Preparing Pharmacist Students for Diversity of Public Health Services. Perceived Impact of an Active Learning Case-Based Strategy

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Abstract

The objective of this study was to evaluate students' learning-related perceptions and beliefs from an active learning case-based instructional strategy implemented in a pharmacy professional course. Weekly active learning modules were scheduled in a SCALE-up classroom. Perception data collected with an end-of-semester survey were integrated in a regression model. The results of this study confirmed that active learning tasks enhance students' engagement and self-efficacy which, in turn, increases their trust in the effectiveness of their own learning.

Motivation and Objective of the Study

Pharmacy students are expected to assume diverse roles once in their profession, including leadership, informatics, patient advocacy, and policy development. In order to function effectively in roles that extend beyond the traditional roles of dispensing medications and medication management for patients, students need to experience instructional tasks that prepare them for this level of content and role diversity. In addition, the 2016 Accreditation Council for Pharmacy Education (ACPE) Accreditation Standard 3 emphasizes the need for competence in problem-solving, communication, and interprofessional collaboration.

Persuaded by the importance of active learning strategies to achieve this type of outcome (e.g. Bakon, Craft, Christensen, & Wirihana, 2016; Fitzsimons, 2014; Miller, Khalil, Iskaros, & Van Amburgh, 2017; Pajares, 1996; Patrio Chiu & Cheng, 2017), the instructor in a *Public Health for Pharmacy* course redesigned the course from a 3-hour weekly lecture to include two parts: a traditional 1-hour weekly lecture and a 2-hour weekly session of active learning. The instructional context for the active learning part of the course was a technology-rich classroom built based on the SCALE-up model (http://scaleup.ncsu.edu/). Considering the potential impact of this active learning setting on students' learning (e.g. Brooks, 2011), the major objective of this study was to evaluate students' learning-related perceptions and beliefs related to the active learning tasks implemented in the *Public Health for Pharmacy* course.

Instructional Intervention

Public Health for Pharmacists (PHRM 540) is a course offered to third-year Doctor of Pharmacy (PharmD) professional students. The majority of the PharmD coursework is focused on mastery, retention and demonstration of the mastery and recall of facts on exams. Laboratory courses add the hands-on skill into the curricular mix but their focus is mainly on demonstration of skills related to the role of dispensing medications in pharmacy. In this context PHRM 540 stretches students' learning habits beyond their comfort zone, because it requires them to master new content areas including biostatistics, epidemiology, behavioral science, environmental health, and health policy, and to incorporate them into the practice of pharmacy (Strand, Miller, & Focken, 2016). It also requires them to analyze new types of information, generate new knowledge, and use the conclusions drawn to solve complex public health problems. These course-specific requirements indicate a diversity of content and method compared to more clinical-based courses these students are engaged in throughout their academic life.

In order to increase student engagement with the material and methods in the course, the instructor developed and implemented a case-based team-driven active learning strategy in the course. A traditional lecture-driven method is used for a traditional 1-hour a week classroom instruction early in the week. Active learning modules were scheduled for 2-hours a week in a SCALE-up technology-rich classroom. The case studies used in this part of the course required students to apply and integrate the knowledge base they built in the 1-hour lecture to solve problems presented in the cases.

Students were placed in groups of nine, and seated around tables equipped with surround content display technology. Prior to each class, students were expected to individually complete 1/3 of the case. During the active learning classroom activity, they started by comparing their work on the first portion. This allowed students to hear how other members of their group solved the assigned problems, and to compare answers. To ensure the coherence of the group activity during this first part of the activity one person in each group assumed the role of the group leader, being responsible at the end of the day for submitting the group's completed work. Next, students were instructed to move on to the second part of the case, and collaboratively complete the case. Most cases had three major sections to complete. Several 10-15 minute mini-lectures were inserted by the instructor at critical times with the goal to correct misconceptions, emphasise the critical knowledge required for that stage in the case analysis, and explain his own rationale for the acceptable solutions for the case. Students were occasionally asked to report to the entire class how they used the software to perform a calculation or create an image, utilizing the consoles at their own table to project their monitor to the entire class, and speaking over a microphone to ensure audibility to all in the room. Three critical competencies in the PharmD program are leadership, informatics, and patient advocacy. To illustrate the process of helping students increase and diversify their competence in these areas in preparation for being a more well-rounded pharmacist, a few examples will be given.

