

A PILOT USE OF TEAM-BASED LEARNING IN GRADUATE PUBLIC HEALTH EDUCATION

Marc Van der Putten and Nuntavarn Vichit-Vadakan

Faculty of Public Health, Thammasat University, Pathum Thani Thailand

Abstract. This pilot study was undertaken to determine the impact of team-based learning (TBL) on graduate students of public health in a Thai context. The pilot project adopted Michaelsen's approach with the aim of improving learning among Thai graduate students enrolled in public health ethics. This TBL approach attempted to motivate students to do pre-class reading and be active "in-class" learners. Pre-class preparation allowed teachers to address and concentrate on learning gaps, while team work promoted peer interaction and active learning. TBL was found to be useful in fostering student preparedness and to transform "passive" into "active" learning, which especially benefited students "academically at risk" through peer teaching opportunities. With TBL, students valued the relevance of the course content and learning materials. They had positive opinions regarding the effect of TBL on individual and group learning. TBL was perceived to be instrumental in translating conceptual into applicable knowledge, and stimulated individual efforts as well as accountability. This study should be useful to those considering using TBL for public health education.

Key words: team-based learning, public health, graduate students, Thailand

INTRODUCTION

Team-based learning (TBL) is an approach to engage students in class individual learning and team based assessments and TBL. Michaelsen pioneered TBL in the late 1970s as a way to foster student commitment and interaction (Michaelsen *et al*, 2004a). This approach is of interest in Thailand context where Thai student attitudes are generally passive in nature (Pagram and Pagram, 2006). This study also found Thai students to be quite de-

pendent on teachers even at higher education levels. Thai students appear to be more oriented towards social learning than individual learning. This affinity for social learning provides a favorable context for TBL among Thai students.

A challenge in Thai education for learning public health ethics is the lack of quality textbooks in Thai on this subject, requiring the need to learn English to study the subject. Thais have a lower level of English proficiency than most other countries in Asia (Wiriyachitra, 2001). Thai students are not well prepared for the demands of the evolving discipline of public health and in an era of globalization, where access to literature beyond national sources becomes paramount.

Graduate students in public health

Correspondence: Marc Van der Putten, Faculty of Public Health, Thammasat University, Rangsit Campus, Klong Luang, Paholyothin Road, Patum Thani 12121, Thailand.

Tel: +66 (0) 2986 9213~9 ext 7449; Fax: +66 (0) 2516 2708; Mobile: +66 (0) 81830 3864

E-mail: mvdpt@tu.ac.th

face the challenge of understanding the importance of social determinants affecting public health and need to form a holistic view of public health (Beaglehole and Bonita, 1997, 2004; Marmot and Brunner, 2004). There is a growing interest in the ethical, legal, and social aspects of public health policies and practices. This has created a demand for the teaching ethics in public health and for resource materials to support it (Jennings *et al*, 2003), but this requires instructional formats that facilitate exploration of the breadth and complexity of its concepts and the transformation of declarative into procedural knowledge.

To address these issues, the Faculty of Public Health, Thammasat University, Thailand, reorganized its public health ethics course. The overall goals of the teaching-learning process included the following:

Increasing student responsibility for acquisition of knowledge, communicating the importance of extra classroom preparation, increasing active engagement with the learning material and improving efficiency of learning.

TBL, which is increasingly being applied to health sciences education (Levine *et al*, 2004), was used as the instructional strategy to meet these goals. The primary rationale for the use of TBL was to improve learning by helping students take a more active role in the learning process. In this pilot study, the TBL model was applied to a theory-intensive public health ethics course, addressing the following research questions: How can TBL be developed to teach and learn applied public health ethics? What is the effect of TBL on student preparedness and involvement in learning? What is the student's appreciation of the learning objectives and resources?

How do students perceive learning with this instructional approach? How do students experience the learning process? What is the effect of the pilot study findings on teaching-staff views regarding TBL?

In order to address these research questions, the study had the following objectives: to design a context appropriate team-based learning approach (develop an instructional format based on TBL), to assess the readiness of students to use TBL, to describe student's perceptions regarding the relevance of the course contents to the practice of public health, the effect of TBL on the efficiency of self and team learning and the effect of TBL on self and team efforts and to describe the teachers' perceptions of the TBL pilot study experience.

MATERIALS AND METHODS

Study design

A case study research design was used applying both quantitative and qualitative approaches to ascertain the effects of the TBL instructional format.

