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Active Learning Strategies: Student Perceptions

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Abstract

Literature supports the efficacy of utilizing active learning strategies to enhance student learning outcomes but there has been little evidence comparing strategies in pharmacy school courses. The purpose of this study was to integrate five active learning strategies in 2 related courses and to assess students' perceptions of each as they related to learning outcomes. Student surveys revealed that case-based learning and audience response systems were the most engaging and helpful strategies to enhance learning in both courses.

Introduction

The need for active learning strategies in pharmacy education may be greater than ever. With the growing number of pharmacy schools, class size, and increase in knowledge base in the medical field, students may require more effective instruction. The Accreditation Council for Pharmacy Education (ACPE) has recommended that in order to foster student learning and to meet certain learning standards, instructors should consider using active learning strategies. (Accreditation Council for Pharmacy Education, 2012) The purpose of our study was to integrate different active learning strategies in 2 required courses to enhance student learning outcomes. The participants of the study were second-year pharmacy students enrolled in a Microbiology and Immunology (fall) and an Infectious Diseases Pharmacotherapeutics (spring) course. Five active learning strategies were used in different class sessions: Audience response systems, case-based learning, memory matrix, muddiest point, and Think-Pair-Share. Students were surveyed using an IRB approved survey designed by the authors. The survey addressed the level of engagement and helpfulness of each learning method and whether they would recommend its continued use in future courses.

Literature Review

Active learning can enhance students' motivation to learn by reinforcing the relationship of the material to real life. (Fink, 2003) The pharmacy literature has supported the use of active learning in the classroom for some time (Jungnickel et al., 2009) and active learning strategies may be the most effective way to enhance and reinforce new information. (Stewart et al., 2011; Wells, et al., 2008.) In a survey of all of the current schools of pharmacy in 2011 by Stewart

et al., 87% of respondents reported using some type of active learning strategy, suggesting that the academy has embraced active learning to enhance student learning. The survey also revealed that faculty members of lower academic rank and in the area of pharmacy practice were more likely to utilize these methods than those in the pharmaceutical sciences and of higher academic rank. But studies have shown that when used effectively, they can enhance student learning outcomes (Fink, 2003) regardless of the course or academic standing of the professor. (Stewart et al., 2011).

Within pharmacy education, many studies have assessed the efficacy of specific active learning methods. (Fink 2003; Jungnickel et al., 2009; Stewart et al., 2011) Most of them tend to focus on active learning strategies used longitudinally for the duration of an entire course. Poirier and O'Neil used a constructed knowledge game and discussions to assess student learning outcomes in a Quality Assessment Methods in Health Care course. (Poirier & O'Neill, 2000) Similarly, Chavez et al. incorporated an assemblage of popular game shows to engage students in pharmacotherapeutics and board exam reviews. Quick-thinks and case-based learning were used to enhance critical thinking skills during pharmaceuticals lectures (Reddy, 2000) whereas a combination of cases and student presentations to enhance the relevance of a biochemistry course to the practice of pharmacy. (Matthews, 1997)

For an instructor to supplement a lecture with active learning methods, strategies that are not time-intensive in terms of preparation and in-class time are typically preferred. The authors are unaware of any studies that compare a variety of active learning strategies that are not time consuming, utilized in 1 course, and are based on student preferences applied to that specific course.

Methods

The participants of this study included 82 second-year pharmacy students enrolled in both Microbiology and Immunology in the fall 2011 semester and Integrated Pharmacotherapeutics- Infectious Diseases in the spring 2012 semester. The students were given 13 surveys over the 2 semesters. The first was a pre-intervention survey that assessed their awareness of active learning methods. They were also surveyed after each active learning method was used in class (10 surveys total, 5 per course) to record their perceptions of each strategy. The students were given 2 post-course surveys (1 after all 5 methods were used in each course) to rank each method based on engagement, helpfulness, and the likelihood that they would recommend other instructors to use each method. Surveys were administered via the Internet with SurveyMonkey (SurveyMonkey, Palo Alto, CA), and a link to each survey was provided to the students either on their PowerPoint slides, an e-mail, or their Blackboard site (Blackboard Inc., Washington D.C.). All study data was transcribed to Microsoft Excel (Microsoft Inc., Redmond, WA) in order to calculate percentages and medians shown in the results section. Approval for this study involving students as human research subjects was obtained from the Institutional Review Board of the university prior to deployment of any surveys or interventions.

