

A PILOT STUDY ON SUBJECT MATTER EXPERT-PEER LEARNING IN HIGHER EDUCATION: A CONTINUOUS IMPROVEMENT PROCESS

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ABSTRACT

AACSB International (Association to Advance Collegiate Schools of Business) accreditation requires business schools to gather data on student goal achievement. Unsurprisingly, data showed that students tend to forget content covered during their freshman and sophomore years. There was a marked decline in content knowledge between the time the content was first delivered and when students reached their capstone class. Therefore, researchers at a four-year institution of higher education developed a pilot study to evaluate the efficacy of peer-learning as a methodology to increase student content re-acquisition. This pilot study is a first step in a broader research agenda. Results from this study showed that peer learning was a successful student learning re-acquisition tool when used in the capstone class.

Key words: peer-learning, accreditation, pedagogy, capstone class

INTRODUCTION

The goal of a business degree program is to provide students with an education that prepares them for successful careers in the world of business. This aim mandates the integration into the curriculum of knowledge across the functional areas of several business disciplines. In

order to measure the effectiveness of the program, faculty members must develop measurable objectives by which they can evaluate the program and improve pedagogy for teaching these courses to ensure student success. An overarching expectation of a program, then, might be that graduating seniors are able to demonstrate their understanding of key concepts and theories in various specified functional areas of business by successfully completing a capstone course near the end of their program of study.

From the researchers' experience and past assessment data gathered at a four-year institution of higher education, insights from objective measures taken at different points in time showed that students lost content knowledge between the time the content class was taken and their graduation. For example, students took managerial accounting in their sophomore year, but the same students had forgotten much of this content knowledge by graduation. In order to increase the learning experience of students while remediating and maximizing content knowledge re-acquisition, faculty implemented a Subject Matter Expert (SME)-Peer Learning process in the business degree capstone course with the belief that this continuous improvement action would positively impact the student learning experience and outcome of knowledge learned across multiple business function areas.

REVIEW OF LITERATURE

Assessment of students' knowledge and skills is necessary to understand what learning has taken place within a program and if this learning has matched the goals of the program. T. W. Banta, M. Griffin, T. L. Flateby, and S. Kahn (2009) stated that educators must be able to identify assessment methods that establish a baseline of students' knowledge and skills and then provide documentation that learning has occurred. This documentation would provide accountability for all stakeholders to ensure that learning has taken place and is tied to program goals. They identified three assessment methods: electronic portfolios, rubrics, and online assessment communities.

A related concern involves the delivery of course content. Assessment should identify shortcomings in student learning that careful consideration of pedagogy may remedy. Which instructional teaching methods or strategies seem to work? E. S. Ebert, C. Ebert, and M. L. Bentley (2011) listed a variety of successful strategies. These strategies included the following: (1) instructor-led strategies like direct instruction, drill and practice, lecture, question and answer, and discussion, and (2) student-led strategies like mental modeling, discovery learning, and inquiry. Among these teaching strategies was also peer teaching.

Peer teaching was defined as a method of teaching through which a peer, one who is "equal in rank or experience," shepherded an associate through the learning experience. Research indicated that successful students placed responsibility for their learning on themselves (Fines, 2008). A cooperative learning experience or peer teaching device enhanced the learning experience. Students learning from peers involved a shared learning of knowledge and ideas between contributors and was considered an underutilized resource (Boud, Cohen, & Sampson, 2002). Students benefitted from the reciprocal peer teaching technique in two ways. First, they benefitted by explaining to another individual, in their own words, their understanding of concepts and ideas. Lord (2001) suggested that students working in groups tended to perform at a higher level on tests than those students learning material on their own. This is particularly true in regard to critical thinking and reasoning.

Secondly, the student had a more positive learning experience by hearing the explanation of materials presented by the peer (Landers, 2015). K. Goto and J. Schneider (2010) supported this notion. They contended that, in this model, students spending time recapping material and

explaining underlying principles of knowledge promoted critical thinking aptitudes, long term retention, and comprehension of more complicated ideas.

Dioso-Henson (2012) studied the effect of reciprocal peer tutoring on the performance of college physics students. The author discovered that the academic gains of college students who received peer learning tutoring versus non-peer tutoring were significantly larger than those of the traditional classroom instruction. Although formal peer-to-peer collaboration is well known in educational practices, this study compared the academic gains of college students enrolled in physics using “Reciprocal Peer Tutoring (RPT) with others using non-Reciprocal Peer Tutoring (non-RPT)”. The procedures developed were supported by on-line mentoring, and used student pairs. Students administered a practice test to one another, switching roles as one being instructed while the other acted as instructor. In the non-RPT group, one student was always the tutor and the other always acted as the tutored. It was discovered that “both types of peer tutoring produced significantly larger academic gains than traditional classroom instruction and RPT resulted in marginally larger academic gains than non-RPT”.

