning (PBL) scenarios are two such examples that have recently gained popularity. This exploratory paper describes a pilot (Study I) and follow-up study (Study II) investigating the impact of these specific active learning methodologies in a library instruction setting at the American University of Sharjah (AUS), United Arab Emirates. It maps the successes and challenges of these unique classroom encounters, and through correlation of findings from a broader educational context, considers the impact of these teaching strategies on student performance in the library instruction environment. Results provide some insight into the potential and implications of active learning strategies as a means of engaging students in the learning process and measuring impact on performance.
Background

The American University of Sharjah is located in the United Arab Emirates and is a co-educational institution first founded in 1997 by the Ruler of Sharjah, His Highness Sheikh Dr. Sultan Bin Mohammad Al Qassimi. The university is based on a US model of education and is recognized as a leading university in the Persian Gulf, serving students from the region and around the world. The student body is unique in this multicultural setting, the majority with ESL backgrounds. All AUS students are required to complete information literacy (IL) training. The library instruction sessions are delivered as part of a foundation Academic Writing course, English 204, which is a required component of the General Education Program. In the first weeks of each semester, librarians deliver 50 minute ‘one-shot’ research skills classes to over 400 students in 25 sections of English 204. The General Education program includes an information literacy specific outcome that proposes that students should be able to “identify and access information resources efficiently and effectively based upon the Association of College and Research Libraries (ACRL) standards.”

Formal assessment of the AUS Library’s IL program has been developed over the past three years and is ongoing. In 2008, an assessment study of the IL program identified several IL competency areas where improvements could be made to library instruction classes. These areas included students’ ability to evaluate resources, identify characteristics of scholarly articles, understand citations, and build effective search strategies. In response, librarians decided to target areas highlighted in the original assessment study through an IL program redesign. This decision would allow librarians to make continuous quality improvements in program delivery and outcomes, ensuring the demands of ongoing accountability and accreditation requirements could be met. A redesign also offered an opportunity for librarians to explore and apply active learning strategies as a way of injecting extra life into information literacy sessions, and a chance to investigate the impact of active learning as a program enhancement tool.

In 2009, the university awarded an internal grant to the library that supported the purchase of a “personal response system” or clicker technology. As a technology used to promote active learning in the instruction environment, clickers have seen widespread implementation within academia and across the curriculum, particularly in large lecture hall courses. A number of case studies describe librarians, including Christina Hoffman and Susan Goodwin, Barbara Petersohn, and Emily Dill, beginning to explore and test the application of clickers for library instruction. As an alternative to the traditional lecture style approach to library instruction and as an opportunity to explore one active learning approach as enhancement to existing library sessions, AUS librarians designed a new IL class incorporating the use of clickers. In the Fall of 2009, Study I was initiated to investigate the impact of active learning, namely clickers, on student learning in the library instruction environment.

Study I aimed to investigate the following research questions:

• Do clickers have a positive impact in the library instruction environment?
• How do students perform during in-class activities measuring certain IL skills?
• Are students able to demonstrate an increase in IL skills following class attendance? If so, is this attributable to the use of clickers?
Building on findings of this first study, Study II followed in Spring 2010. Study II extended the initial research findings to focus on problem-based learning as an alternate active learning strategy in comparison with more traditional techniques.

In meeting our original IL program redesign plans, and additionally responding to calls in the literature for a comparison of different active learning methodologies, Study II aimed to investigate the following research questions:

- Do other active learning techniques produce positive results?
- Which technique has the most positive impact?
- How does student performance compare?

These studies necessitated the design and delivery of three unique library sessions. The first was designed around the use of clickers, the second relied on a problem-based learning scenario, and the third utilized a traditional lecture approach. Results provide insight into the potential and implications of active learning strategies as a means of engaging students in the learning process and measuring impact on performance.