First, leadership and communication are skills that need to be developed through practice, and not as theoretical concepts. In this course, a different student served as table leader each week with the task to facilitate conversation, and to assume responsibility for submitting the table's group work. Students took this resonsibility seriously, and if they did not get full points on their work, the table leader who submitted it was frequently checking with the teacher about what was wrong with their work. This proved to be a good practice for helping students build the responsibility that goes along with leadership, and allowed them to practice skills of leadership and communication along the way.

Second, informatics, or the ability to retrieve, generate, analyze and interpret data, is an important skill for pharmacists. In the cases used in this course, student were frequently given a large data set, which they then needed to analyzed, and generate conclusions or recommendations based on the results of their own analysis. For example, students were given data on volume of opioid prescriptions nationwide over time, and the number of heroin overdose deaths, to look for an association between the two variables. Just telling them that an association between the two exists could generate defensiveness among some students, because they could assume that the pharmacy is being blamed for the heroin overdose deaths. But when the students analyzed the dataset themselves, and generated their own conclusions, they need no persuading for accepting this association. Students beaome deeply engaged in trying to explain why that association happen, rather then being defensive about its potential negative stigma to phamacies and pharmacists. This exercise required them to analyze new types of information, to generate new knowledge, and then to solve problems using actual public health data. This activity was engaging, increased students' self-efficacy, and increases their confidence that they were learning and built the skills to do what was expected of them.

Third, patient advocacy, and the importance of policy that is in the best interests of the patient's needs, are important skills for pharmacists, but these are skills that students do not perceive as interesting or important. As an example, by asking students to engage with medication-based problems that they were interested in, such as the release of the new and very expensive anti-Hepatitis C drug Harvoni, it was possible to guide the students toward considering why they should advocate for their patients, the impact of policy on their patients, and how to address problems in these areas. In the Harvoni case study students were first required to analyze data regarding the prevalence of Hepatitis C, and the use of Harvoni to treat it. But then the activity moved to a different level required student to consider current policies around required prior authorization for patients to be reimbursed for a drug that costs $85,000 per patient. They were required to analyze new types of information through consideration of the cost of treating all patients in need. They built new skills by determining that the best long-term solution to prevent the spread of Hepatitis C is to treat all patients, which then challenges them to consider how this would be paid for. Finally, they engaged with reviewing the criteria patients need to meet in order to be granted prior authorization, realizing that some of the requirements are discriminatory. This process is engaging for the students, they feel competent to make recommendations toward a fair way to manage Hepatitis C patients, and they develop passion for justice to address the problem. This happens through the process of evaluating data together as a group, and then being challlenged to solve big problems using what they have generated.

These are just three examples of how this course used engaging activities to increase student interest. Increased engagement then contributed to a sense of self-efficacy and confidence that they can perform the tasks required of them. Finally, engagement and self-efficacy increased students' perception of the impact of these processes on their learning, which is a proxy for student success.

Research Questions & Methodology

The exploratory question for this study was if students perceived that the active learning section of the course had a significant positive impact on their own learning process.

Research Design

An exploratory quantitative design research was used to analyze if perceived engagement and self-efficacy were significant predictors of students' perceived impact of the active learning tasks on their own learning. The proposed conceptual model is presented in Figure 1.