Another example of a peer- to- peer teaching model was presented in a material science course for mechanical engineering students in Berlin, Germany and reported by authors Pfennig and Hadwiger (2016). Lecture films created and presented in the classroom in a one term semester found that students watching these films performed slightly better in their testing results. Peer learning lecture films were also successfully implemented teaching to other complicated course subjects with similar results. The classroom results indicated the students who participated in the peer learning teaching activities benefited from the experience in film making and the peer- to - peer teaching approach as a positive form of lecture.

RESEARCH PROBLEM

Based on the peer-to-peer and assessment literature review and the authors’ desire to create a classroom environment within the School of Business that replicated the optimum teaching and learning environment, the goal of this pilot study was twofold. The first goal of this pilot study is to determine if there was a statistically significant increase in the students’ knowledge of key concepts and theories in the various functional areas of business due to the inclusion of the SME-Peer Learning Process in the capstone course. The second goal is to determine if this significant increase was equal to or higher than the established measure of 25%. Faculty decided on the 25% measure based on previous results of the post-test score performed in the School of Business. Students’ average in the post-test without the SME- Peer Learning process was 58%. Based on this number, faculty decided that a 25% increase was an acceptable goal. The 25% increase measure was agreed upon by a faculty council and approved by all faculty. The intervention required each student be designated as a Subject Matter Expert (SME) in one of the assigned disciplines for the duration of the capstone course. All students experienced the Peer Learning classroom environment. For the purposes of this study, this learning process was referred to as the SME-Peer Learning process.

The researchers expected there would significant improvement in School of Business Knowledge Exam (SoBUSKE) test results based on the implementation of the SME-Peer Learning process. By extension, the researchers expected the mean scores would demonstrate that student performance was higher than the scores on the pretest across all ten functional disciplines. Such findings would indicate that students performed at a higher level on the exam following the implementation of the SME-Peer Learning process and that the classroom learning experience

engaging students in the SME-Peer Learning process across the School of Business disciplines was successful.

METHODOLOGY

Students in the capstone course at a four-year institution of higher education agreed to be part of this three step, experimental design pilot project. The study was reviewed and approved by the Institutional Research Board. First, students were given a pre-test, the School of Business Knowledge Exam (SoBUSKE), to measure content knowledge in all functional areas taught by the School of Business. Faculty designed the SoBUSKE, a 146-question multiple-choice exam to evaluate graduating seniors' grasp of fundamental concepts and theories across ten functional disciplines.

Faculty developed the SoBUSKE as a parallel measure to the Educational Testing Services (ETS) Major Field Test in Business in an effort to cover several of the ETS content gaps that did not match the School of Business curriculum. Faculty determined the ETS Major Field Test in Business, for example, did not adequately test students in the legal and social environment and the information systems areas of the degree the School of Business wished to have these topic areas represented and measured. The faculty designed an exam (SoBUSKE) where each of the ten core disciplines (accounting, economics, management, quantitative analysis, finance, marketing, legal & social environment, information systems, international issues and ethics) was represented on the exam. The researchers administered the SoBUSKE to students as a pre-test at the start of the semester.

At the completion of the SoBUSKE, students were randomly assigned to subject matter expert (SME) teams comprised of two team members. Each team was assigned a random section of the exam, a subject or topic area, which they were to review and subsequently prepare a teaching experience on the topic to be presented to the entire class during the course of the semester. Three teams reviewed an additional subject matter area and presented this additional subject matter section of the exam to the class. Teams provided supplemental materials such as handouts, using powerpoint slides during their presentations, and devising learning activities such as games and props to assist in the learning and retention process. The learning or "re-acquisition" process varied by SME team design. Each SME presentation was graded by the class as either exceeding, meeting or not meeting their need for information on the subject. Additional questions were asked by the class following the presentation. Each SME team presenting the subject matter topic was held accountable for adequately answering peer questions following the initial presentation. If students were unable to answer a question immediately following the presentation the SME team was tasked to return the next scheduled class period with answers to the unanswered questions. The capstone professor was available to critique the presentations and assist as a consultant for all SME teams as needed.

Researchers re-examined the students at the conclusion of the semester following the SME-Peer Learning process with a post-test on the SoBUSKE. After both exams were completed, the researchers calculated individual student scores and group average scores.

Two hypotheses were tested:

H1: Student average scores in the post-test exam will be significantly different than their scores in the pre-test exam.

H2: Student average scores in the post-test exam will be at least 25 percentage points higher than their scores in the pre-test exam.

Paired sample T-tests were conducted to test the hypotheses.