**Literature Review**

Active learning is a form of experiential learning, and is well documented in the literature as a teaching methodology that gets students dynamically involved in the learning process. Charles C. Bonwell and James A. Eison suggest that a working definition be “anything that involves students in doing things and thinking about what they are doing.” Having students ‘do’ and ‘think’ about what they are doing forces them to analyze, synthesize, and evaluate information, which increases their retention and understanding of concepts. With active learning, there is more of an emphasis on developing skills; students are engaged in reading, writing, discussing, and solving problems and in doing so, begin to explore their own attitudes and values. Increased awareness of the value of active learning in higher education has been noted in the literature over the last ten years, and across various disciplines. Emphasis on incorporating active learning approaches in higher education has been noted as far back as 1984, with the National Institute of Education recommending that faculty use active modes of teaching to ensure students take greater responsibility for their learning. Similarly, recommendations from the National Research Foundation, the National Science Foundation, and the American Association of Higher Education indicated acceptance of active learning as good practice over more traditional classroom and lecture style approaches.
Nor is the concept of active learning and its benefits new to librarians. As the ACRL Guidelines for Best Practice highlight, active learning strategies offer alternate approaches for effective information literacy program delivery. Bell has shown that diverse approaches to teaching and the use of active, collaborative activities build on students’ prior knowledge, support multiple learning styles, improve student retention of material, increase student interaction with information, and also increase student responsibility for their own learning. With greater understanding of the benefits of active learning, delivery of library instruction is becoming more focused on engaging students in an active learning experience.

Individual strategies to promote active learning in the classroom abound and include a wide range of activities and applications across different disciplines, from class discussion, hands-on activities, group exercises, problem-based activities, peer teaching, and simulations to interaction with new technology. Emphasis is on maximizing the classroom learning experience and environment and de-emphasizing the traditional lecture format. Overall, studies in the broader educative context report improved student performance when comparing active learning over more traditional teaching approaches. However, as Margie Martyn points out, many of these individual studies provide evidence highlighting the “affective benefits” of individual approaches to active learning, such as increased student engagement, interest, discussion, and interactivity. This does not necessarily equate to improved student learning outcomes or increased learning performance. Many different active learning strategies can be utilized by faculty, for different purposes. According to Marcia Keyser, the method chosen depends on the course being taught and the level of students. The change in pedagogical focus from passive to active learning appears to produce the better learning outcomes, rather than the particular or individual active learning approach or strategy.

Librarians have embraced many active learning methodologies as opportunities to enhance their own session delivery and to engage students in one-shot library sessions. An annual review of the literature provides many examples at various institutions of librarians employing dynamic, diverse, and interactive strategies requiring students to be actively involved in the learning process. Keyser provides a good overview of a range of active and cooperative learning applications that can be introduced for different purposes within the library instruction setting, and highlights the advantages of these techniques over traditional lecture-based library instruction. Keyser surmises that such teaching styles can play an important role in how a class learns effective library use concepts. She includes a summary of earlier library literature highlighting the benefit of active learning in meeting learning needs and styles of diverse students, improving student retention, increasing student interaction, and responsibility for their own learning. The same is echoed by Bell in 2006. Fiona Hunt and Jane Birks, working in a UAE academic library setting similar to the researchers’ own, speak of students’ active involvement in the learning process as “creating excitement and enthusiasm for the material,” which “increases the likelihood that students will see the transferability of IL concepts and skills.” As with the more general education context, direct correlations between active learning and student learning in the library instruction environment appear to be more generally linked with “affective benefits” rather than specific learning outcomes themselves. When considering and drawing conclusions about the direct impact of active learning on student learning outcomes, it is important to recognize that the benefits of active learning are not limited to the classroom setting and can extend to the library environment as well.
learning approaches on student learning in the library classroom, one potential research direction suggests the comparison and contrast of individual teaching approaches.

The studies presented in this paper focus on two active learning methodologies and their impact on student performance: problem-based learning and the use of clicker. Both have been employed and reported upon extensively in the literature as viable alternatives to traditional lecture style classes and as means for librarians to provide hands-on, active instructional experiences for students. Within the context of alternate approaches for active learning program delivery, comparing and contrasting student performance and student learning experience offers potential reward.

