

Performance and Perceptions of Pharmacy Students using Team-based Learning (TBL) within a Global Health Course

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Keywords: Team-based learning, TBL, active learning, self-directed learning, Global Health Course, pharmacy education

ABSTRACT

Purpose: Team-based learning (TBL) has been shown to be a very useful active learning tool in a variety of disciplines and educational settings. The objectives of this study in a Global Health elective course within a PharmD curriculum were to (1) determine whether TBL contributes to performance (as measured by iRAT scores, tRAT scores, and grades); and (2) evaluate students' perceptions of TBL as an instructional strategy. **Case Study:** TBL sessions were incorporated into a new elective course in Global Health along with other teaching methodologies. Student performance was evaluated during the TBL sessions and course team projects, among others. An anonymous student qualitative survey explored their perceptions of and experiences with TBL at the end of the course. Students' performance in the TBL sessions improved as reflected in the comparison of individual Readiness Assurance Tests (iRATs) and the team Readiness Assurance Tests (tRATs) scores. Overall students' performance in the course resulted in over 88% earning the letter grade A. Students' performance in the TBL sessions, especially their iRATs, was reflected in their overall course grades. Over 75% of the students believed that TBL increased their analytical skills and nearly 50% believed that learning utilizing TBL would have the most lasting effect on their careers. **Conclusion:** TBL was successfully implemented in a Global Health elective course in a PharmD curriculum and students perceived it as a beneficial instructional strategy. This study adds to the TBL literature by providing some evidence of the applicability of TBL in a course not traditionally taught in the PharmD curriculum (i.e., Global Health). Future research and intervention(s) leading to the development and growth of TBL in pharmacy education are recommended.

An Introduction to TBL

The ever-increasing class size and associated high student-to-faculty ratios in higher education have led to the need for innovative ways to promote student engagement and facilitate learning. Active learning techniques, involving small student groups, have therefore gained popularity in higher education.¹⁻⁴ One such active learning technique is team-based learning (TBL). TBL, described by Michaelsen et al as an instructional strategy, is rapidly gaining momentum in higher education.⁵

Michaelsen has described three phases of TBL. Phase 1 is the preparatory phase where students prepare for the in-class TBL session by learning the content of the material provided by the faculty.⁵ Phase 2 is the accountability phase where individual students demonstrate their readiness for the class by taking an in-class test called the individual Readiness Assurance Test (iRAT). This iRAT is based on the content of the materials provided to the students prior to the TBL session. Individual students then join their preformed teams and the teams answer the same set of questions as in the

iRAT. The team tests are known as the team Readiness Assurance Tests (tRATs). The tRATs, when compared to iRATs, help to determine whether the peer-to-peer student engagement, discussion, and "negotiations," that take place within the team as they work through the tRAT together, enhance performance. Phase 3 of a TBL session is the application phase where student teams work on the same problems or cases designed to provide the teams the opportunity to apply the concepts learned in phases 1 and 2 to solve significant real life problems of varying complexity.⁵ An important component in phase 3 is the class feedback and discussion when, guided by the faculty in the capacity of a facilitator, teams share their answers to the application exercises with the whole class. The faculty has the opportunity to address any misconceptions and reinforce the key concepts in this feedback session.

The benefits of TBL have been described in the literature. They include enhancing student engagement and performance; developing critical thinking, analytical, collaborative, and team-building skills; and enhancing student-to-student and student-to-faculty interactions.^{1,5-12}

TBL has been effectively utilized in medical,^{1,4,12-14} nursing,⁷ and health sciences education.¹⁵ The adaptability of TBL as an instructional strategy has been shown by its successful

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application in didactic and experiential education.^{1-3,8,10,12,14,16,17}

TBL in Pharmacy

Documentation of the use of TBL in pharmacy education is limited.^{6,9,18,19} Beatty et al of the Ohio State University College of Pharmacy and the University of Cincinnati College of Pharmacy have described the successful incorporation of TBL into the workshop portion of a pathophysiology and therapeutics course sequence.⁶ The aim was to promote greater integration of concepts across the pharmacy curriculum and promote consistency in the problem-based approach to patient care; they found the strategy very effective in achieving the desired outcomes.⁶

Conway et al of the University of Oklahoma College of Pharmacy have also described the incorporation of TBL strategies into a lecture-based cardiovascular module within a 10-semester pharmaceutical care integrated course sequence taught across two campuses simultaneously.¹⁸ They replaced eight hours of classroom lectures with six self-directed learning assignments and transformed the case discussions portion of the course into TBL case sessions, with the aim of increasing students' ownership of their own learning as well as student-student engagement and participation.¹⁸ Each TBL case session was preceded by a quiz to assess students' readiness for the session but there was no mention of team quizzes. The researchers reported the achievement of the course objectives with no adverse effects on overall students' course grades.¹⁸

Letassy et al transformed an endocrine module taught across two campuses (University of Oklahoma College of Pharmacy and the Oklahoma State University Center for Health Sciences) into 13 TBL sessions and determined that iRAT and tRAT scores significantly predicted overall course grades, and course grades were higher than those earned prior to the implementation of TBL.⁹

It is pertinent to note that the use of TBL as an instructional strategy in pharmacy education, as described above, occurred within traditional core courses in the PharmD curriculum. However, Poirier et al of the Southern Illinois University School of Pharmacy have also incorporated TBL into a non-traditional but required course in cultural competency.¹⁹ The course included individual readiness assessment tests and team readiness assessment tests (RATs). However, it is not clear whether the individual and team tests involved the same sets of questions as is the norm in TBL sessions.⁵ In addition, the normal TBL application exercises were also absent in this particular study.¹⁹

TBL at Touro College of Pharmacy, New York (TCOP, NY)

TBL was introduced to the faculty of Touro College of Pharmacy, New York (TCOP, NY) in 2009 through a college-sponsored workshop on our premises, facilitated by an outside educator with expertise in TBL. The author was among the first to introduce TBL into a course in TCOP, NY.