The active learning strategies used to supplement the lecture material included: Audience response systems (clickers), case-based learning, memory matrix, muddiest point, and Think-Pair-Share. (Angelo & Cross, 1993) Each method was used once in each course during the survey period, and they were used on separate lecture days so that students were only exposed to 1 of these strategies at a time. Table 1 lists the topics that were covered for each active learning method immediately prior to surveys being administered.

Table 1. Topics covered with each active learning strategy		
Strategy	Microbiology and Immunology (Micro/Immuno)	Integrated Pharmacotherapeutics- Infectious Diseases (Infect Dis)
Audience Response Systems	Introduction to Immunology	Skin and Soft Tissue Infections
Case-Based Learning	Immunology Review	Tuberculosis
Memory Matrix	Humoral Immunity	Fungal Infections
Muddiest Point	Cytokines	Introduction to Infections and Review of Clinical Microbiology
Think-Pair-Share	Cell-Mediated Immunity	Introduction to Antimicrobial Pharmacology

Results

Survey response rate varied for each survey and tended to decrease over time. The pre-intervention survey had a 94% response rate. In the Microbiology and Immunology course the response rate averaged 69% for the surveys given after each method was used and 66% for the post-course survey. In the Infectious Diseases Pharmacotherapeutics course the average response rate was 29% for the surveys given after each method used and 40% for the post-course survey.

Pre-Intervention Survey

The pre-intervention survey indicated that most students were familiar with active learning methods, with only 4 of 75 respondents answering that they were 'Not familiar' with them. Only the memory matrix was completely unfamiliar to

the class. Table 2 shows a more inclusive representation of the pre-intervention survey questions and responses.

Table 2. Pre-intervention survey questions and responses (N=75)		
Pre-Intervention Survey Question	Answer	N (%)
How familiar are you with active learning methods?	Not familiar	4 (5.3%)
	Somewhat familiar	30 (40%)
	Familiar	32 (42.7%)
	Very familiar	9 (12%)
Have you encountered/heard of audience response systems?	Yes	74 (98.7%)
Have you encountered/heard of case-based learning?	Yes	65 (86.7%)
Have you encountered/heard of memory matrix?	Yes	0 (0.0%)
Have you encountered/heard of muddiest point?	Yes	74 (98.7%)
Have you encountered/heard of Think-Pair-Share?	Yes	50 (66.7%)
Do you want to be engaged during class?	True	67 (89.3%)
	False	4 (5.3%)
	Not Sure	4 (5.3%)
Do you want to be challenged to think during class?	True	49 (65.3%)
	False	12 (16.0%)
	Not Sure	14 (18.7%)
Do you enjoy being taught by active learning methods?	True	60 (80%)
	False	6 (8%)
	Not Sure	9 (12.0%)

Active Learning Method Surveys

Figures 1 and 2, as well as the text below, describe the results of the surveys given immediately following the use of each active learning method. Several students made note of certain themes about audience response systems in the comment section of the survey. They expressed that the clickers did not work every time, sometimes being perceived as a waste of class time. Others stated that they did not like being asked questions on topics they have not yet learned, as opposed to only being asked review questions. Some students did state that using the clickers throughout the class period let them know which areas they need to work on in order to improve.