RESULTS AND DISCUSSION

In the fall 2014 semester, 14 students completed both the pre-test and the post-test. Initially, 16 students completed the pre-test. However, two students did not complete the class because of work and school scheduling issues and, therefore, did not complete the post-test. Their scores were removed from the data set. A set of descriptive statistics was completed using Excel on both data sets. When examining the pre-test class point scores across the disciplines, it was determined that the average score was 51.05%, ranging from 28.85 % to 73.82%. When examining the post-test class point scores across disciplines, it was determined that the average score was 75.83%, ranging from 52% to 97%. A paired T-test with an alpha of .05 was calculated to determine if the means of pre- and post-test groups were in fact different. The result of the test showed that the mean results of the pre-test and the post-tests were significantly different (p-value = 3.88756E-06). Results supported our first hypothesis (*H1: Student average scores in the post-test exam will significantly be different than their scores in the pre-test exam*). There appeared to be a significant increase in the students’ test scores across every discipline from pre-test results through intervention [SME-Peer Learning Intervention Process] through post-test results. As expected, the classroom learning experience significantly increased student learning across the ten functional disciplines; therefore, the School of Business intervention was successful. (See Table 1)

Table 1 - MGT 4300 School of Business – Pilot - SoBUSKE Assessment Pre-Post Test Results Summary by Disciplines

Discipline	PRE-TEST Mean % correct	MGT4300 Discover Research Peer Learning Process Continuous Improvement Action	POST TEST Mean % correct
Accounting	40		67
Economics	43		65
Management	56		78
Quantitative (STATS & OPMGT)	51/55		65/80
Finance	48		82
Marketing	58		84
Legal	48		70
Information Systems	67		76
International Business	36		75
Ethics	63		80

When comparing pre-test and post-test class point scores, there was a significant difference in scores. There was an average increase in class point scores of 23.57%. These results suggested that the pilot classroom learning experience that engaged students in the discovery-research-peer learning process across the School of Business disciplines was successful. The results by student are shown in Table 2 - MGT 4300 SoBUSKE Assessment Summary.

Table 2 - MGT 4300 School of Business – Pilot - SoBUSKE Assessment Pre-Post Test Results Summary by Students

<u>Student #</u>	<u>Pre-Test</u>	<u>Post-Test</u>	<u>Difference</u>
1	29%	76%	47%

2	58%	72%	14%
3	47%	81%	34%
4	48%	73%	25%
5	74%	91%	17%
6	57%	82%	25%
7	51%	68%	17%
8	34%	62%	28%
9	52%	75%	23%
10	48%	70%	22%
11	66%	78%	12%
12	47%	52%	5%
13	50%	68%	18%
14	54%	97%	43%
Mean	51%	75%	24%

A secondary test was conducted to test if the percent average increase was significant; in other words, if the average means calculated did differ by at least 25 percentage points. Results from this test provided significant evidence to state that the average score between the pre-test and the post-test would differ in 25% points (p-value = 2.74368E-32). See Table 3-T Test Paired Two Sample for Means.

Table 3: T-Test Paired Two Sample for Means >25%

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	0.5106	0.7464
Variance	0.01286	0.01282
Observations	14	14
Pearson Correlation	0.4762	
Hypothesized Mean Difference	25	
df	13	
t Stat	-813.9602	
P(T<=t) one-tail	2.7436	
t Critical one-tail	1.7709	
P(T<=t) two-tail	5.4873	
t Critical two-tail	2.1603	

Results from this test suggested that our hypothesis was supported (*H2: Students average scores in the post-test exam will be at least 25% higher than their scores in the pre-test exam*). Our current calculated 24% fell within the margin of error threshold.

The final results of this study were provided to the School of Business faculty for their review. These results provided relevant information to assist faculty in determining which business

concept information was retained by senior students. The results provided further insights into which concepts and discipline areas required additional time or alternative teaching methods to assist students in retaining these key concepts so when the students reached the capstone class the content would still be there.

As a result of this analysis and in the interest of continuous improvement, faculty also reviewed and re-designed the SoBUSKE for clarity in test questions. Some faculty members, while reviewing the results of the study, suggested that a bi-yearly review should be implemented so the questions in the SoBUSKE accurately reflected the content and experiences that happened in the classroom. According to the faculty, if the SoBUSKE is also used to provide feedback regarding assurance of learning for graduating business students, it should clearly match and reflect the content that has been covered in the previous four years of the students' curriculum. Other faculty members suggested that whereas the exam covers the key concepts and theories in the ten core business disciplines of accounting, economics, management, quantitative analysis, finance, marketing, legal environment, information systems, ethics, and international issues, there was a lack of hands-on or subjective assessment that was recently included in the School of Business curriculum. Further developments of the SoBUSKE should reflect this subjective assessment to include the hands-on practice that occurs in the classroom.