TCOP, NY has 3 public health-related core courses in its curriculum. This reflects the College's greater emphasis on public health and the desire for its graduates to play active roles not only in the clinical care of individual patients but also in disease prevention and health promotion at the population or community level. To further prepare students for careers in public health, especially directed at helping to address the many drug-related global health challenges of our time, the elective course in Global Health was developed. The course was offered for the first time in the spring of 2010 to second year students of the College's 4-year professional (2 year didactic +2 year experiential) PharmD program.

The elective course in Global Health is a 3-credit hour course which, following the school's blended curriculum format, allows a 2-hour classroom session weekly and a one-hour session on the school's Blackboard® Course Management System (BB). The detailed description of the course is the subject of another manuscript being developed; this paper focuses on the TBL sessions of the course.

The study sought to answer the following specific questions:

- 1) Will TBL contribute to the performance of students in this Global Health elective course, as evidenced in iRAT scores, tRAT scores and grades?
- 2) What are the perceptions of pharmacy students of TBL as an instructional strategy in this course?

The study was approved by Touro College's School of Health Sciences Institutional Review Board (IRB), as it is covered by the IRB's approval of TCOP's application regarding the Evaluation of College of Pharmacy Curriculum, Student and Faculty Outcomes.

TBL in the Global Health Course

In line with the College's policy of fostering the development of "Learning Communities," student teams of 5-6 team members each are established from the beginning of the academic year by the Office of Student Affairs. The initial team assignments for each year are based on their advisee groups and the teams are re-arranged every semester in an effort to provide the opportunity for students to work with a wide variety of individuals by the time they complete the program. This system ensures consistency in teams for all

classes across the curriculum. Therefore, the same teams worked in the 4 TBL sessions and the 3 group projects in the Global Health course (Table 1).

Fifty three students, 84% of the P2 class in the 2009-2010 academic year, enrolled in this course in the spring of 2010; the class consisted of 10 student teams. Each team was assigned to one of the six World Health Organization (WHO) regions, into which the 193 member countries of the world body have been divided. Within each WHO region, selected countries of focus were identified (Table 2). For each TBL session or team project, student teams were required to work with different countries within their assigned WHO region.

Table 3 lists the topics in the course which were addressed as TBL sessions. Topics were selected for TBL if they provided greater opportunity for enhanced student-to-student engagement and for developing critical thinking and analytical skills. Each TBL session lasted for 1 hour 50 minutes which is the allocated time for all classroom sessions across our curriculum. Approximately three days prior to a TBL session, content materials in the form of PowerPoint slides and internet website links, with or without research papers, were posted on Blackboard® (BB). A BB announcement was posted, supported by an email sent through BB, to remind students of the scheduled TBL session and of the availability of these materials on BB. Since TBL was very new to the students at this time, they were asked to limit their pre-session preparation to the content of the PowerPoint slides and to use these and the additional resources for the application part of the TBL session.

During the first 10 minutes of the TBL session, students' individual readiness for the session was assessed with a 10 multiple-choice questions iRAT. Each correct score in the iRAT had a value of one point. (Appendix 1 provides an example Assurance Test for Macroeconomics and Health). Although some researchers have used Student Response Pads (i.e., clickers) for the iRATs,¹⁷ the author used scantron sheets for the iRATs. After the iRAT, students moved into their preformed teams and were allotted 10 minutes to answer the same 10 questions (i.e., tRAT). As described earlier, the rationale for using the same questions for the iRATs and the tRATs was to determine whether the student-to-student engagement during the team sessions would enhance overall team performance and student learning as reflected in their tRAT scores when compared to the iRAT scores of individual team members. During each tRAT, teams discuss and reach consensus to select the best answer choice for each question.

Since immediate feedback, especially during the tRAT, is a key component of TBL, student teams in this course used the Immediate Feedback Assessment Technique (IF-AT) scratch-off forms to answer the questions during the tRATs.^{5,20} When scratched, a correct answer reveals a star on the IF-AT forms.^{21,22} Research has shown that students appreciate the instant feedback that the IF-AT forms provide, creating an opportunity for greater team interaction, student engagement, and overall enhancement of the classroom experience.^{21,22} TCOP, NY uses the 10-question, 5-options (A-E) IF-AT scratch forms. Teams in this course obtained 5 points for every correct answer revealed during their first attempt; 3 points for a second attempt, 1 point for a 3rd attempt, and no points for a 4th attempt. Therefore, the maximum points any team could earn for a tRAT was 50.

After the usual 10 minute break, students re-joined their teams to work on the application phase of the TBL session, which usually required 40 minutes of class time. Student teams searched for additional information from reputable websites, among other resources, in order to provide acceptable answers to the questions in the application exercises. The application part of the TBL session earned each team an additional maximum of 50 points, giving each team, an overall maximum obtainable score of 100 points for each TBL session.