Population samples and study approval process

All forty-five students at Thammasat University, Faculty of Public Health registered for the Thai Master of Public Health course PB613 (Public Health Ethics) during the first semester of the 2008 academic year were included in the study. They were divided into 9 teams of 5 students each team. Nineteen faculty members were invited to participate in a seminar introducing the TBL approach and to evaluate the pilot study findings.

Approval for this study was obtained from Faculty Management, the Curriculum Committee administering the pro-

Table 1
The TBL process applied.

In class - primarily group work			
Readiness assessment	Session on basic concepts	Case study work	
Study basic concepts	Reflect and review	Case study work	Reflect and review
Outside class - primarily individual work			

(Michealsen and Black, 1994)

gram and the Institutional Review Board (IRB). The project was introduced to students and the teaching-learning approach explained. Written informed consent was obtained from all participating students and instructors.

Instructional design

The TBL strategy used was adopted from Michealsen and Black (1994). The model was modified for use with a public health ethics course. The people-oriented nature of ethics in public health and the student characteristics rendered the course suitable for developing desirable graduate student attributes, such as teamwork, interpersonal skills and critical thinking skills. Course content included applied ethics in public health, research, disease control, health promotion, environmental and occupational health, health systems, and the need to be conscious of relevant beliefs and values when undertaking an analysis of these issues.

Student learning was stimulated through processes that were student focused. In addition to highlighting teamwork factors, various team-building exercises were implemented to help students develop the skills for working effectively in teams. As per Biggs (2003), the assessment method was used to encourage effective teamwork. Advice regarding learning and assessment approaches was avail-

able from a senior academic advisor who had previously used the TBL approach.

The learning outcomes included the ability to critically appraise issues related to research, policies and practices of public health.

Each fortnight, the students were tested on their preparatory knowledge from the assigned readings. Each student completed a 10 question multiple choice quiz individually, then joined their teams to complete the same quiz. The individual and team components were each weighted as 10% of their grade. After the quizzes were completed, time was dedicated to providing feedback and to revisit basic concepts. With the readiness to learn assurance process completed, the next class applied this knowledge to solve complex problems (case studies).

The readiness to learn assessment was tested 6 times over the 15 weeks of the semester (Table 1).

Assessment of preparedness

Readiness Assessment Technique (RAT). For each of the six course modules a multiple choice quiz of ten questions was given to evaluate, individual-learning and team-learning outcomes in terms of comprehension of key concepts.

Observation on preparedness. Observation of preparedness was facilitated by proxy

variables, such as the appearance of clarifying notes and translation of terms in textbooks, and the use of external resources (eg, papers, books).

Assessment of individual student perceptions

Perceptions of course relevance. An individual self-administered questionnaire was used for each course module which assessed the student's perceptions regarding: the relevance of learning objectives and content matter to practice, learning materials and the overall module value, using a 10 point "Likert scale".

Perceptions on self-learning. An individual self-administered questionnaire was used for each course module which assessed the student's perceptions regarding: preparation for team work, reliable class attendance, attendance at team meetings that may have occurred outside class, contributions to team discussions and valuing and encouraging input from fellow team members, using a 10 point "Likert scale".

Perceptions regarding the learning process. An individual self-administered questionnaire was used for each course module which assessed the student's perceptions regarding: time dedicated to self-study, impact of RAT on learning, support from teaching sessions, support from team-learning, and the use of case studies, using a 10 point "Likert scale".

Assessments of learning-team's perceptions

Perceptions regarding course relevance. A structured learning-team discussion was used for each course module which assessed the normative view of group perceptions regarding: the relevance of learning objectives and content matter to practice, learning materials and overall module value.

Perceptions regarding team-learning. A structured learning-team discussion was used for each course module which assessed the normative view of group perceptions regarding: preparation for team work, reliable class attendance, attendance at team meetings that may have occurred outside class, contributions to team discussions and valuing and encouraging input from fellow team members.

Perceptions regarding the learning process. A structured learning-team discussion was used for each course module which assessed the normative view of group perceptions regarding: time dedicated to preparation for teamwork, impact of team-RAT on learning, support from teaching sessions, support from team-learning and the use of case studies.

Assessment of in-class dynamics

Observations of group dynamics were facilitated by variables, such as the involvement of and interactions among learning-team members during the team-RAT and case study work. Student engagement in plenary dialogues was observed by the frequency of questions raised throughout the course.

