INSTRUCTIONAL DESIGN AND ASSESSMENT

A Team-Based Learning Course on Nutrition and Lifestyle Modification

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Objective. To create, implement, and evaluate an elective team-based learning (TBL) course on nutrition and lifestyle modification for pharmacy students.

Design. An elective course with 15 contact hours was developed for second-year pharmacy students based on the principles of TBL. Student knowledge gained and satisfaction with the course were measured.

Assessment. Sixty-two students completed the course. Knowledge about nutrition and lifestyle modification was significantly improved by completing the course (59% and 91%, respectively, $p < 0.001$). The satisfaction survey instrument had a response rate of 97%, and the majority of students (>85%) responded favorably to the TBL components.

Conclusion. An elective course using TBL effectively delivered course content while teaching students communication and teamwork skills. The course was well received by students.

Keywords: team-based learning, self-directed learning, active learning, nutrition, lifestyle modification

INTRODUCTION

One of the Healthy People 2020 goals is to promote health and reduce chronic disease risk through the consumption of a healthy diet and achievement and maintenance of healthy body weight.¹ The 2007-2008 National Health and Nutrition Examination Survey indicated that 68% of US adults over age 20 years are overweight or obese, and that percentage has been steadily increasing since the 1988-1994 survey data.² In 2008, the US total cost of overweight and obesity combined was estimated to be \$147 billion.³ Lack of physical activity and poor diet are 2 major causes of this obesity epidemic. Obese Americans are more likely to develop chronic diseases such as diabetes, high blood pressure, and heart disease.

Traditional training for healthcare professionals focuses on disease treatment rather than disease prevention. As 1 of the largest, most accessible, and trusted groups of healthcare professionals, pharmacists can play a significant role in disease prevention by educating patients in multiple healthcare settings. However, to do so, they must be equipped with the necessary knowledge and skills. A survey of US pharmacy colleges and schools found that few were addressing recommendations to promote public health education through formalized classroom courses and that more courses focusing on

public health education should be offered to pharmacy students.⁴

The American Association of Colleges of Pharmacy's Center for the Advancement of Pharmaceutical Education (CAPE) has released educational outcomes intended to provide a framework for pharmacy colleges and schools to revise or develop their curricula.⁵ One of the major headings of the 2004 CAPE outcomes includes public health, which is intended to promote health improvements, wellness, and disease prevention in cooperation with patients, communities, at-risk populations, and other members of an interprofessional healthcare team. Additionally, the National Association of Boards of Pharmacy released blueprint standards in 2010 for the North American Pharmacist Licensure Examination.⁶ Area 3 of the blueprint includes a competency that discusses providing health information about nutrition, lifestyle, wellness, and other nondrug measures that can promote health or prevent disease progression.

Team-based learning (TBL), which was initiated in medical education at Baylor College of Medicine in 2001, has garnered interest from other areas of health professional education.⁷ The idea behind TBL is that it has the ability to address many professional competencies, including communication, interpersonal skills, teamwork skills, knowledge acquisition, and application of knowledge. It is able to meet many of the Accreditation Council for Pharmacy Education curriculum standards through self-directed and active team learning.⁸ For these reasons, TBL appears to be an ideal method for teaching

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a course on nutrition and lifestyle modification. Students would gain not only knowledge but also skills that they can use while working with patients and as part of a healthcare team.

A review article of 17 studies that evaluated TBL⁹ included 10 studies involving medical students, 2 with undergraduate nursing students, and 1 study each involving medical doctors, psychiatric residents, medical physiology students, economic students, and industrial physiology students. This review found that 3 outcomes are commonly studied in TBL: student satisfaction, student engagement, and examination scores. Students generally were satisfied with TBL as an active-learning method, students were more engaged while taking TBL courses, and examination scores improved with TBL. The review suggested that TBL is a potentially powerful teaching method but that more research based on outcomes should be conducted. It also acknowledged the importance of student engagement and satisfaction but emphasized that student learning and ability to work as part of a team should be considered the most meaningful outcomes for testing TBL.