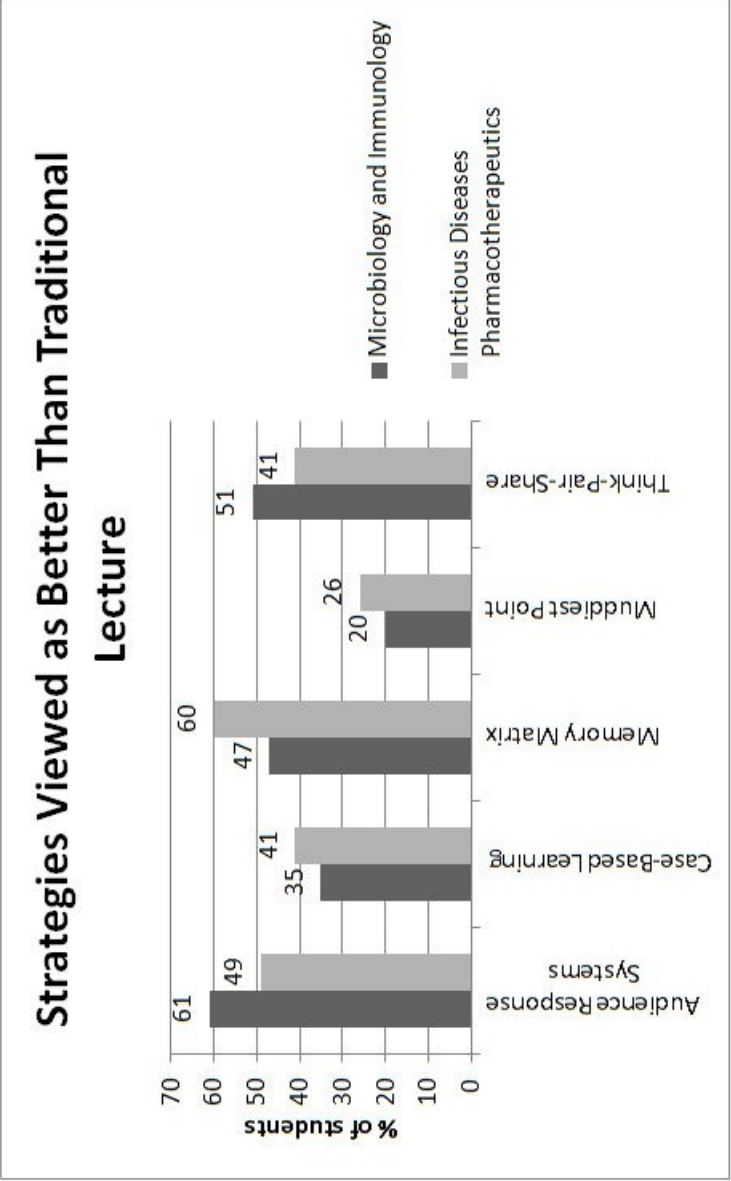


Figure 1. Responses are reported as percentage of students who agreed that the active learning strategy was better than traditional lecturing.