Problem-based learning scenarios involve students working together to strategize and solve a problem. Learning is centered on authentic real-world contexts, which are designed to engage students in direct inquiry and problem solving. According to Kellah M. Edens, the strategy has been widely used in the medical education environment, teaching students how to think and solve problems based on real-world scenarios as health-care professionals. Problem-based learning has also been incorporated as an effective teaching methodology in a range of undergraduate settings. Edens provides a helpful analysis of the types of scenarios that have been successfully employed across various disciplines. Overall, results show that PBL is a viable approach for engaging students and creating learning situations that allow students to construct their own understanding and knowledge outside of the traditional lecture style classroom. Cindy Hmelo-Silver corroborates, stating that “PBL offers the potential to help students become reflective and flexible thinkers who can use knowledge to take action,” suggesting also that opportunity exists for further exploration of how PBL operates in the context of different learning variables, such as intrinsic motivation and collaboration skills.

In the library instruction environment, Michael Pelikan describes the design and delivery of a first-year seminar course, using PBL as a focus for information literacy instruction. He sees PBL as a foundation for student research that goes beyond the traditional notion of “library research.” Debora Cheney sees PBL as providing a process model, which students can employ to use information outside of the classroom as they progress as researchers. It challenges and engages students in critical thinking and is also a way to facilitate greater student-to-student and student-to-instructor interactions. Within a time frame of a fifty minute one-shot instruction session, Barbara Ferrer Kenney contends PBL is a “particularly useful option for a student-centered experience.” Students are engaged and motivated as they work together, they take responsibility for their own learning, and they discover...
how the library can support learning. The teaching environment becomes more dynamic as librarians have an opportunity to interact more with the students as facilitators or guides. Cheney points out that PBL sessions provide relevancy for students as they are better able to link the library instruction session to their own research needs.

As an alternate option for incorporating active learning into sessions, the literature also reports extensively on clicker technology. Through wireless connectivity, students use clickers to respond to instructor questions posed through an application such as PowerPoint. Responses are anonymous and answers are tallied in graph format allowing immediate group performance feedback during class time. Employed in-class, clickers are used to test understanding of important concepts and act as a gauge for instructors needing to reinforce concepts that might otherwise have been overlooked in traditional lecture or demonstration settings.

In reviewing the literature, the majority of studies report on attitudes surrounding clicker use. There are countless case studies from across various curricula providing anecdotal evidence of both student and faculty experience or perceptions in using the technology. The response is positive overall. In one recent study, interviews were conducted with students, teaching faculty, librarians, and administrators at the same institution. The study focuses on each groups' experience of clicker use and provides a useful summary of attitudes, echoed throughout the literature. Clickers are a way to engage students, to stimulate interest, to appeal to different styles of learning, and as means of capturing data on student comprehension. Through use of clickers, student participation rates increase and students become more animated as they respond to the game-like and competitive nature of the technology.

In their comprehensive review of the published literature, Vicki Simpson and Martin Oliver summarize how practice has matured from 2002, with educators now beginning to investigate the role of clickers within particular contexts and their overall contribution to the classroom environment. Martyn notes in 2007 that research on learning outcomes has been limited to clickers and traditional lecture comparisons only. Further research is needed to determine whether clickers complement or surpass other active learning approaches in improving student learning outcomes.

In a library class setting, Hoffman and Goodwin see clickers as a way to move beyond the more traditional lecture style type of instruction session toward “a more robust learner-centered environment,” and as a means of enhancing the quality of library sessions, but note that the effectiveness of clickers requires further research. Two studies do just that, evaluating clicker effectiveness in terms of student learning outcomes and short-term recall of library instruction materials. Results present conflicting conclusions. While Petersohn finds that the use of clickers improves learning for simple concepts in the library instruction environment, Dill finds that clickers do not have a positive effect on short-term recall of library instruction material, and, as a result, may not always be effective in aiding student learning. Much is dependent on how the technology is employed and the pedagogical scenarios that are used. Dill suggests that research into the comparison of clickers with other active learning methodologies is necessary.