The purpose of the current project was to: (1) develop a pharmacy course that discusses nutrition and lifestyle modification for disease prevention or treatment; (2) implement the TBL approach, including using the Readiness Assurance Process over the typical lecture-based learning currently used at the College of Pharmacy-Glendale; and (3) assess students' knowledge gained from the course as well as their opinion about TBL.

DESIGN

This study involved students in a 3-year doctor of pharmacy (PharmD) degree program. In the spring quarter of 2012, a new elective entitled Nutrition and Lifestyle Modification in Pharmacy was offered to pharmacy students in their second classroom-learning year at Midwestern University College of Pharmacy-Glendale. Twenty-seven students enrolled in the spring course. In order to include more student data, the same course was offered again to a different class of 35 second-year pharmacy students in fall 2012.

Electives at Midwestern University College of Pharmacy-Glendale are usually structured as 1.5 hours over 10 weeks, for a total of 15 contact hours. Since a longer class time was needed to implement the components of TBL, it was decided to offer the course over 7 weeks, with 5 core modules. Since TBL was unfamiliar to most of the students who enrolled in the course, the principles of TBL were introduced to the students during a 1-hour introduction session. The grading system and point breakdown were explained in an attempt to alleviate students' concerns about their course grade. At this

session, students completed a precourse knowledge survey instrument that included 15 concepts that would be covered in the course. Students were told that their survey scores would be used to form TBL teams, which would remain the same throughout the course. The intent of using this method to assign teams was to allow for even distribution of baseline knowledge among teams to form equal and effective teams.

The course was split into five 2.5-hour modules covering nutrition and lifestyle modification related to obesity, cardiovascular disease, cancer, diabetes, and sports enhancement. An online learning platform was used to distribute precourse material, which was designed by the course instructor. This material was posted 1 week prior to class and included defined objectives for the assigned study material, a Microsoft PowerPoint or Word handout on the topic, reading assignment(s), and assessment questions. Students were instructed to review and study the material prior to coming to class.

The first 45 minutes of each 2.5-hour session were devoted to assessing students' preparation through the readiness assurance process (RAP). Students first took an individual readiness assurance test (iRAT) consisting of 5 to 10 multiple-choice questions based on content from the precourse assignments. To ensure it was consistent with current literature on TBL, iRAT questions were based on the low level of Bloom's taxonomy and were designed to assess students' knowledge and comprehension.^{7,10} After each student submitted his/her iRAT, teams took a version of the same test designed to be administered to groups (gRAT). Immediate feedback assessment technique was used for the gRAT. The intent of providing immediate feedback was to allow teams to reflect on how their team failed to capitalize on the knowledge of 1 or more members of the team, naturally allowing for assertive members to do more listening and quieter students to become more active in the team discussion. After a team completed the gRAT, they were asked to write their score on a dry-erase board at the front of the room. The intent of this exercise was to facilitate team development by creating a natural competition among teams, motivating each team to do its best. After all the gRAT team scores were posted, the facilitator answered class questions and clarified concepts from the test or the precourse assignments that students did not understand. A team appeal process was implemented for gRAT questions, which allowed them to appeal questions they did not answer correctly in writing on the first try. The iRATs and gRATs were worth 25% and 12.5%, respectively, of the student's final grade.

The remaining class time was used for a team in-class application exercise. In order to enhance learning,

application exercises were written at the application and/or analysis level of Bloom's taxonomy.¹⁰ The first time the course was offered, all in-class application exercises consisted of a patient case in which students were asked to write a nutrition and lifestyle modification plan. Simultaneous reporting was done by means of a gallery walk. Teams were asked to write the key elements of their plan on a 3' x 4' anonymous poster that was submitted to and then displayed by the instructor in the room, along with a poster that she developed. Students were asked to critique other teams' posters, writing down 1 thing they liked about 1 poster and 1 question they had on 1 poster that was not their own. This feedback was then given to the instructor to be used for group discussion at the end of class, with each group having to respond to the questions that were directed toward their poster.

Feedback from the first offering of the course included several comments on the repetitive nature of the group application exercises. Based on this feedback, the instructor developed several new application exercises to be used in the second offering of the course, including developing concept maps, case team debates, and multiple-choice team debates. The concept-maps activity was carried out with a gallery walk, as described above. The case team debate required teams to develop a nutrition-and-lifestyle modification plan. Simultaneous reporting was carried out in a debate style, wherein teams verbally discussed their plans with other teams. The multiple-choice team debates included case-based questions with 3 to 5 plausible options to provoke discussion among team members. Answers were reported simultaneously using answer cards that displayed the team's specific choice. The in-class application exercises were worth 12.5% of the student's final grade.