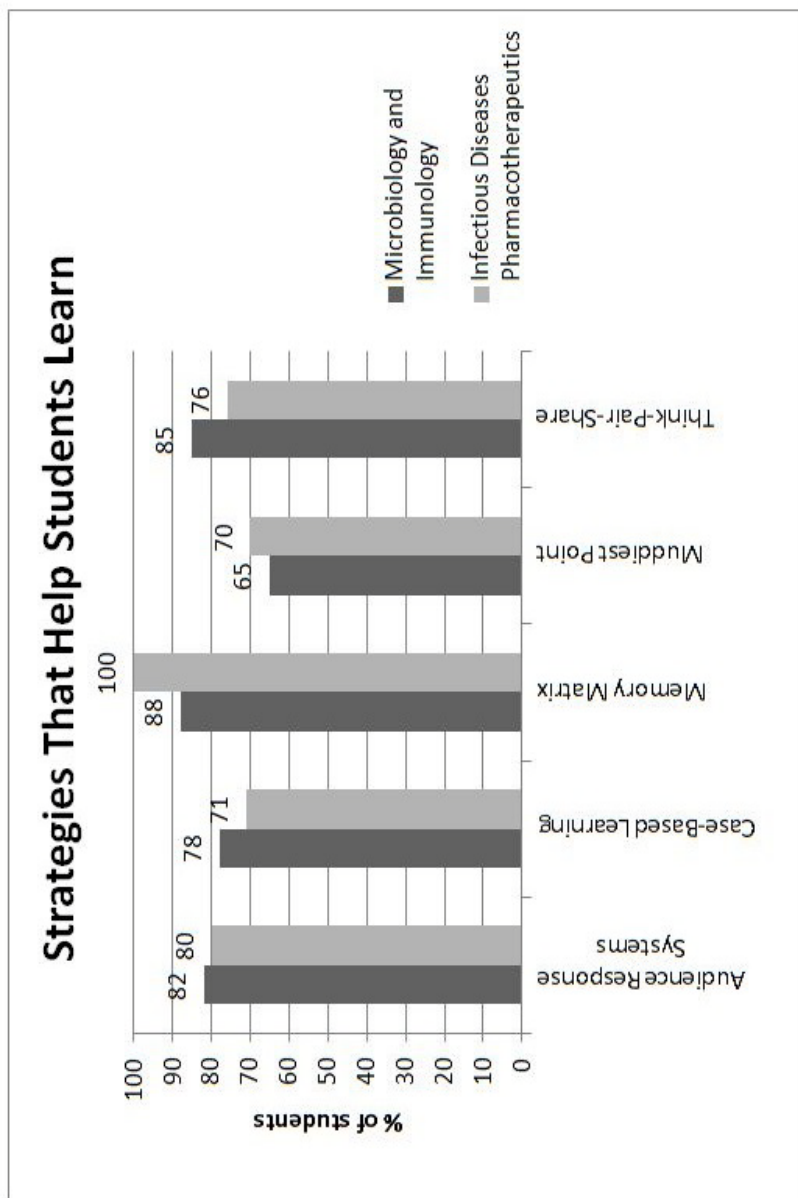


Figure 2. Responses are reported as percentage of students who agreed that the active learning strategy helped them learn.

Students commented that case-based learning was beneficial because it helped synthesize the information and that it is good for pharmacy students because that is how they will be practicing someday. Some students suggested that answers to the cases be posted because it was too difficult to take notes while going over the answers at the end of class (the answers in Microbiology and Immunology were not posted, but they were in the Infectious Diseases Pharmacotherapeutics course based on this suggestion).

Other students wanted the case to be used as a study tool as opposed to part of the lecture because it distracted them from the lecture material. Several students preferred that the cases be covered at the end of the lecture as opposed to during it because they felt they needed to learn the material better before doing a case.

There were comments that the memory matrix was very helpful as a study tool. Students liked that it organized a topic into a chart they could fill out. However, students stated that they only found it helpful if the lecture material provided all the answers for them, and only if there was a key posted.

Students shared that they enjoy using muddiest point when it is anonymous, when all points clarified by the professor are sent out as a document so they can study, and only when the concepts being taught are very difficult to understand. They commented that it is beneficial because other students may think of things that they did not think to ask. One student's insight captured that this method "relies on students actively participating and offering up suggestions to the professors, but if this does not occur, then this method gets the class nowhere."

In addition, students commented on the positive effects of Think-Pair-Share because of its ability to have the students immediately apply what has been taught and to receive different perspectives on a topic from other students. Other students felt that the Think-Pair-Share period sometimes went too long, and students could get off topic. Others were frustrated that other students were not participating in the discussion. There were comments on multiple surveys that the students preferred using a variety of learning methods, and did not have a preference for just one.

Post-Course Surveys

In both post-course surveys, students were asked to rank each active learning method from least engaging to most engaging (1 through 5), and also from least helpful to most helpful (1 through 5). They were also asked to rank how likely they would be to suggest that other instructors use each active learning method (1- Not Likely to 5- Very Likely). Table 3 shows the median scores of each response from both post-course surveys.

The results shown in Table 3 indicate that in Microbiology and Immunology, students tended to prefer audience response systems the most favorably, followed by case-based learning, then memory matrix, Think-Pair-Share, and finally muddiest point the least. For Infectious Diseases Pharmacotherapeutics, students preferred case-based learning the most, followed by audience response systems, then Think-Pair-Share, memory matrix, and finally muddiest point the least. Some students felt that learning methods are appropriate at different times. One student in particular felt they should not be forced to participate in active learning processes because they learn better by self-teaching.

Table 3. Students' rankings of each strategy from the post-course surveys (1-5 Likert scale)						
Strategy	Most Engaging-Median Scores		Most Helpful-Median Scores		Likelihood of Recommending to Other Instructors-Median Scores	
	Micro/Immuno	Infect Dis	Micro/Immuno	Infect Dis	Micro/Immuno	Infect Dis
Audience Response Systems	5	4	4	3.5	4	4
Case-Based Learning	4	5	3	5	4	5
Memory Matrix	3	1	3	3	4	3
Muddiest Point	1	2	2	2	3	2
Think-Pair-Share	3	3	3	3	3	3.5

Discussion

With the increase in the number of pharmacy schools in the last decade and the quest for superior applicants, pharmacy schools need to remain competitive. Traditional teaching methods enhanced with active learning strategies may better meet the expectations of students raised on the Internet. (Oblinger, 2003) Such curricular innovations can enhance a school's reputation and marketability. This study gives insights into student preferences toward active learning techniques used by instructors to supplement their lecture material. The results indicate that students at our institution are well aware of active learning methods in general and that most students want to be engaged and challenged to think during class. This suggests that instructors should be willing to attempt to challenge students in the classroom using various active learning methods.