Assessment of faculty perceptions

Based on the model by Rogers (2003) and the framework of Frambach and Schillewaert (2002), a self-administered questionnaire was used to elicit faculty member views regarding: relative advantage (is the innovation perceived to be superior to the traditional approach?); cultural compatibility (is the innovation perceived to be compatible with existing values, beliefs, experiences and needs?); complexity (is the innovation perceived to be relatively difficult to use or understand?); trial-ability (is the innovation perceived to be usable on a trial basis before confirmation and adoption must occur?); visibility

Table 2
Individual vs team RAT scores.

Chapter	Individual RAT scores						Team RAT scores	
	Lowest ^a		Mean		Highest ^b		$\bar{\chi}$	SD
	$\bar{\chi}$	SD	$\bar{\chi}$	SD	$\bar{\chi}$	SD		
Chapter1	75.56	20.68	84.67	15.32	93.33	8.66	87.56	11.31
Chapter2	68.89	28.92	81.78	20.70	92.22	13.94	86.67	12.43
Chapter3	67.78	13.02	75.33	8.42	78.89	6.01	80.00	4.77
Chapter4	81.11	6.01	86.00	7.20	90.00	7.07	90.00	8.26
Chapter5	63.33	25.50	72.44	19.09	78.89	11.67	77.78	4.20
Chapter6	70.00	27.84	82.22	14.91	88.89	6.01	84.67	8.42
Overall	71.11	6.29	80.41	5.36	87.04	6.50	84.45	4.69

^aLowest individual RAT score was defined as the lowest individual score for each team.

^bHighest individual RAT scores were defined as the highest individual score in each team.

(is the innovation perceived to have results which are visible or observable by others?); effect of external variables (are there external influences, such as supplier marketing efforts, impacting the innovation adoption?); and characteristics of the organization (are there university/faculty influences, such as the organization's innovativeness or positioning, impacting innovation adoption?).

Analysis

The effect on student readiness was measured by comparison of individual and team quiz scores, and by comparison of perception surveys. Tests for significant differences were conducted using the ANOVA, *t*-test, and Pearson's correlation (at 0.05 and 0.01). A qualitative analysis of responses of learning-teams to open ended questions assisted identification of key themes. On analysis, inter-analyst reliability showed a Coefficient of Reliability by the Holsti test (>0.80). Triangulation of sources and methods was applied. The perceptions of faculty members regarding the innovation process served a descriptive analysis and open ended questions were analyzed thematically.

RESULTS

Profile of students

Among the 45 students studied, 16 (35.6%) were males, and 29 (64.4%) were females; their ages varied from 24 to 51 years old (mean 31.84). Their prior degrees were public health (71.1%) and related health sciences (28.9%). Of the 45 students, 24.4% majored in health promotion management and 75.6% majored in environmental health and safety management.

Assessment of student preparedness

Table 2 shows a comparison of individual and team RAT scores. TBL resulted in consistently high team quiz scores. The team average was marginally higher than the best team member individual results for some chapters and lower for other chapters, but differences were not statistically significant ($p=0.086$). However, these scores were significantly higher than the average individual student scores ($p=0.000$). The team quiz was clearly an opportunity for peer teaching, particularly for those who scored near the bottom of each quiz, with an average 13.3% difference ($p=0.000$). Of the course chapters,

Table 3
Individual vs team perception scores by chapter.

Chapter	Individual perception scores						Team perception scores	
	Lowest ^a		Mean		Highest ^b		$\bar{\chi}$	SD
	$\bar{\chi}$	SD	$\bar{\chi}$	SD	$\bar{\chi}$	SD		
Chapter 1	61.78	21.41	77.94	14.10	88.82	6.98	87.14	7.97
Chapter 2	75.55	10.04	83.96	8.07	91.26	3.13	87.76	4.12
Chapter 3	71.78	27.63	84.47	14.58	93.26	3.79	90.10	3.96
Chapter 4	73.93	28.38	86.13	14.33	93.78	3.50	90.55	3.07
Chapter 5	84.44	5.38	89.11	4.74	93.26	2.93	88.22	4.36
Chapter 6	83.85	4.68	87.94	4.52	91.63	2.69	88.92	4.47
Overall	75.22	8.41	84.93	3.95	92.00	1.85	88.78	1.34

^aLowest individual perception score was defined as the lowest individual score among the teams per chapter.

^bHighest individual RAT score was defined as the highest individual score among the teams per chapter.

both individual student and team, scores were significantly lower on Chapter 3, about communicable disease control, and Chapter 5, about environmental health ($p=0.000$), although these scores were still considered satisfactory. Qualitative data indicate these chapters received relatively less preparation time and were perceived by students to be more challenging than expected.