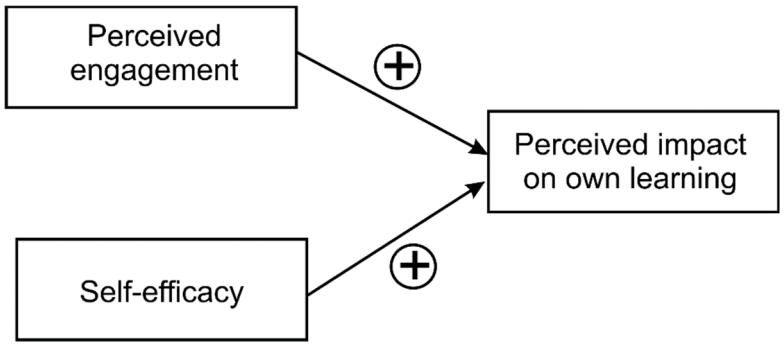

Figure 1. Proposed conceptual model related to the implemented instructional intervention

As shown in Figure 1, due to the engaging nature of active learning tasks integrated in the target course, the expectation is that the active learning tasks increase perceived student engagement and self-efficacy beliefs which in turn will increase the perceived impact on their own learning process, a perceptual proxy for students' performance in the course.

Participants

The course used for this study had an enrollment of 86 students in their third year of the Doctor of Pharmacy program, the last coursework year in the program. A convenience sampling strategy was used, all students in the course being invited to participate in the study. A number of 84 (98%) students volunteered to participate in this study.

Data Collection

The instructor collaborated with an instructional designer to administer online, using Qualtrics®, an end-of-course survey with questions specific for three constructs adapted from the literature. The first construct, perceived engagement, had six items selected from Gebre, Saroyan, and Bracewell (2014) and adapted to reflect the structure and nature of active learning tasks implemented in the analyzed course (see Appendix 1). The second construct was a measure of course self-efficacy (Cernusca & Price, 2013) and the third one measured perceived impact of the active learning strategies on own learning (Grasman & Cernusca, 2015). The last two constructs were implemented with minor changes (e.g. including the course name and building name) to customize them for this study. All three constructs used a 5-point Likert evaluation scale ranging from 1 for *Strongly Disagree* to 5 for *Strongly Agree*. Scores for each construct were computes as the average of the scores of its individual questions, resulting in a continuous score ranging from 1 to 5. The online survey was administered during the last two weeks of the course and students had 10 days to complete the survey. The instructor gave 3 bonus points for those that participated in this research study but an alternative equivalent task to earn these points was offered to those that decided against participating in this study. This study was approved by the local Institutional Review Board and the informed consent form was posted at the onset of the survey indicating the voluntary participation in the study and the alternative task available for those interested in earning the bonus points but not participate in this study.

Data Analysis

Data collected were analyzed for outliers, normality and basic statistics using SPSS v13. Analysis of raw data revealed two outliers, one for the engagement variable and one for the impact variable. Both outliers were deleted leaving 82 participants for the final analysis. Analysis of z-scores (< +/-2.5), skewness and kurtosis (< +/-0.5) indicated an accepted level for the normality of the dataset. All three constructs adapted from the literature showed a very strong internal reliability with Cronbach's Alpha values of 0.93 for perceived engagement and 0.92 for both self-efficacy and perceived impact on own learning. Multiple linear regression was used to test the inferential model described in Figure 1 above. The independent continuous variables were perceived engagement and self-efficacy while perceived impact of active learning tasks on own learning was the dependent continuous variable. All continuous variables had values ranging from 1 for low levels to 5 for high level of measured value.

Findings

Table 1 presents the basic statistics for each of the measured continuous variable at the exit point in the course.

Table 1
Means, Standard Deviations, and Pearson Correlations for continuous variables (N=82)

	M	SD	1	2	3
1. Perceived engagement	4.00	.69	-	.50**	.53**
2. Self-efficacy	3.68	.65		-	.62**
3. Perceived impact on own learning	3.55	.77			-

Note: **p < 0.01 (2-tailed)

As shown in Table 1, all variables had means above the middle point of the evaluation scale (3- neutral) with perceived engagement having the highest mean value, which is the main focus of active learning strategies. All correlations among the three variables were statistically significant and had medium to high strengths (see Table 1), with the correlation between self-efficacy and perceived impact of active learning strategies on own learning being the closest one to 0.7, the accepted level for a strong correlation.