Appendix 2 illustrates the application exercise for the TBL session on the Report of the Commission on Macroeconomics and Health (CMH). The Report of the CMH established the global evidence that increasing resources for health in low income countries, which carry the greatest proportion of the global burden of diseases, yields dramatic and sustainable socioeconomic growth.²³

The last 10 minutes of the TBL session were used for discussing the application exercises. During this time, teams could be called upon at random by the faculty to answer any questions regarding the significant issues raised within the application exercises. Teams could also ask questions or provide comments to other teams. Discussions enhanced the learning experience by providing students with the opportunity to learn the concepts being studied as they related to countries other than those assigned to their teams.

Student Performance

Students were assessed based on their performance on the iRATs, tRATs, the application exercises, and group projects. Class attendance and participation as well as team members' evaluation of a student's contribution to overall team effort, following a given rubric (Appendix 3), also contributed to a student's overall course grade. Peer evaluation points for

each student (maximum 32) consisted of the average of the total points received from the team members.¹⁹ Class participation was evaluated based on class attendance and general contribution to class discussions. Unannounced class attendance was taken throughout the course. Table 4 gives the distribution of points in the Global Health course offered in the spring of 2010.

Table 5 gives a breakdown of team members' iRAT and tRAT scores for the TBL session on the Report of the Commission on Macroeconomic and Health. Peer-to-peer learning took place within the teams during the tRAT as reflected in the higher tRAT scores compared to iRAT scores. Apart from team 10 that had one answer correct after their second attempt, the other 9 teams answered all 10 questions correct at their first attempt, an indication of enhanced learning and performance of the individual students making up each team.

With the aim of developing applicable skills for Global Health careers in the students, the course did not assess student learning through the usual examinations. It is important however to note that the 4 TBL sessions in the course accounted for a total of 30% of the overall course grade; 15% for both the iRATs and the team grade (i.e., tRATs and application exercises). Results of course performance included 88.7% of students earning a letter grade of A, 9.4% earning a B, and 1.9% earning a D. The letter grade earned by students was found to mirror closely their participation and/or performance in the TBL sessions, especially the iRAT component. Thus, those earning a B in the course either had one or more low iRAT scores or missed one TBL session altogether. Those who earned a D were found to have missed 2 TBL sessions. The peer evaluation of contribution to team effort was not part of the TBL grading; team members evaluated their peers with respect to their efforts and other attributes related to the completion of the three group projects in the course.

Student Perceptions

As a newly-introduced instructional strategy in the College, it was important to explore students' perceptions of TBL compared to other methodologies used in the course (Table 1). At the end of the course therefore, the qualitative responses of students to the statement "I believe the learning I did during (chose one) will have the most lasting effect on my career," were obtained anonymously using Student Response Pads (clickers).²⁴

Forty eight percent of the students believed that their learning during the TBL sessions would have the most lasting effect on their careers as compared to 30% and 22% who believed classroom lectures and group projects, respectively,

would have this same effect (Figure 1). To confirm or refute literature reports that TBL improves analytical and critical thinking skills of students, students were again evaluated for the extent of their agreement with the statement, "I believe the TBL sessions helped to improve my analytical skills." Fifty seven percent of the class strongly agreed with the statement; 19% agreed; 5% were neutral; 17% disagreed; and 2% strongly disagreed (Figure 2).

Discussion

TBL has been successfully implemented throughout an endocrine module in a PharmD curriculum and also in the workshop portion of a course sequence in pathophysiology and therapeutics.^{6,9} Elements of TBL have also been incorporated in a cardiovascular course module and a cultural competency required course in pharmacy.¹⁸⁻¹⁹ This paper presents qualitative evidence of the applicability and effectiveness of TBL in a PharmD course outside the traditional PharmD curriculum (ie. a Global Health elective course). This further supports the adaptability and versatility of TBL as an instructional strategy, a fact that has been established in other health professional courses.^{2,3,7,8,10,12-14,16} The use of TBL in this Global Health elective course has highlighted the importance of carefully formulating the iRAT and tRAT questions that will test not only the knowledge of key concepts, but also the understanding of the interrelation with concepts of topics previously covered in the course. This sets the tone for the successful application of these concepts in the application phase of the TBL session where critical thinking, analysis, reasoning, and formulative skills are developed. Grading the TBL sessions, especially the iRATs, as was done in this course, has been found to increase the importance and value that students attach to these sessions.^{6,9}

Different TBL users have reported different time allocations for the readiness assurance tests and the application phases of the TBL session.^{6,9,18} In this course, the 10 minutes allocated for the iRATs and the tRATs, the 40 minutes allocated for the application exercises, and the 10 minutes allocated for discussion of application exercises were found to be adequate. All teams were required to hand in their written or typed application answers by the end of the class. It is the belief of the author that the time allocated to the various parts of a TBL session and the TBL session as a whole will be determined by the nature of the topic, the nature and number of questions in the readiness assurance tests, and the degree of complexity of the application exercises. As students become more comfortable with TBL, their efficiency increases.¹⁵

As the coordinator of the Global Health course, the author made a conscious effort to use methodologies such as TBL and group projects to develop requisite skills for global health careers, with the goal of avoiding the “cramming, pouring and forgetting” tendencies of students during routine examinations. It was gratifying to note, however, that the personal accountability associated with TBL made it possible to appropriately reward students for their personal efforts in the course. Class participation and high iRAT scores were associated with a letter grade of A in the course. On the other hand, class absenteeism and/or low iRAT scores resulted in low overall course grades. Thus it can be inferred that TBL scores in a course, even in the absence of routine examinations, would be appropriate assessment tools for students’ course grading.