Student learning was assessed using a 50-question individual final examination, which consisted of multiple-choice and short-answer questions. This examination included the same 15 questions that were asked on the precourse survey instrument to assess knowledge gained through taking the course. Students also took a group final examination that included writing a detailed nutrition and lifestyle modification plan for a patient. The individual final examination was worth 25% of the student's final grade whereas the group final examination was worth 12.5% of the student's final grade. To pass the course, students were required to receive an average of at least 65% on the iRATs and individual final examination.

At the end of the course, students were required to complete a peer assessment of each team member's contribution to the course adapted from a published instrument.⁷ Students were given a defined number of points

and were asked to assign each team member a score (7 to 14) based on what he/she contributed to the group. Students were encouraged to score each team member based on his/her individual performance as a member of the team. The peer evaluation process was worth 12.5% of the student's final grade.

EVALUATION AND ASSESSMENT

The impact of TBL was assessed in 2 ways. The first method evaluated student learning by comparing pre- and post-course examination scores. Secondly, students were asked to complete an anonymous, voluntary course-survey instrument that included 7 Likert-scale items: 4 of the items focused on the TBL process, 2 were based on improved student confidence regarding the topic, and 1 related to recommending the course to other students. The survey instrument also included 3 short-answer questions asking what were the most and least valuable aspects of TBL and how the course could be improved. The project was approved by Midwestern University's Institutional Review Board and the University of Massachusetts School of Public Health and Health Sciences Local Human Subjects Review Board.

Continuous data are presented as mean $\pm$ SD. Dichotomous data are presented as n (%). To compare differences in continuous data that were normally distributed pre- and post-intervention, a paired *t* test was used. Significance was set at $p < 0.05$. SPSS Statistics, version 19 (SPSS, Chicago, IL) was used for all statistical analyses.

Sixty-two students completed the course. Knowledge about nutrition and lifestyle modification was significantly improved by taking the course (59% and 91% respectively, mean score, $p = < 0.001$). The class average on the iRATs ranged from 75% to 85%. The satisfaction survey instrument had a response rate of 97% with favorable responses being "agreed" or "strongly agreed." The majority of students responded favorably regarding the required reading and activities prior to class enhancing their learning (90%), the iRAT enhancing their learning (87%), and the gRAT (98%) and in-class application exercise enhancing their learning (88%). Additionally, 95% of students responded favorably regarding the course increasing their confidence in counseling patients on lifestyle modifications, and 98% of students responded favorably regarding the course increasing their ability to design and implement a lifestyle modification plan for a patient with a specific disease state. Most students (92%) agreed or strongly agreed that they would recommend this course to other students (Table 1).

The survey instrument also included 3 open-ended questions about the course and TBL. The top 3 topics that were discussed for each open-ended question were

Table 1. Pharmacy Students' Satisfaction Regarding a Team-Based Learning Course in Nutrition and Lifestyle Modification (N=61)

Survey Item	Student Responses, %			
	Strongly Agree	Agree	Disagree	Strongly Disagree
The required readings and activities prior to class enhanced my learning experience.	51.7	38.3	6.7	3.3
The individual readiness assurance tests enhanced my learning experience.	53.3	33.3	13.3	0
The group readiness assurance tests enhanced my learning experiences.	75.0	23.3	1.7	0
The in-class application exercises enhanced my learning experience.	60.0	28.3	10.0	1.7
The course increased my confidence in my ability to counsel patients on lifestyle modifications.	60.0	35.0	5.0	0
The course increased confidence in my ability to design and implement a lifestyle modification plan for a patient with a specific disease state.	56.7	41.7	1.7	0
I would recommend this course to other students.	62.7	28.8	8.5	0

compiled and reported (Table 2). Students felt like the most valuable component of TBL was being able to learn from their peers and that the least valuable components of TBL were team disagreements, the group application exercises, and lack of lecture time. Recommendations to improve the course included having fewer poster-type application exercises, allowing some time for in-class lecture, and making sure the notes were clear on important topics.