The multiple linear regression calculated to predict the perceived impact of active learning tasks on own learning based on perceived engagement and self-efficacy found a significant regression equation, $F(2, 79) = 32.83$, $p < .001$. The two independent variables, perceived engagement and self-efficacy, explain 45% of the variance of the perceived impact on own learning, the dependent variable used in this study ($R^2 = .45$). The full results of this regression analysis are presented in Table 2.

Table 2
Regression Analysis Results (DV-Perceived Impact of Active Learning Tasks on Own Learning Process)

	B	SE B	β	t	p
1. Perceived engagement	.33	.11	.30	3.09	.0030
2. Self-efficacy	.56	.11	.48	4.95	.0001

Figure 2 synthesizes the regression findings for the proposed model.

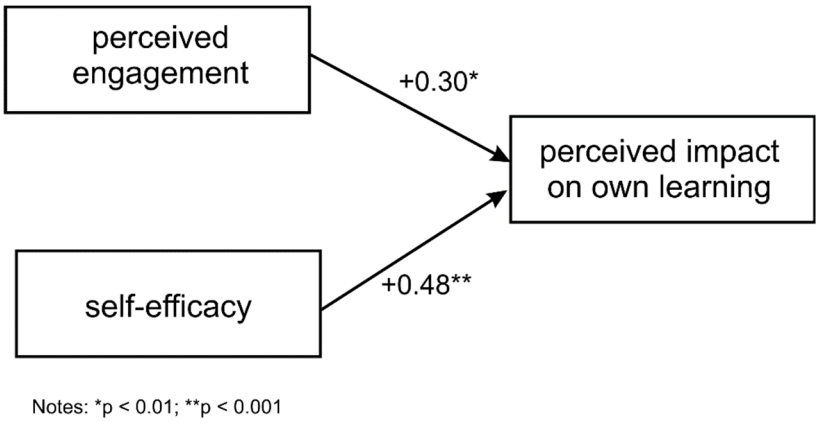

Figure 2. Resulted conceptual model tested for the target instructional intervention

As independent variables, perceived engagement and perceived self-efficacy are strongly associated with perceived impact on learning, with self-efficacy having the strongest association. Self-efficacy is a proxy for self-perceived competence, and the ultimate goal of the exercises is competence. Engagement is a learning strategy that is meant to increase student performance. Therefore, it is to be expected that self-efficacy would be a more sensitive predictor of impact on learning than engagement. The goal is learning and mastery, and this appears to have been achieved in part by increasing student self-efficacy.

Discussions and Further Research

Traditional lecture-driven teaching methods are appropriate for some portions of the PharmD curriculum. However, with a format of instruction that included only lecture followed by examination it is very likely to underestimate student interest and ability. This approach is frequently a result of assuming that the students are a blank canvas upon whom information and knowledge is to be written, and they are dependent upon that transfer of information from the teacher to be successful. On the other hand, it is also assumed by some instructors that students need to be taught everything they will be asked to perform in laboratory or case-based exercises prior to the activity, so they are fully prepared to be successful in it.

The method described here builds on a middle road by assuming that students have varying levels of knowledge and expertise, a gap that is initially reduced by their exposure to an expert-lead presentation of specific topics, upon which they can draw when engaging in case study instructional tasks to fully build the expected knowledge and skills. Furthermore, by working in groups, the group altogether will be well prepared to approach challenges which they have not previously seen, and for which they may not begin with full knowledge. But this creates a challenge to the students, and thus contributes to increased engagement, because they feel challenged, and not just that they are regurgitating information, or repeating skills they have already been taught.