A particularly interesting observation made was the team dynamics that occurred during TBL sessions as compared to team or group projects in the course. As explained earlier, the same teams worked in the TBL sessions as well as the 3 group projects in the course. However, 48% of students believed that TBL, as an instructional strategy, would have the most lasting effects on their careers. On the other hand, less than half of that (22%) believed group projects would have the same benefit. This confirms the transformational benefits of TBL as compared to traditional group work.^{5,15} The difference may be due to the greater individual responsibility and accountability for learning and team collaboration that are required for success in a TBL session.

It is important to explain here that the group projects differed from the TBL sessions in one fundamental way. Group projects did not include the individual readiness assurance process associated with TBL. Thus, all students in a given team received the same team grade for each group project irrespective of their individual contribution to the team effort. Each team completed their group projects outside of class, thus it was possible for “low team contributors” to earn the same grade as “high team contributors.” One way of attempting to distinguish between students within teams in this course was the peer evaluations completed at the end of the course. Every student evaluated each team member’s contribution to team effort following a standard evaluation rubric (Appendix 3). The peer evaluations contributed 5% of each student’s overall course grade.

Higher tRAT scores of teams compared to the iRAT scores of the individual team members found in this study confirmed enhanced team performance and individual student learning, through improved student-to-student engagement during TBL sessions, that has been reported in earlier studies.^{6,9,15}

Furthermore, over 75% of students in this course believed that TBL has helped to improve their analytical skills.

Implications

It is important to note that the increased student-student and student-faculty engagement achieved through TBL increases faculty workload, especially in preparation for TBL implementation.^{12,15} Faculty time is needed in the preparation of pre-session content for students’ self study, the development of questions for the readiness assurance tests and the development of application exercises, followed by facilitating discussions during TBL sessions and grading of TBL coursework (i.e., iRATs, tRATs, and application exercises). Hence faculty buy-in is critical for successful implementation of TBL. Faculty buy-in will make possible the willingness, interest, and enthusiasm required to follow through with the increased faculty workload associated with TBL.¹⁵ Second to faculty buy-in is experience with and expertise of the faculty in the use of TBL.^{12,15} Expertise is developed through initial and continuous training, experience with TBL, as well as internal and external mentoring by educators with greater experience and expertise with TBL.^{12,15} A critical mass of faculty using TBL in a given school facilitates collaboration and mutual support among the faculty.^{12,15}

Students’ buy-in has also been found to be important for the successful implementation and continuation of TBL in a course.^{12,15} It is important to appreciate that despite the benefits of TBL, not all students will be comfortable with TBL as an instructional strategy due to different learning preferences among students. Some students prefer lectures over TBL and resistance of students to TBL implementation has resulted in its discontinuation in some schools or courses.^{12,15} In this Global Health course, for example, 30% of the students believed that learning through classroom lectures would have the most lasting effect on their careers. However, it is the belief of the author that the enthusiasm, the level of comfort of the faculty with TBL, as well as the faculty member’s competency in implementing TBL will have a direct bearing on the level of acceptance of TBL by students.

Finally, buy-in by administration has been found to be essential in successful implementation of TBL in individual courses or across the curriculum.^{12,15} Support from the administration would be shown in the resources provided to facilitate TBL implementation.^{12,15} The required resources include preformed student teams, adequate class time for TBL sessions, and Student Response System (clickers). The administration of TCOP, NY has laid the foundation for active learning in general and of TBL in particular in the College’s PharmD program. This is because the College has adopted a blended learning curriculum involving the use of technology

and a variety of instructional strategies which, together, provide students the opportunity to learn in the classroom, laboratory, the community, online, and by themselves. This curricular arrangement has meant the establishment of student “learning communities,” or preformed student teams, whose membership is changed every semester as has been explained earlier, even before the introduction of TBL into the College’s teaching tool box in 2009. Classes across the curriculum have also been uniformly allocated 1 hour 50 minutes to provide adequate class time for TBL sessions. Furthermore, the Administration also acquired, for faculty’s use, the faculty’s choice of the IF-AT scratch-off forms. Finally, basic science and therapeutic courses in our curriculum have seen enhanced integration and better sequencing to facilitate student learning and better understanding of the inter-relationships of concepts across courses. Since such integrated courses typically have more faculty than non-integrated courses, implementing TBL in such integrated courses may reduce the work load of individual faculty but over all coordination may prove to be more challenging although it has been successfully done by others.¹⁸

Future Research

From available literature, it is clear that the use of TBL in pharmacy education is relatively new and limited. Thus an exploratory study of TBL use in pharmacy schools, similar to the one undertaken by Haidet et al within medical education is needed.¹³ Such exploratory study of TBL use will serve to document which schools of pharmacy have embraced TBL as an instructional strategy in their curriculum. It will also uncover in which courses- required or elective, traditional or non-traditional, basic science, therapeutics, public health etc. TBL is being implemented and to what extent. Faculty, students, and administration perceptions and experiences with TBL will also be elicited in this initial exploratory study. The findings of this exploratory study of TBL use could form the basis for implementing the desired intervention (s) in pharmacy education. Such intervention(s) may include capacity building of pharmacy faculty in TBL. The intervention(s) may then be followed up with a second study of TBL’s development and growth in pharmacy education, such as was undertaken by Thompson et al two years after the exploratory study of Haidet and colleagues.¹² The ultimate goal of all these research and other interventions is to rake into pharmacy education, the transformatory benefits of TBL.