DISCUSSION

Several elective courses in pharmacy have been developed on nutrition or lifestyle modification.¹¹⁻¹³ Although this is not the first course to discuss TBL in an individual course of a PharmD curriculum, to the author's knowledge, it is the first elective nutrition and lifestyle modification course to use TBL.¹⁴⁻¹⁷ This course, which used TBL to teach nutrition and lifestyle modification,

was able to improve not only students' knowledge about course material but also their confidence in their ability to counsel patient's on lifestyle modifications.

The results of this research are consistent with the current literature on TBL. As was noted in other articles, most students are satisfied with TBL, with some students preferring traditional lecture-based learning.^{9,14,15} Further, student knowledge about course material increased as a result of taking this TBL course, as demonstrated by an increase in postcourse examination scores. One limitation to these data is that student scores were not compared to those of a control group that took a traditional lecture-based course. This comparison was not possible because only the TBL course has been offered. However, research in pharmacy has shown consistently higher performance in courses that use TBL compared with that in traditional lecture-based courses, suggesting that TBL is a more effective teaching method.¹⁴⁻¹⁶

Table 2. Feedback From Pharmacy Students' Regarding a Team-Based Learning Course on Nutrition and Lifestyle Modification

Responses	Students Giving This Response, No.
Top 3 things students found most valuable about TBL	
The ability to learn and get feedback from other students	36
The GRAT process with immediate feedback and discussion	5
The application exercises that allow for an opportunity to apply what is learned	5
Top 3 things students found least valuable about TBL	
Team disagreements or problems (members not agreeing on answers, getting along with each other, or lack of participation from some members)	8
Poster type group application exercises	6
TBL didn't allow for any classroom lecture time	4
Top 3 recommendations for improving the course	
Vary the in-class application exercise more (fewer poster activities)	13
Give a short lecture before class starts	8
Improve handouts	6

Abbreviations: TBL = team-based learning; GRAT= group readiness assurance process.

The transition to TBL may be difficult for students. One challenge is that students are intimidated by the idea of having weekly quizzes that constitute a large part of the final course grade. To alleviate some of the concern about course grade, iRAT and traditional final examination scores were equally weighted at only 25% of the student's final grade. Another way the instructor attempted to alleviate stress about iRAT performance was to increase the number of questions on the iRAT. As the course progressed, iRATs included 10 questions instead of 5. After the course was over, it appeared that the concern was unfounded, with the class performing well on the iRATs (average correct range, 75% to 85%).

One study has shown that students may have difficulty staying on topic with the application exercises.¹⁷ The same challenge was encountered in the current research, with students commenting on team disagreements and problems. Further, students became bored with the same in-class application exercise, which could have led to group dysfunction. Students stated at the end of the course that they found these exercises repetitive and that members of their group often had a hard time staying on topic. The second time the course was offered, the activities were varied. Students stated that they disliked the application exercises that included writing down answers on large sheets of paper with gallery walks, favoring the debate-style exercises. The next time the course is offered, more debate-style in-class application exercises will be implemented in an attempt to improve course satisfaction, enhance student learning, and improve group cohesiveness.

In traditional lecture classrooms, the instructor often emphasizes important points and answers questions from students before they are tested on the material. For most students, this course was their first experience with TBL and independently studying course material in preparation for an examination. Because TBL does not allow for classroom interaction before the RAP, several students commented on finding a better way to present the pre-course material. Although the objectives were directly tied to the iRAT questions, students still felt that the handouts could be improved and that some difficult topics presented in the precourse material were not explained well enough. Some students suggested a short lecture before each iRAT so that important topics could be reviewed. Because this would take up valuable class time, an alternative solution will be implemented the next time the course is offered. A concept known as "flipped classrooms" is becoming popular among some educators. This approach includes having students go online for video lectures outside of class so they can spend time in class working on activities and assignments with their teachers or in groups.¹⁸ In order to help students transition to the

TBL style in the future, this concept will be implemented. Brief videotaped lectures by the instructor will be developed and posted on an online learning platform at the same time that the required readings are posted in an attempt to clear up confusing topics prior to class.