In responding to assessment demands and continuing quality improvements at a local level, AUS librarians redesigned information literacy course delivery for the English 204 program initially through the introduction of clickers. Integration of this technology provided the opportunity to investigate the impact of this one active learning methodol-
ogy against alternate approaches, namely PBL scenarios and the traditional library class. It was hoped that results would inform the clicker studies carried out by Petersohn and Dill, and build upon the library literature discussing implementation of PBL and other active learning approaches through comparative analysis of different class types and in particular, their impact on student learning. Librarians sought to lend credence to the notion that a change in pedagogical focus, from passive to active learning, will produce better learning outcomes. The remainder of this paper details the methodology by which the AUS Library studies were conducted, provides an analysis of these studies’ findings and discussion of inherent difficulties encountered, and proposes potential areas for further investigation into the area of student learning research.

Methodology

Initiated in the Fall of 2009, with 143 students from 8 sections of the English 204 program participating, Study I integrated the use of clickers into the library classroom. The number of participants constituted a third of all sections taking the library component for that semester. This initial library study focused on three key areas: students’ ability to evaluate resources, their ability to identify characteristics of scholarly articles, and their ability to recognize citation components. As discovered in a previous 2008 study, these are skill areas deemed problematic for AUS students. A newly designed IL class targeted these specific skills and integrated the use of clickers.

Before attending their library session, students completed a compulsory pre-class assessment administered via the university’s online course management system. This consisted of ten multiple choice questions assessing all identified IL skills areas. Students next participated in a hands-on active learning library session utilizing clickers. Clickers were used on a number of levels and at different stages throughout the session to test students’ understanding of identified IL concepts and to provide immediate feedback on progress during class time. Toward the end of the semester, the same cohort of students participated in a post-class online assessment utilizing the same quiz as before to assess the impact of active learning, and clicker technology specifically, in the library instruction environment.

Study II, building on findings of the first, was initiated in the Spring semester of 2010. This second study included 199 participating students, constituting 12 sections of the English 204 program. This time the number of participating sections equaled half of all sections taking the library component for that semester. In this study, three alternate library classes were designed as a means of testing further the impact of active learning in the library instruction environment. Four sections participated in a session incorporating clickers, four sections in a class based on a problem-based learning activity without the use of clickers, and the remaining four sections participated in a more traditional lecture style library session. Each class was designed to focus on the students’ ability to identify and combine key concepts and refine search results. It was felt that these competency areas, although different from those assessed in the first study, are subsequent steps in the natural research process and as such, provided more pedagogical scope for the class designs required. Data were collected and reviewed through various in-class data capture methods including student worksheets, clicker responses, and formative feedback. Once again, all students completed a compulsory pre- and post-class assessment utilizing the
same questions. The intention of the second study was to provide comparative data on
other active learning techniques to identify the active learning teaching methodology
with the most positive impact.

Class Design
Before results of both studies are presented and analyzed, a brief overview of the three
different library sessions delivered is warranted.

The traditional class, typical of all previous instruction sessions, rested upon a
lecture and demonstration format. Students selected from a range of research topics
and followed the librarian step by step through the entire research process, from brain-
storming the topic, identifying related keywords, to searching the catalog and a library
database to select and retrieve an appropriate article. Students completed a worksheet
during the session.

The clicker session was built from lessons learned in Study I. In this class students all
worked with the same research question about the 2010 Haiti earthquake. Students were
all very aware of events and were keen to discuss social issues and provide opinions on
international response efforts. Students were guided through the research process, with
clickers used to reinforce the main competencies being tested. Clickers captured students’
progress during class time. Worksheets demonstrating students’ use of keywords and
search strategy were also collected.

In the problem-based learning class, students were presented with a controversial
statement taken from a local newspaper related to the environmental (and regional)
issue of desalination. In this library session, the desalination problem was presented
to student groups prompting group driven exploration and discovery of the library’s
resources. Librarians stepped in when group level assistance was required, and group
steering was needed. Time was given at the end of the session for reporting, discussion,
and follow up demonstration. For in-class data capture, students were asked to log their
experiences on worksheets, listing keywords explored, results, tactics, and discoveries.