Summary

TBL was successfully implemented in a new elective course in Global Health in a PharmD blended curriculum. As an instructional strategy, it was well received by students, as nearly half of the class believed TBL provided the degree of learning that would have the most lasting effect on their

careers. For successful implementation, buy-in from faculty, students, and administration is critical.

Acknowledgements

The author would like to thank Dr. Arjun Dutta, Associate Dean for Academic Affairs of TCOP, NY for kindly reviewing the initial draft of the manuscript.

References

1. Haidet P, Morgan R, O'Malley K, Moran B, Richards B. A controlled trial of active learning versus passive learning strategies in a large group setting. *Adv Health Sciences Educ.* 2004; 9(1):15-27.
2. Koles P, Nelson S, Stolfi A, Parmelee D, Destephen D. Active learning in a Year 2 pathology curriculum. *Med Educ* 2005; 39(10):1045-1055.
3. Rao SP, DiCarlo SE. Active learning of respiratory physiology improves performance on respiratory physiology examinations. *Adv Physiol Educ.* 2001; 25(1-4):127-133.
4. Trevena LJ, Clarke RM. Self-directed learning in population health. a clinically relevant approach for medical students. *Am J Prev Med.* 2002; 22(1):59-65.
5. Michaelsen LK, Knight AB, Fink LD. *Team-based learning: A transformative use of small groups.* Westport, CT: Praeger; 2002.
6. Beatty SJ, Kelley KA, Metzger AH, Bellebaum KL, McAuley JW. Team-based learning in therapeutics workshop sessions. *Am J Pharm Educ.* 2009; 73(6):100.
7. Clark MC, Nguyen HT, Bray C, Levine RE. Team-based learning in an undergraduate nursing course. *J Nurs Educ.* 2008; 47(3):111-117.
8. Hunt DP, Haidet P, Coverdale JH, Richards B. The effect of using team learning in an evidence-based medicine course for medical students. *Teach Learn Med.* 2003; 15(2):131-139.
9. Letassy NA, Fugate SE, Medina MS, Stroup JS, Britton ML. Using team-based learning in an endocrine module taught across two campuses. *Am J Pharm Educ.* 2008; 72(5):103.
10. Levine RE, O'Boyle M, Haidet P, Lynn DJ, Stone MM, Wolf DV et al. Transforming a clinical clerkship with team learning. *Teach Learn Med.* 2004; 16(3):270-275.
11. Tai BC, Koh WP. Does team learning motivate students' engagement in an evidence-based medicine course? *Ann Acad Med Singapore.* 2008; 37(12):1019-1023.
12. Thompson BM, Schneider VF, Haidet P, Levine RE, McMahan KK, Perkowski LC et al. Team-based learning at ten medical schools: two years later. *Med Educ.* 2007; 41(3):250-257.

13. Haidet P, O'Malley KJ, Richards B. An initial experience with "team learning" in medical education. *Acad Med.* 2002; 77(1):40-44.
14. Searle NS, Haidet P, Kelly PA, Schneider VF, Seidel CL, Richards BF. Team learning in medical education: initial experiences at ten institutions. *Acad Med.* 2003; 78(10 Suppl):S55-S58.
15. Thompson BM, Schneider VF, Haidet P, Perkowski LC, Richards BF. Factors influencing implementation of team-based learning in health sciences education. *Acad Med.* 2007; 82(10 Suppl):S53-S56.
16. Kelly PA, Haidet P, Schneider V, Searle N, Seidel CL, Richards BF. A comparison of in-class learner engagement across lecture, problem-based learning, and team learning using the STROBE classroom observation tool. *Teach Learn Med.* 2005; 17(2):112-118.
17. Pileggi R, O'Neill PN. Team-based learning using an audience response system: an innovative method of teaching diagnosis to undergraduate dental students. *J Dent Educ.* 2008; 72(10):1182-1188.
18. Conway SE, Johnson LJ, Ripley TL. Integration of Team-based learning strategies into a cardiovascular module. *Am J Pharm Educ.* 2010; 74(2):35.
19. Poirier TI, Butler LM, Devraj R, Gupchup GV, Santanello C, Lynch JC. A cultural competency course for pharmacy students. *Am J Pharm Educ.* 2009; 75(5):81.
20. Michaelsen L. Team-based learning in large classes. In: Michaelsen L, Knight A, Fink L, eds. *Team-based Learning: A Transformative Use of Small Groups.* Westport, CT: Praeger; 2002: 157-171.
21. Cotner SH, Baepler P, Kellerman A. Scratch This! The IF-AT as a technique for stimulating group discussion and exposing misconceptions. *J Coll Sci Teach.* 2008; 37(4):48-53.
22. Cotner SH, Fall BA, Wick SM, Walker JD, Baepler PM. Rapid feedback assessment methods: Can we improve engagement and preparation for exams in large-enrollment courses? *J Sci Educ Technol.* 2008; 17(5):437-443.
23. World Health Organization. Investing in Health: A Summary of the Findings of the Commission on Macroeconomics and Health. Available at: <http://www.who.int/macrohealth/infohealth/advocacy/en/investinginhealth02052003.pdf> Accessed 12/01/2010
24. Patton MQ. *Qualitative Research and Evaluating Methods.* 3rd Ed. Sage Publications Inc; 2002.