This study confirmed that active learning tasks stimulate both students' engagement with classroom tasks and their self-efficacy which, in turn, increases the trust in the effectiveness of their own learning. This strategy created opportunities for students to undertake the joint activities of simultaneously increasing their competence in informatics, data analysis, communication, collaboration, problem-solving, and development of policy recommendations. This allowed for continual reflection on one's own mastery, and increasing trust in their ability to use what they had learned. Previously students had learned most of these skills in the theoretical, and not in the practical domain of collaborative work as team members around a table. In addition, this course redesign experience indicates that pharmacy instructors can find ways to effectively balance the more traditional lecturing with active learning strategies to engage students in more complex and diverse, real-life bound learning contexts while enhancing their overall learning experience.

Considering the piloting nature of this study, the research team intends to further explore the identified trends by increasing the depth of the analysis to a more granular level linked to specific active learning tasks students perform in this course during the active learning activities.

References

Bakon, S., Craft, J., Christensen, M., & Wirihana, L. (2016). Can active learning principles be applied to the bioscience assessments of nursing students? A review of the literature. *Nurse Education Today, 37*, 123-127. doi:http://dx.doi.org/10.1016/j.nedt.2015.11.030

Brooks, C. D. (2011). Space matters: The impact of formal learning environments on student learning. *British Journal of Educational Technology, 42*(5), 719-726. doi:10.1111/j.1467-8535.2010.01098.x

Cernusca, D., & Price, C. E. (2013, June 23-26). *Can undergraduates learn programming with a "Virtual Professor"? Findings from a pilot implementation of a blended instructional strategy.* Paper presented at the 120th ASEE Annual Conference & Exposition, Atlanta: GA.

Fitzsimons, M. (2014). Engaging students' learning through active learning. *Irish Journal of Academic Practice, 3*(1), Article 13. doi:10.21427/D7842T

Gebre, E., Saroyan, A., & Bracewell, R. (2014). Students' engagement in technology rich classrooms and its relationship to professors' conceptions of effective teaching. *British Journal of Educational Technology, 45*(1), 83-96. doi:10.1111/bjet.12001

Grasman, K., & Cernusca, D. (2015). Strategies to enhance learning in a large engineering course: Including students' perceived values in the instructional redesign process. *Journal of Online Engineering Education, 6*(1), Article 2.

Miller, D. M., Khalil, K., Iskaros, O., & Van Amburgh, J. A. (2017). Professional and pre-professional pharmacy students' perceptions of team based learning (TBL) at a private research-intensive university. *Currents in Pharmacy Teaching and Learning, 9*, 666-670. doi:http://dx.doi.org/10.1016/j.cptl.2017.03.001

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*(4), 543-578.

Patrio Chiu, P. H., & Cheng, S. H. (2017). Effects of active learning classrooms on student learning: a two-year empirical investigation on student perceptions and academic performance. *Higher Education Research & Development, 36*(2), 269-279. doi:10.1080/07294360.2016.1196475

Strand, M., Miller, D., & Focken, R. (2016). Assessing public health knowledge of pharmacy students before and after completion of didactic and experiential public health coursework. *Currents in Pharmacy Teaching and Learning, 8*(1), 1-6. doi:10.1016/j.cptl.2015.09.013

Appendix 1 – Instructional engagement construct

Compared to my other lecture-based courses, during this courses' activities held in the STEM building I…	Strongly Disagree				Strongly Agree
…was engaged more often in discussions with other students on the same table	1	2	3	4	5
…had more opportunities to think aloud (expression of ideas, answers to instructor questions, working on case studies)	1	2	3	4	5
…had more opportunities to engage in reflection on course topic	1	2	3	4	5
...had cooperated more often with colleagues on classroom assignments	1	2	3	4	5
… was engaged more often in increasing knowledge on course topic	1	2	3	4	5
…had more opportunities to engage in reflection on my learning	1	2	3	4	5