Our observations found the presence of pre-session notes and clarifications in handbooks. Case study handouts were also common and use of external learning material was regularly observed.

Assessment of individual student versus team perceptions

Table 3 shows a comparison of individual and team perception scores regarding course content, learning and the TBL process by chapter. The team perception scores were marginally higher (3.9%, $p=0.045$) than the individual average. The team average was marginally lower (3.2%) than the highest individual student scores,

while the average team scores was significantly higher (13.6% at $p=0.010$) than the lowest average individual score. It is of interest to note the lowest team scores (88.2%) were in Chapters 3 and 5, which showed low individual scores for Chapters 3 and 5 (Table 1). This observation indicates some competition between learning-teams for team RAT scores.

Assessment/description of faculty perceptions

The instructors' perception was the readiness assurance aspect of TBL was extremely valuable. Observations indicate students were more engaged than expected by traditional lectures and attendance was better. The team quiz was particularly engaging, students were not only enthusiastically debating and engaging in peer teaching but also appeared to be enjoying the experience. This perception was supported by the overall survey results regarding perceptions with 88.8% of teams and 84.9% of individual students agreeing on positive statements (Table 3).

Table 4

Comments of learning teams regarding course content, learning, and the TBL process.

Aspects	Comments
Course contents	<ul style="list-style-type: none"> • The course content was highly relevant to public health practice; we enjoyed most chapters. • Helpful learning materials, summarizes key points, Chapter 5 was more challenging than expected.
Learning	<ul style="list-style-type: none"> • RAT stimulated us to read chapters, assisted in understanding key points and helped us to study. • Job and family responsibilities sometimes prevented good pre-class preparation. • Studying in the English language medium was challenging. • Examples gave enhanced understanding. • Dialogue lectures were helpful in tackling confusion. Chapter 5 was difficult. • Case studies were instrumental in understanding theory and concepts, and were helpful in applying understanding. Case study 5 was challenging. • Group work greatly contributed to understanding complex concepts, boosted exchange of ideas, gave a variety of perspectives and experiences and provided mutual support; we learned from group work.
TBL process	<ul style="list-style-type: none"> • We all tried to prepare, however it was not always easy because of limitations due to job and family responsibilities. • We found class attendance important to achieve learning objectives and most of us attended regularly. • Attendance of outside class team meetings was sometimes hindered due to miscommunication or time limitations, however to overcome these obstacles, we used phone and internet communications. • All members contributed well because sharing perspectives, experiences and insights were considered important. • We all enjoyed and felt good about teamwork “in class” and “out of class” because everybody contributed and we all benefited.

The students' opinions are summarized in Table 4.

Ten out of 19 Faculty of Public Health academic staff members participated in the TBL seminar. Eight were from Thammasat University and two were members of other Thammasat University Faculties. Among the 10 participants, 8 (80%) returned the self-administered questionnaire.

The perceptions of the academic staff who participated in the discussion on TBL are summarized in 7 themes (Table 5). The lecturers' responses revealed that the TBL

approach was perceived to have advantages over a more didactic traditional approach (mean 8.63) because it stimulated students to prepare for class learning activities. It had relatively high (mean 8.63) cultural compatibility, TBL stimulates students to become more active and independent learners. Overall, applying TBL was not perceived to be very complex (mean 4.13), although it was recognized the course design and development of learning material might require substantial preparation. The willingness to try TBL

Table 5
Faculty perception scores regarding the TBL Innovation Process.

Factors	Perception scores			
	Min	Max	$\bar{\chi}$	SD
Relative advantage	7	10	8.63	1.30
Cultural compatibility	7	10	8.63	1.30
Complexity	1	8	4.13	2.30
Trial-ability	6	10	8.88	1.36
Visibility	8	10	9.00	0.76
Effect of external variables	2	10	7.25	3.15
Characteristics of the organization	2	10	7.50	2.73

scored high (mean 8.88), while presentation of the pilot study findings was perceived strongly positive (mean 9.00). Among faculty members, prior information regarding TBL varied considerably (mean 7.50; SD 3.15). Although overall positive, opinions regarding compatibility of TBL with organizational characteristics were variable (mean 7.50; SD 2.73). The variations may be explained by possible discrepancies between formal organizational policy (values) and perceived organizational culture. The overall positive perceptions may be explained by voluntary attendance of participants in the TBL seminar, assuming that participants had an interest in innovation in education and were open to explore alternative instructional approaches.