Table 1. Time Distribution of the Instructional Strategies Used in the Global Health Course in spring, 2010

Lectures (7)	TBL Sessions (4)	Blackboard Sessions(13)	Team Projects (3)
14 hours	8 hours	13 hours	Variable
^a 40	22.9	37.1	

^a% of instructional time, excluding team projects

Table 2. Team Assignment to World Health Organization (WHO) Regions

Team	WHO Region	Countries of Focus
1	WHO/EURO	Bulgaria, Cyprus, Georgia, Portugal, Ukraine
2	WHO/WPRO	Australia, Cambodia, China, Vietnam, Papua New Guinea
3	WHO/EMRO	Afghanistan, Iran, Iraq, Sudan, Pakistan
4	WHO/PAHO	United States, Brazil, Cuba, Haiti, Venezuela
5	WHO/PAHO	Canada, Mexico, Jamaica, Dominican Republic, Suriname
6	WHO/EURO	United Kingdom, Israel, Azerbaijan, Monaco, Serbia
7	WHO/AFRO	Botswana, Ghana, Tanzania, Uganda, South Africa
8	WHO/WPRO	Malaysia, Japan, Samoa, Tonga, Solomon Islands
9	WHO/SEAR	Bangladesh, Democratic Republic of Korea (N. Korea), India, Thailand, Sri Lanka
10	WHO/AFRO	Nigeria, Democratic Republic of the Congo, Kenya, Rwanda, Malawi

EURO=European Region; WPRO=Western Pacific Region; EMRO=Eastern Mediterranean Region; PAHO=Pan American Health Organization (i.e., the American Region); AFRO= African Region (sub-Saharan Africa); SEAR=South East Asia Region

Table 3. TBL Session Topics in the Global Health Course

1. Millennium Development Goals (MDGs)
2. Macroeconomics and Health
3. Global Humanitarian Agencies
4. Skills in Global Health Work: Health Program Management

Table 4. Grade Points Distribution in the Global Health Course

Grading Element	Total Points	Weight (%)
Class Participation	10	10
Group Project 1	100	15
Group Project 2	100	10
Poster Presentation	100	15
Group Project 3	100	15
Peer Evaluation	32	5
iRATs (n=4)	40	15
Team grade (tRATs (n=4) and application exercises)	400	15
TOTAL	882	100

Table 5. Macroeconomics and Health: iRAT and tRAT Scores

Team Number	Number of Team Members	iRAT Scores	tRAT Scores
1	5	10;7;8;10;10	50
2	5	10;9;9;8;10	50
3	5	10;10;9;9;10	50
4	6	7;7;9;10;9;10	50
5	6	10;8;8;9;0;10	50
6	6	10;9;10;10;10;8	50
7	5	10;6;7;9;10	50
8	5	10;9;4;6;5	50
9	5	5;6;6;10;9	50
10	5	9;9;10;9;10	48

Note

The same 10 questions were answered by individual students and their teams to receive the maximum obtainable iRAT and tRAT scores of 10 and 50, respectively. An iRAT score of 10 is equivalent to a tRAT score of 50. An iRAT of 0 (e.g., Team 5) indicates the student was absent in that session and so also earned a 0 for the tRAT.