At our institution, the results of this study helped faculty in two different ways. First, it led to renewed attention to and revision of the SoBUSKE with the goal of matching content taught with assessment. This is an ongoing focus and effort. The faculty's intent to change the SoBUSKE was not to increase the successful metrics but to reflect the actual content and experiences covered in the degree program as it changed through the continuous improvement plan. Second, the results identified content areas in which students needed reinforcement before they graduated. In both cases, changes to the curriculum and changes to the SoBUSKE were presented and approved by the School of Business. Additional subject matter materials were introduced to course curriculum in SoBUSKE subject areas where students performed poorly to assure the core concepts were reinforced in the introductory courses. In relevant subsequent subject matter area courses, these same key concepts were intentionally repeated to assist in re-acquisition and retention of information. For example, a key concept presented in the junior level Organizations & Management course was repeated in the junior-senior level Advanced Management course and senior level Strategic Management & Policies course. Faculty teaching course material within the individual disciplines reviewed the associated SoBUSKE questions to determine if (a) questions adequately tested the core concept(s) and (b) if the core concepts being tested continued to be relevant. It was suggested the SoBUSKE be reviewed by faculty every two to three years to determine if there are any questions that no longer reflect required core concepts, thereby removing the outdated questions and replacing them with relevant questions reflecting new core concepts.

LIMITATIONS AND FUTURE RESEARCH

Pilot studies generally represent a fundamental stage or initial step in the research process. Their purpose is to examine the feasibility of a specific model, method, or approach that is intended to be used in a larger scale study. A pilot study can be used to assess the value of a new method or novel intervention. Pilot results can help identify needed modifications in the design of a larger study. This pilot project studied the results of a one semester duration and a limited student population. The sample size of 14 students in a single class over the course of one semester is small and recognized as a limitation of the study. Although this is a study limitation, it did provide initial data to suggest the need for future study with a larger sample over multiple sections with a

control group. Future research should focus on the repeatability of the results and future development of the SoBUSKE.

First, it will be interesting to know if these results are replicated yearly over time. For a future study, the researchers will perform the same type of activities as in this pilot study in a longitudinal study. Students will complete the pre-test SoBUSKE. Then, students will undergo a peer learning process during which all ten areas of the functional business content will be reviewed and discussed in class. Finally, students will complete the post-test SoBUSKE. Data will be collected over several semesters and analyzed to discern if the results of the present study can be replicated over time.

Secondly, the focus of this pilot study was on the peer learning process as it relates to teaching in teams and learning on a group basis. A question for future research is to determine how does one assess individual learning when activities are typically group work? The measurement tool and design as well as the results might address a new and innovative way to assure individual critical thinking and subject matter retention are enhanced.

Lastly, due to the constant curriculum changes in terms of content being delivered and classroom activities being utilized, the researchers need to ensure that the SoBUSKE reflects the content and the activities that the students learn and complete during their years in the program. For this reason, a secondary study will be conducted to compare different types of knowledge exams across several sections of the capstone classes. The goal will be to find out if the different types of exams (subjective, objective, and subjective + objective) will show similar results.

CONCLUSIONS AND IMPLICATIONS FOR PRACTICE

Faculty in schools of business are trying to find ways to make sure their students not only learn the content but are able to retain it. There is an observed disconnect between the initial point when content is introduced into the curriculum and the exit point of the program when the students graduate and are ready to enter the workforce. The peer learning intervention technique used in this study seems able to activate the re-acquisition of content knowledge and could provide an opportunity to increase the content retention and engagement of the students. After this pilot study is replicated and data supports our findings over multiple years, we should be able to introduce this peer learning activity as a model for all faculty to follow and integrate into other courses in our curriculum.

Moreover, this type of SoBUSKE measurement test could be replicated at other institutions that fall under the same AACSB accreditation requirements. If that happens, their faculty would have to review the questions and activities included in the knowledge exam to ensure that the content being tested and the method of testing does reflect what happens in their individual classrooms.

At our institution, we are moving towards a more active learning methodology and, as such, our assessment methods also have to change. Our faculty realized that it is neither fair nor valid as a reflective measure for the students to rely solely on the completion of a multiple choice assessment to test their knowledge when in class they complete case studies, group projects, business analyses, video tutorials, and other activities that significantly differ from the multiple choice exam format. Our faculty are currently studying how to construct and implement a measuring tool that will account for not only the content but also the activities being conducted in the classroom. We believe that this type of new assessment tool will give us a more accurate account of how the students are learning, when they are learning, and, finally, what their content knowledge level and application level are when they finish the program.

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