DISCUSSION

To our knowledge, this is the first report of the use of TBL in public health education in Southeast Asia. This paper presents the results of a pilot application of a TBL approach pioneered by Michaelsen *et al* (2004) that focuses on minimizing didactic lecturing by motivating student readiness and active participation in learning. As discussed by Michaelsen and

Richards (2005), exploration of the effects of TBL on student active involvement is a common design approach with TBL studies in health sciences. Our study did not aim at comparative analysis of outcomes between traditional and TBL, however Hettler (2006) reported TBL showed no significant differences in learning outcomes compared to traditional approaches measured by exams.

Ideally, learning teams should be heterogeneous and not based on existing subgroups, such as educational background, native speakers of the same language, or boy/girlfriends etc. Groups should be as diverse as possible in order to maximize the number of perspectives brought to bear on a task (Duke University, n.d.). In our study, groups were formed by instructor based on criteria such as: education background, student majors, student self-reported English proficiency, and out of class access.

Our findings confirm an earlier study (Freeman *et al*, 2006): RAT has the potential to motivate student preparation and teams performed better than individuals, with mean team scores being consistently higher than mean individual scores. Students became clearly more active and re-

sponsible, while cheer participation was observed. However, as pointed out by Yen-Lun (2007), challenges and grading methods have an impact also.

TBL has the potential to improve student learning, especially for “academically at-risk students” (Nieder *et al*, 2005; Freeman *et al*, 2006; Hettler, 2006). However, the determination of “at-risk students” in our study remain unclear: whether it refers to individual capacity (*ie*, reliability of student selection outcomes), to access (*ie*, secondary language skills), or time management (pre-class preparation).

Our findings indicate perceived relevance fosters interest in the course and learning (Yen-Lun, 2007). Student perceptions show TBL helps to build a bridge between theory and practice especially, with cases studies (Roebuck, 1998; Touchet and Coon, 2005). The relationship between subject matter and TBL in our study is unclear, *ie*, comparison between science vs humanities subjects. Michaelsen and Sweat (2008) argued TBL can be applied successfully to both groups of study.

The students in our study felt TBL helps to apply critical thinking to real world challenges (*ie*, case studies), which is supported by earlier studies (Roebuck, 1998; Touchet and Coon, 2005) and develops the ability to translate declarative into procedural knowledge. In our study, students felt they learned complex concepts (*ie*, ethics) better with TBL, which is similar to previous studies (Light, 1990; McInerney and Fink, 2003).

In our study, TBL clearly improved individual accountability through RAT and case study preparation; it avoided the burden of large group reports through presentations of case study outcomes, which confirms earlier findings (Hunt *et al*, 2003; Hodgson *et al*, 2005). TBL was able to over-

come the difficulty of meeting outside class, especially since our study program applied a part-time study plan.

Our observations indicate a shift from individual competition to team competition especially for the RAT. One question could be raised as to the extent the phenomenon of “free-riders” (students who do not participate but glean the benefits) who may undermine the motivation of more advanced students. Avoidance of large teams is one way to prevent “free-riders” and equally important is the avoidance of global group marks. Individual RAT and exam scores should be balanced with group marks to prevent frustration among advanced students.

In line with Bell and Bell’s (2005) suggestions, our faculty seminar on the pilot study to identify and disseminate good practices in teaching-learning has the potential for institution-wide application and change. The overall positive perceptions of the faculty members to TBL are shown by the voluntary attendance of participants of the TBL seminar, whom we assumed were interested in teaching innovations in education and were open to explore alternative instructional approaches.

The general applicability of TBL may be difficult to analyze because of the variety of practices to which it could be applied and the lack of a single core element across studies. Different applications emphasize different elements. This study focused on the effects of TBL on student active involvement in the teaching-learning process. Future studies may include individual student characteristics, the effect of context on implementation, learning outcomes, and the utility of TBL teams.

In summary, TBL was useful in fostering student preparedness and transforming “passive” into “active” learning.

TBL benefited those “academically at risk” through peer teaching opportunities. Students clearly valued the relevance of learning objectives, course content and learning materials. They had strong positive opinions regarding the effect of TBL on the individual as well as group learning; it proved to be beneficial for learning in a secondary language, and was instrumental in translating conceptual knowledge into application knowledge. Finally, TBL clearly stimulates individual efforts and accountability on team efforts. These findings may provide an input for discussion of the place of TBL in public health education and the use of TBL by individuals and institutes for improving student engagement in learning at the graduate level.

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