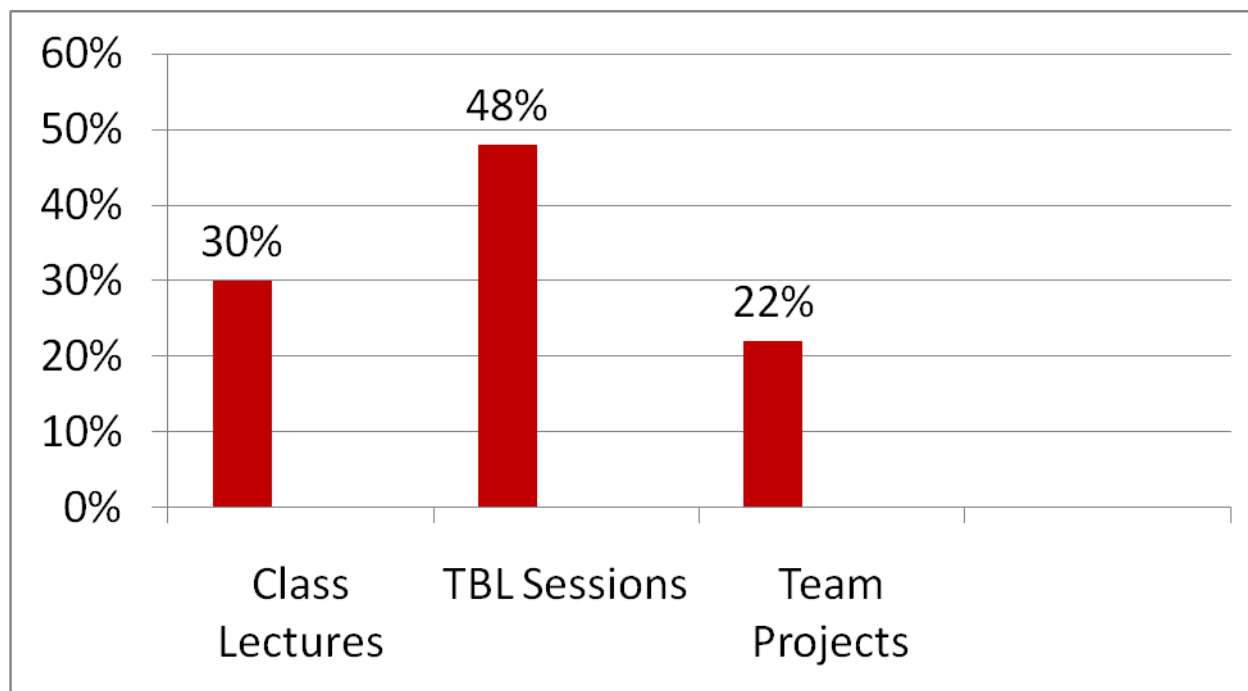


Figure 1. Student Responses to “I believe the learning I did during (choose one) will have the most lasting effect on my career.”

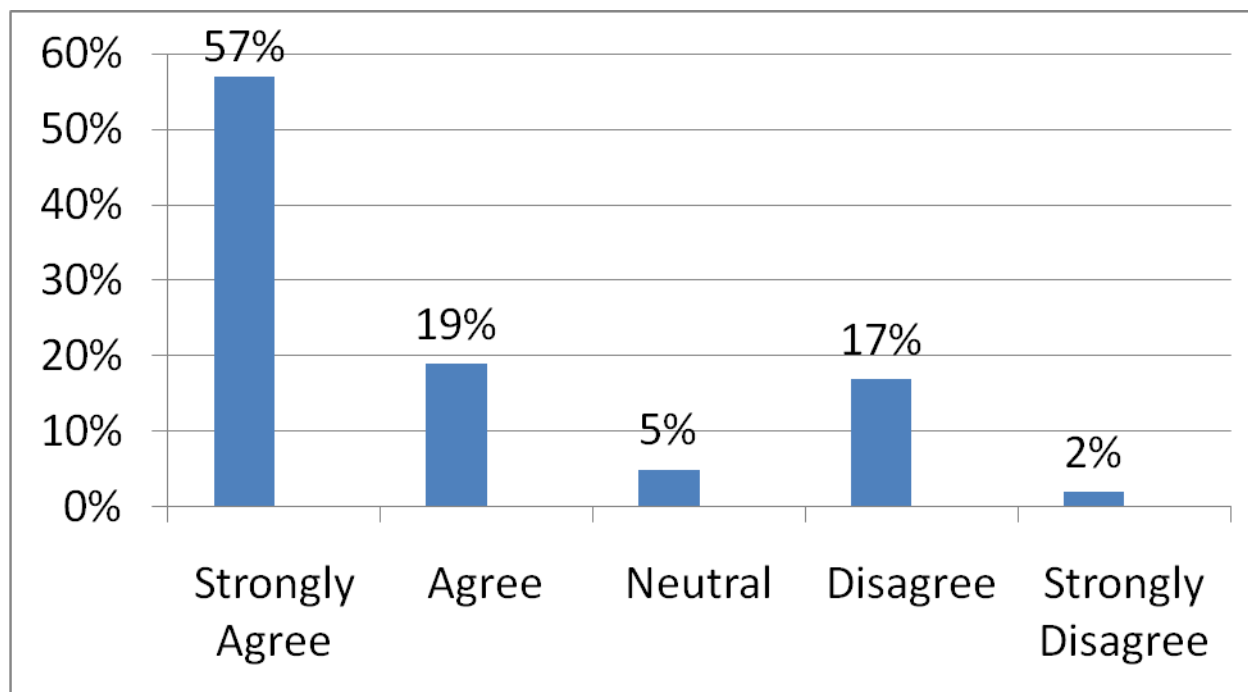


Figure 2. Student Responses to “I believe the TBL sessions helped to improve my analytical skills”

Appendix 1**Macroeconomics and Health: Individual Readiness Assurance Test (iRAT) and Team Readiness Assurance Test (tRAT)**

- 1) The work of the Commission on Macroeconomics and Health (CMH) focused on:
 - a) All populations in low income countries of the world
 - b) The poorest populations in low and middle income countries of the world
 - c) The poorest populations in middle income countries of the world
 - d) All populations in middle income countries of the world
 - e) All populations of the world

- 2) The world body that set up the Commission on Macroeconomics and Health (CMH) in year 2000 was the:
 - a) United Nations (UN)
 - b) United Nations Children's Fund (UNICEF)
 - c) World Bank
 - d) World Health Organization (WHO)
 - e) None of the Above

- 3) The CMH consisted of 18 leading experts in the world, involving the following EXCEPT:
 - a) Public health experts
 - b) Health system engineers
 - c) Economists
 - d) Policy makers
 - e) Development professionals

- 4) The following IS NOT a goal of the Commission on Macroeconomics and Health (CMH):
 - a) Predict the occurrence of emerging diseases
 - b) Examine the relation between health and macroeconomic issues
 - c) Demonstrate that investments in health can promote economic growth
 - d) Both b and c
 - e) None of the Above