Results
Study I
Of all participating students, 83 percent thought clickers to be an effective learning tool.
Study I explored the use of clickers further, however, by setting out to determine if the
use of clickers had a positive impact on the library instruction environment and how
students performed with the use of this active learning technology. In drawing conclu-
sions, data from in-class clicker use and from pre- and post- library class assessments
were compared. Overall results highlighted a 6 percent skills improvement following
clicker class attendance.

The use of clickers during class time allowed librarians to focus on and assess in-
dividual information skills areas a number of times. When students from six sections
were assessed on citation component recognition using clickers during class time, a three
percent improvement in-class was noted.

When students were assessed on the same IL skill a number of weeks following
their library session, a 14 percent improvement over initial pre-class results was evident.
(Table 1)
Table 1
Did students’ IL skills improve following clicker class attendance?

<table>
<thead>
<tr>
<th>IL Skill Tested</th>
<th>Pre-Class score</th>
<th>Post-Class Score</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall skill</td>
<td>64%</td>
<td>70%</td>
<td>+6%</td>
</tr>
<tr>
<td>One skill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citation Recognition</td>
<td>41%</td>
<td>55%</td>
<td>+14%</td>
</tr>
</tbody>
</table>

Table 2
Did students’ IL skills improve during the clicker class?

<table>
<thead>
<tr>
<th>IL Skill Tested</th>
<th>1st In-Class Score</th>
<th>2nd In-Class Score</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citation Recognition</td>
<td>71%</td>
<td>74%</td>
<td>+3%</td>
</tr>
</tbody>
</table>

Study II
Initiated in Spring 2010, and as an extension to the first study, Study II set out to explore whether other active learning techniques such as problem-based learning produced positive results and whether it would be possible to identify which active learning technique has the most positive impact. To draw conclusions, results from three separately designed library classes were studied. These classes included a clicker-based class, a problem-based learning class, and a more traditional demonstration style class. Four sections per teaching method were included in the study; 79 students in the clicker group, 68 students in the PBL group, and 52 students in the traditional lecture group.

When comparing pre- and post-library class assessments across each group, there was an increase in all students’ information literacy scores, regardless of the type of library session attended. The highest performers, with an increase of 2.7 percent, belonged to the traditional group.

When assessing scores for individual key competency areas, measuring against pre- and post-library class results, the following data was collected.

For the first competency of “Key concept identification,” the traditional lecture class scored highest with an 8 percent increase from the pre to the post class quiz.

For the second competency, “Combining key concepts,” two questions were asked. In the first question, the traditional lecture class scored highest with a 14 percent increase.
but a follow-up question demonstrated a dramatic decrease for the same group (-7 percent) indicating reduced performance in comparison against the other two groups. It is interesting to note that no group improved on their score. The PBL class in this instance scored the highest.

The third competency reviewed students’ ability to refine search results. The clicker group out-performed the other groups with a score of 3.4 percent. However, when tested for a second time in this skills area the clicker group’s average score dropped considerably. This time, the PBL group showed a marked improvement, rising to 15.5 percent; an increase outperforming all other groups.

Table 3
Did students’ IL skills improve following library class attendance?

<table>
<thead>
<tr>
<th></th>
<th>Clicker class</th>
<th>Traditional class</th>
<th>Problem-based learning class</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0.3%</td>
<td>+2.7%</td>
<td>+2.4%</td>
<td></td>
</tr>
</tbody>
</table>

Table 4
Did students improve in IL skills focus areas during class?