SUMMARY

An elective course on nutrition and lifestyle modification that used TBL delivered course content effectively. Healthcare professionals must feel comfortable counseling patients on lifestyle modification topics. Most US pharmacy colleges and schools need more courses to help address public health education, and TBL may be a good option for delivering these types of courses. By using TBL, content can be delivered to the students while they are working on their communication and teamwork skills. This research shows that students may respond favorably to a course that uses TBL in a curriculum that is primarily lecture based.

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REFERENCES

1. Office of Disease Prevention and Health Promotion. US Department of Health and Human Services. Developing Healthy People 2020. <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=29>. Accessed January 9, 2013.
2. Ogden CL, Carroll MD. Prevalence of overweight, obesity, and extreme obesity among adults: United States, Trends 1976-1890 through 2007-2008. June 2010. http://www.cdc.gov/NCHS/data/hestat/obesity_adult_07_08/obesity_adult_07_08.pdf. Accessed January 9, 2013.
3. Finkelstein EA, Trogon JG, Cohen JW, Dietz W. Annual medical spending attributable to obesity: Payer- and service-specific estimates. *Health Aff (Millwood)*. 2009; 28(5):w822-w831.
4. Lenz TL, Monaghan MS, Hetterman EA. Therapeutic lifestyle strategies taught in US pharmacy schools. *Prev Chronic Dis*. 2007; 4(4):A96. <http://www.cdc.gov/pcd/issues/2007/oct/06.0116.htm>. Accessed January 9, 2013.
5. American Association of Colleges of Pharmacy, Center for the Advancement of Pharmaceutical Education. <http://aacp.org/resources/education/Pages/CAPEEDucationalOutcomes.aspx>. Accessed January 9, 2013.
6. National Association of Boards of Pharmacy. NAPLEX Blueprint. The NAPLEX Competency Statements. <http://www.nabp.net/programs/examination/naplex/naplex-blueprint>. Accessed January 9, 2013.
7. Michealsen LK, Parmalee DX, McMahon LL, Revine RE. *Team-Based Learning for Health Professions Education: A Guide to Using Small Groups for Improving Learning*. VA: Stylus Publishing;2008.

8. Accreditation Council for Pharmacy Education. Accreditation standards and guidelines for the professional program in pharmacy leading to the doctor of pharmacy degree. <https://www.acpe-accredit.org/deans/standards.asp>. Accessed January 9, 2013.
9. Sisk RJ. Team-based learning: systematic research review. *J Nurs Educ.* 2011;50(12): 665-669.
10. Bloom BS, ed. *Taxonomy of Educational Objectives. The Classification of Educational Goals. Handbook I: Cognitive Domains.* New York, NY: McKay;1956.
11. Machen R, Hammer D, Odegard P. Elective course in nutrition taught by a pharmacy student. *Am J Pharm Educ.* 2007;71(4): Article 65.
12. Chang L, Popovich N, Iramaneerat C, Smith E, Lutfiyya M. A clinical nutrition course to improve pharmacy students' skills and confidence in counseling patients. *Am J Pharm Educ.* 2008;72(3): Article 66.
13. Lenz T. An elective course on lifestyle modifications in pharmacotherapy. *Am J Pharm Educ.* 2007;71(5): Article 92.
14. Zingone MM, Franks AS, Guirguis AB, George CM, Howard-Thompson A, Heidel RE. Comparing team-based and mixed active-learning methods in an ambulatory care elective course. *Am J Pharm Educ.* 2010;74(9): Article 160.
15. Persky AM. The impact of team-based learning on a foundational pharmacokinetics course. *Am J Pharm Educ.* 2012;76(2): Article 31.
16. Persky AM, Pollack GM. A modified team-based learning physiology course. *Am J Pharm Educ.* 2011;75(10): Article 204.
17. Grady SE. Team-based learning in pharmacotherapeutics. *Am J Pharm Educ.* 2011;75(7): Article 136.
18. Schachter R. Avoiding the pitfalls of virtual schooling. *District Administration.* 2012;48(6):74-76,78-79. <http://www.districtadministration.com/news/avoiding-pitfalls-virtual-schooling>. Accessed January 9, 2013.