- 5) One key finding of the CMH was that "poverty and ill health are closely linked." The following evidence was provided in support of this finding:
 - a) Countries whose populations have poor health status and low education have difficulty achieving sustainable economic growth
 - b) An average minimum of \$34/person/year is needed to provide the required set of essential health interventions
 - c) Many people in developing countries lack financial and/or geographic access to essential drugs
 - d) At least \$7 billion/year by 2015 is needed for the provision and supply of global public goods
 - e) None of the Above

- 6) The 10 recommendations of the Commission on Macroeconomics and Health (CMH) identified the "International Community" that should be strengthened to support the expansion of health interventions in developing countries as including:
 - a) The World Health Organization (WHO)
 - b) The WHO, the World Bank, and the Global Fund to Fight HIV/AIDS, TB and Malaria
 - c) The World Bank
 - d) The World Trade Organization (WTO)
 - e) None of the Above

- 7) What steps has the WHO taken following the publication of the Report of the Commission on Macroeconomics and Health (CMH)?
 - a) Widely distributed and advocated for the findings and recommendations of the CMH
 - b) Translated the report from English into 6 other languages
 - c) Sensitized policy makers with regards to the relationship between health and economic growth
 - d) Offers technical assistance to support countries to implement the recommendations of the Report
 - e) All of the Above

- 8) What steps are countries that choose to follow the macroeconomics and health framework expected to take?
 - a) Advocate for the findings of the Report of the CMH and define a response appropriate to the country's needs
 - b) Analyze data, develop specific strategies and define a national framework for Macroeconomics and Health action
 - c) Build local capacity to implement country plan and monitor achievements
 - d) All of the Above
 - e) A and B Only

- 9) Health has now assumed center stage, globally, in the context of development. This is due to the following:
 - a) The Millennium Development Goals (MDGs)
 - b) The MDGs and the Macroeconomics and Health Framework
 - c) The Macroeconomics and Health Framework
 - d) The Doha Declaration
 - e) None of the Above

- 10) The Macroeconomics and Health framework promotes global health because it facilitates the achievements of the MDG targets within countries. It does so by:
 - a) Advocating for greater resources for health and their more efficient use
 - b) Advocating for the use of the most expensive global technologies
 - c) Advocating for reducing the resources for health
 - d) Advocating for the use of only patented medications because they are more effective
 - e) None of the Above

Appendix 2**The Application Exercise on the Report of the Commission on Macroeconomics and Health**

For this application exercise, the following are the country assignments for each team:

Team Number	Country of Assignment
1	Indonesia
2	Cambodia
3	Yemen
4	Nepal
5	Mexico
6	Sri Lanka
7	Senegal
8	China
9	India
10	Ghana

Reference Materials:

- 1) PowerPoint slides
- 2) Report of the Commission on Macroeconomics and Health
- 3) The **“Tough Choices: Investing in Health for Development. Experiences from National Follow-up to the Commission on Macroeconomics and Health”** document.
- 4) The World Wide Web

Questions

Countries that choose to adopt the Macroeconomics and Health framework are expected to take certain key steps:

- 1) Outline the key steps that your assigned country has taken and analyze these for conformity with those summarized in the power point slides.
- 2) By the use of relevant indicators over time, provide evidence to support your evaluation as to whether your assigned country’s health and development agenda appears to be working or not
- 3) Make recommendations, with reasons, for improving the health and development outcomes of your assigned country.

Take Note: Answers should be well and neatly written in **INK** or typed and numbered to correspond to the question number being addressed.

Answer sheets should indicate the group name and the names of team members present.

All answer sheets are due at the end of the class without exception

Provide references of all the sources used for your answers

Appendix 3 Peer Evaluation Form

Course _____ Year _____

Your Name _____ Group Number _____

I. Names of your group members. (Each letter corresponds to one student's name)

- a. _____
 b. _____
 c. _____
 d. _____
 e. _____

Performance in the Group

II. Rank each member (a,b,c,d,e) with a 4,3,2,1,0 (4=highest,0=lowest)

1. Reliable for meetings

a. _____ b. _____ c. _____ d. _____ e. _____

2. Reliable with meeting deadlines for work in progress and final project

a. _____ b. _____ c. _____ d. _____ e. _____

3. Contributes ideas to the group

a. _____ b. _____ c. _____ d. _____ e. _____

4. Respects each group member's opinions

a. _____ b. _____ c. _____ d. _____ e. _____

5. Contributes his/her share to discussions

a. _____ b. _____ c. _____ d. _____ e. _____

6. Knowledgeable about assignments and her/his role and fulfills that role

a. _____ b. _____ c. _____ d. _____ e. _____

7. Gives input for work-in-progress promptly and with a good faith effort

a. _____ b. _____ c. _____ d. _____ e. _____

III. If given the opportunity, would you want to work with this team member again?

("Yes"= 4 points; "Maybe"= 2 points; "No"= 0 points)

a. _____ b. _____ c. _____ d. _____ e. _____

IV. In one sentence, what is your overall impression of each member's performance?

- a) _____
 b) _____
 c) _____
 d) _____
 e) _____

[Don't base your evaluations on friendship or personality conflicts. Your input can be a valuable indicator to help assess contributions in a fair manner. THESE EVALUATIONS WILL NOT BE SEEN BY YOUR GROUP MEMBERS.]