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Clicker class</th>
<th>Traditional class</th>
<th>PBL class</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Key concept identification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 1</td>
<td>+0.8%</td>
<td>+8.0%</td>
<td>+2.0%</td>
</tr>
<tr>
<td>Question 2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B. Combining key concepts with Boolean operators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 1</td>
<td>-2.3%</td>
<td>+14.6%</td>
<td>+3.9%</td>
</tr>
<tr>
<td>Question 2</td>
<td>-5.5%</td>
<td>-7.2%</td>
<td>-3.7%</td>
</tr>
<tr>
<td>C. Refining results</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 1</td>
<td>+3.4%</td>
<td>-0.3%</td>
<td>-0.6%</td>
</tr>
<tr>
<td>Question 2</td>
<td>-0.8%</td>
<td>-3.7%</td>
<td>+15.5%</td>
</tr>
</tbody>
</table>
Analysis

In analyzing results from both studies, librarians learned that eighty-three percent of students from Study I thought that the use of clickers in the classroom was an effective learning tool; this echoed reports in the professional literature highlighting the “affective benefits” of clicker use. Heartened by students’ resounding reception of the clickers, librarians were further encouraged by the six percent increase in assessment scores between the pre- and post-class quizzes in Study I. Results, it seemed, correlated with the general literature surrounding active learning, and lent support to the notion that a change in pedagogical focus from the passive to more active format of class produces improved student performance. Findings also corresponded with Petersohn’s pilot study results which highlighted the effectiveness of clickers as a means of increasing student performance. Despite the positive results, however, librarians were unable to confirm whether this noted increase in performance was attributable to the use of clickers or the type of active learning approach employed. As Dill suggested in her study, which contested the effectiveness of clickers as an aid to student learning, when considering impact, questions pertaining to the technology and its application within different pedagogical contexts remain.

Study II explored this issue further, by comparing against another active learning format, independent of technology, and also against the more traditional style class. This follows Dill’s suggestion to compare clicker use against other active learning methodologies, and extends exploration further to include traditional style classes. Librarians hypothesized that a repeat of improved results across another active learning class would reinforce the positive benefits of a change from the passive to more active style of class. If clicker class results outperformed the second active learning approach, then inferences surrounding the influence of technology and its impact on performance could also be made.

Results of Study II indicated that the traditional classes scored highest overall. This contradicted the initial findings and librarians’ assumption that active learning has the most impact on student performance. When focusing on individual skills areas to identify whether scores showed any increase, or whether any patterns across the other active learning class type could be established, results indicated inconsistency in skills attainment across different groups. Study I assessed citation recognition with results showing improvement. This competency area was tested twice during a library session and in doing so, provided students with the opportunity to improve their learning specific to this skill. Study II focused on three individual competencies: key concept identification, combining key concepts, and refining search results. Classes allowed for repeat testing of these skills. Without clear patterns between assessment scores however, librarians in these studies were unable to determine which active learning teaching strategy had the most positive impact on student learning - clickers or problem-based learning.

Results of Study I had led librarians to believe that active learning strategies produced better student performance. In Study II, the reverse is apparent with those students attending the traditional pedagogical session outperforming those in both active classes. This has obvious impact on overall conclusions regarding the effectiveness of approaches and conclusions. When looking for any positive outcome, and in assessing overall pre-
and post-assessment scores, librarians noticed improvement in overall student IL performance scores regardless of class type attended, suggesting that each approach appears to be valid and is an effective means of instruction. In the light of these studies, however, results were unable to confirm which active learning approach was the most effective overall. Nor could the studies provide evidence to support the notion that a change from passive to active learning produces improved learning outcomes.

Results of Study I had led librarians to believe that active learning strategies produced better student performance. In Study II, the reverse is apparent with those students attending the traditional pedagogical session outperforming those in both active classes.

Discussion

In reviewing the findings, librarians considered a number of factors that may have had an impact on the results. All point to issues surrounding design and implementation of these initial studies and to the need to develop further studies that take into consideration broader implications affecting the incorporation and measurement of active learning in instruction settings. Librarians were naïve in their assumption that a comparison and contrast of different active learning classes and student performance scores, as suggested in the literature, would produce conclusive results. These initial studies uncover a range of important factors that need to be considered, if further investigation into the impact of active learning on student learning or performance is to be made. As the literature suggests, there is opportunity to explore and investigate different active learning methodologies, but as these studies have revealed, conclusions cannot be so readily drawn. A greater understanding of student learning and awareness of the range of external factors that can impact learning is essential. There is great potential for further research, but further studies should draw upon findings and models proposed in the field of education. The remainder of this paper highlights those variables considered to have influenced the AUS librarians' studies and reflects on how further research could add to investigations into active learning and its impact on student learning overall.