However, the results also showed that some students thought that some methods used to enhance the lectures were actually worse than traditional lecture alone. Therefore, instructors should be cautious before using certain active learning methods exclusively. Instructors should only use methods that they are comfortable using. They should have their methods prepared in advance, while being sure that they will function as planned (such as considering occasional technological difficulties with audience response systems) because students in our study were frustrated when things like this happened. Also, if instructors feel like a method is not augmenting student learning outcomes, they should consider discontinuing its use and trying something different.

The results indicated that students did prefer a mixture of instructional strategies. The results also showed that students preferred some methods over others. Therefore, it may be beneficial for instructors to find multiple methods that they prefer to use, and to alternate using methods based on the instructor's comfort level, the students' responses to the methods, and the type of material being presented. It was expected that the students would perceive benefits from all methods used to supplement the lecture. Although some students felt that some of the methods were not helpful or distracted from class time, the majority of students who responded to the surveys agreed that each active learning strategy was better than or comparable to traditional lecture.

Based on the survey results and student comments, this study shows that students, in ranking the methods against each other, prefer audience response systems and case-based learning over the others. It can be further noted that audience response systems was viewed most favorably in the Microbiology and Immunology course, and that case-based learning was viewed most favorably in the Infectious Diseases Pharmacotherapeutics course. This may be because Microbiology and Immunology is a more fact-based course, whereas Infectious Diseases is a more application-based course. Therefore, it may be possible that audience response systems would be better used with factual material and case-based learning would be better used with application-based material, such as pharmacotherapeutics courses.

Other methods which students did not view as favorably still may have use in supplementing lecture material. Student comments were helpful in determining where to possibly use these methods. Students felt that the memory matrix was helpful for an optional study tool. Therefore, it is possible that instructors could generate a memory matrix when it is suitable for the material. Students felt that the muddiest point was helpful when there is enough depth to the material for them to require a more detailed explanation from the instructor than what the lecture provided.

In order to better understand how students felt about the active learning methods, they were given these interventions over 2 courses. This was beneficial because they were able to experience the methods from different professors and in different courses.

Although instructors vary in their teaching styles and certain methods work differently for different instructors, our results indicated some consistency across the 2 courses and instructors. To strengthen the assessment from the students, many surveys were used. This helped to show consistency of the students' attitudes toward each method. The post-course survey results indicated concurrence with the other surveys. And to further strengthen the study, the instructors attempted to avoid any other teaching styles considered "active learning" on the days when a specific strategy was used. This was done so that

students' perceptions toward the strategies being studied were not affected by other strategies in that class period.

There were also several limitations of this study. In class sessions in which students were not surveyed, the instructors used instructional strategies that they felt augmented the chosen lectures. Most notably, the Microbiology and Immunology instructor used audience response systems somewhat frequently and the Infectious Diseases instructor used cases fairly often. This may have had an effect on the students' perceptions of these 2 methods in those classes. Also, the students demonstrated considerable "survey fatigue." As the results showed, the response rates slowly decreased over time. The memory matrix survey in the Infectious Diseases course had only 5 respondents. This was most likely due to the timing of the class and, perhaps, survey fatigue. There was a test the next day, so the attendance in class was poor. Students were most likely studying for the test instead of doing this optional learning method intervention. The lack of participation and respondents severely limits the credibility of that specific survey.

Another limitation of the study is that the students had the option to participate. Class attendance was not mandatory, and students were not given any credit for using the learning strategies. Also, this study did not measure student learning, only their attitudes toward each strategy. Assessing learning would have been difficult to do, given that the different strategies were used on different material which would have varying levels of difficulty. Additionally, the implications taken from the results strongly rely on the post-course surveys and this runs the risk of student perceptions being more or less favorable for methods that were used closer to the post-course surveys.

Conclusion

Students tended to prefer frequent use of case-based learning in a class that was more application-based and audience response systems in a class that had more factual material, although both methods were preferred overall. Students responded favorably to the other methods used as well. Think-Pair-Share and the muddiest point may be beneficial in supplementing lectures that have material with considerable depth. Memory matrix may be beneficial as an optional study tool for students. Instructors should consider using methods they are comfortable with and be willing to consider altering their instructional strategies based on feedback from students.

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