Essential to a move forward is a fuller understanding of the difference between the terms “student performance” and “student learning.” This has an impact on how assessment scores are interpreted and conveyed. What do assessment scores actually reveal about the instruction? Is an increase in scores full indication of an increase in learning? Are results, although an indication of improvement in test scores or performance, an indication that students are demonstrating learning? It was felt that Study I was not comprehensive in determining the primary reasons for student improvement. A distinction between student performance and student learning was not
clearly drawn. Were increased outcomes a direct result of active engagement with the technology? Or was this a direct result of students’ ability to accurately recall information? Could other factors have been involved? To draw firmer conclusions about the impact of technology such as clickers in particular, other assessment approaches could be investigated. One approach would be to replicate Study I with clickers against the traditional lecture class measuring pre- and post-test results when assessing performance. An additional approach could be to change the focus of the traditional lecture class to incorporate more active learning components. This would provide better insight into the potential influence of the technology. To measure learning outcomes, questions related to learning variables and other factors influencing learning such as student motivation, student perceptions, learner confidence, and individual learning styles need to be raised. It is vital to consider the range of variables that may affect student learning. To build on studies and to extend research in the library field, librarians would benefit from exploring areas of educational psychology to better grasp the complexities of learning and teaching. Learner attribution, instructional design theories and models, motivation, meta-cognition, and learning transfer are just a few aspects worth further investigation. Studies could be extended to investigate students’ transferability of skills within various learning, and even cultural, contexts.

Investigation into recognized and valid instruments designed to measure learning in the educational field and acknowledgement of the degree of complexity required to measure and understand meaningful learning is a necessity if librarians are to extend the research further into active learning and its impact on student performance. The lack of a standardized test instrument is something that AUS librarians note as an impediment in their own initial studies, in addition to too many different competency areas being tested in-class between groups. Due to the pedagogical design of each class type, the assessment questions changed to reflect focus of the competencies being taught. If the same competencies had been measured across classes with an assessment instrument reviewed for validity and reliability, librarians may have had a better opportunity to compare and affirm results. This does not necessarily mean that results would have changed. What it does raise, however, is a question as to whether the design of different classes necessitates different approaches and whether it is in fact possible to design assessments that can be utilized across all different class types.

Instructor characteristics and the natural evolution of librarians’ teaching skills between studies are also variables for consideration when comparing outcomes over time.

toward the incorporation of technology and active learning approaches into teaching, AUS librarians can pinpoint over the course of these studies that an emphasis on active learning over time, coupled with growing experience and more confidence working in active learning environments, influenced teaching strategy in subsequent traditional demonstration classes. This may in fact have also influenced student achievement in
the traditional lecture sessions linked to the AUS studies. In measuring the impact of active learning approaches against more traditional classes, attention to the inclusion of active learning components, such as group discussion and questioning strategies, needs to be accounted for.

In an attempt to understand better the outcomes of Study II, librarians conducted post class student interviews, post class formative assessments, and reviewed student critical reflection essays. This helped underscore other issues related to initial study design and provides insight into the importance of collecting such feedback in further studies. Student comments revealed that the quiz was not an accurate representation of how they search for academic information, and many considered the class topic to be boring and were frustrated when they did not find appropriate resources. Again, attention to the validity and reliability of the assessment instrument and class design is needed. In hindsight, librarians felt that additional information could have been gathered from student feedback. As the traditional lecture group of students had outperformed the other class types, it would have been beneficial to try to isolate those factors of the traditional lecture class, which students deem influential and are considered to have the most impact. Collecting student feedback is one way to consider the range of variables that may affect student learning, such as student motivation and different learning styles.

Garnering faculty support is also essential, yet problematic in many situations. For many courses, and in those used to conduct these studies, IL assessment is not integrated into the overall course grade. As faculty reported in discussions with librarians following the studies, students are well aware of this. Several students commented that the post class quiz was not taken seriously since it does not count toward their final course grade. Not all faculty required their students to take the pre-class assessment, so pre- and post-comparison data was not available for all sections. Semester timing of the library sessions seemed to trouble both faculty and students, posing an additional problem. Students wondered why their library session came before their research topics were approved. Moreover, some faculty expressed concern about having library sessions too early in the semester before students begin their research. They believed that students would not retain or be able to apply skills taught in class to their actual research. Finding support from faculty and running library sessions later in the semester when students have already embarked on the research process is a preferred option for future studies, though not always possible.

A review of the AUS study findings has highlighted quite a number of underlying variables, or factors influencing results and hindering conclusive findings. When measuring the impact of different active learning approaches in instruction settings, broader implications need to be considered. These include our own understanding of student learning over student performance and the many variables that may influence learning, such as student motivation and different learning styles. These are fields falling under the scope of educational psychology. An area of further research includes investigation into valid assessment instruments to effectively measure learning. Can these instruments accommodate different pedagogical class focuses? Factors including the natural progression of instructor experience over time and the importance of faculty support, not to mention the necessity of student feedback, can all contribute to the design of additional studies lending to continued research into this field.
Conclusion

The general literature articulates the affective benefits of active learning as beneficial in engaging students and offering a diverse approach to the learning environment. Readings point to an understanding that a change in pedagogical focus from a passive to more active class format produces improved learning outcomes, though as the literature also highlights, investigation into the impact of such approaches is necessary. Previous studies are noted as limited in their analysis of different classes as a measure of student performance.

In redeveloping their own IL program to incorporate an active learning foundation, AUS librarians conducted two studies to determine the impact of active learning in the library instruction environment through contrast and comparison of two different active learning approaches and against traditional class types. The first study concentrated on the use of clickers on overall student performance, the second focused on an alternate active learning approach comparing problem based learning against clickers and traditional demonstration style classes. Researchers hypothesized that results of both studies would provide insight into the potential of active learning, and provide evidence of positive impact on student learning outcomes. Results instead uncovered contradictory evidence undermining initial goals of the study and highlighting a number of flaws in the research methodology undertaken. Librarians were too quick to respond to the call for analysis or comparison of different class types and were naïve in their assumption that improved student performance results across different active learning classes would provide reliable comparative data and evidence. In setting out to determine the impact of active learning in the library instruction environment with a focus on student learning, a better approach would have been to explore different active learning methodologies and to consider the range of factors impacting learning before selecting an assessment focus.

The work of these initial studies, despite contradictory results, has been important for a number of reasons. Not only did it allow librarians to experiment with different approaches to information literacy instruction and to enhance and redevelop an existing IL program, the work has provided insight into the potential and implications of active learning strategies as a means of engaging students. The research also has raised awareness of the issues surrounding the measurement and understanding of student performance and more critically, student learning. In our own teaching realm, we will continue to explore active learning as we move forward with program development and contextualizing information literacy within the academic framework.

Further investigation into the impact of various active learning approaches is advisable, and would benefit from a consideration of the variety of factors touched upon in this paper. A direct comparison or contrast of active learning approaches, as called for in the literature, requires investigation into numerous areas surrounding learning research. It is vital to consider the range of variables that may affect student learning outcomes, including factors such as motivation, engagement, and different learning styles. Valid assessment instruments require investigation, the influence of instructor experience in active learning settings warrants study, and the contribution of faculty support and student feedback remains essential. Continued research into this field can yield valid and important results in relation to student learning. This paper has reflected on the challenges of initiating such a study and has laid the groundwork for future research.
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Notes

5. American University of Sharjah, Undergraduate Catalog 2009-2010 (Sharjah, UAE: American University of Sharjah, 2009), 37.
16. Carmichael, Team-Based Learning, 54; Presby and Zakheim, “Enhancing Student Learning, 153.
29. Ibid., 390.
30. Cheney, “Problem-Based Learning,” 505.