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Team-Based Learning: A Strategy to Enhance Student Learning and Engagement

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Executive Summary

- A continuing rise in student numbers together with a difficulty in engaging large groups of students led to a change in the teaching and learning strategy used with a second year pre-registration nursing evidence-informed decision making module.
- Team-based learning was selected due to the author's personal experience and consequent exploration of the evaluation research which showed that team-based learning was effective at promoting deep learning in large groups of students.
- Team-based learning involves a specific sequence of activities: out-of-class preparatory work, the readiness assurance process (individual and team tests, team appeals), application activities, and peer feedback.
- The evidence-informed decision making module was divided into four units and scheduled over a three month period. Multiple choice questions were designed to reward partial knowledge in both individual and team tests. Immediate feedback assessment technique response cards were used for the team tests so that students got immediate feedback on their results. Individual tests contributed 70%, and team tests 30% of the module summative assessment.
- A post-intervention evaluation was designed to assess the process and outcome of implementing team-based learning. A validated questionnaire was used to measure students' perception of team-based learning, and team working; and structured interviews were undertaken with ten students and the academic team to explore issues around process. Student test results were compared with those obtained in a previous year. Test question analysis was undertaken to establish level of question difficulty and discriminatory ability.
- The module was completed by 275 students of adult, child and mental health nursing. Completed questionnaires were received from 196 (76%). Interviews were undertaken with a convenience sample of ten students, and eight members of the academic team.
- Seventy per cent of the students felt team-based learning was an appropriate strategy for the module, 60% believed it to be an effective and motivating learning strategy, and 54% recommended using team-based learning in other modules.
- Results from the student interviews were positive with the benefits of team working emphasised. Students highlighted difficulties associated with the amount

of resources they were expected to study at a time when they were out on placement, and also working on other module assignments.

- Results from the academic team interviews highlighted the greater level of engagement observed with the students, as well as their own positive experiences of using team-based learning for the first time.
- Overall student results were excellent with 89% achieving; mean score for the individual tests was 52.64 and 82.67 for the team tests. Twenty per cent of the students scored 70% + overall and a further 39% between 60-69%.
- Results from the item analysis revealed appropriate level of difficulty and discriminative ability for the questions for all four units.
- The findings from this evaluation were similar to research results reported by others in that students report higher level learning with the team-based approach; but a minority prefer to have lectures. Overall the implementation was a success and student outcomes good. Lessons have been learnt from this first implementation and appropriate revisions will be made in time for the next delivery.

Background

Team-based learning (TBL) is a teaching and learning strategy developed as a method of ensuring the benefits of small group teaching with large groups of 200+ students (Michaelsen 2002). The strategy requires the use of the backward design model that focuses on what students are expected to do with the knowledge gained at the end of a module or course, and therefore what they need to know to be able to 'do' (Sweet and Michaelsen 2012). Following the backward design process, a course or module is divided into learning units each of which follows a specific sequence of activities: (i) out-of-class preparation with clear objectives to direct student learning; (ii) the 'readiness assurance process' of individual testing and team testing with immediate feedback; and (iii) team applications in which teams work on problems (Parmelee and Michaelsen 2010; Parmelee, Michaelsen et al. 2012). The latter is arguably the most important element of TBL as it requires students to apply the knowledge gained from the preparatory work and the testing process (Parmelee and Hudes 2012). Teams of between 5-7 students are formed in advance by the academic team to ensure team diversity. The TBL sequence provides students with multiple learning opportunities through the combination of independent study, individual and team testing, applying the knowledge gained in the application activities; and the opportunities to discuss with the academic team any issues that need clarification.

As a strategy TBL is consistent with the principles of constructivist learning theory (Hrynchak and Batty 2012) with a focus on academic facilitation using Socratic questioning techniques (Sibley and Parmelee 2008), the centrality of problem solving and on active learning through interaction with other students and reflection on their own understanding and how to improve understanding. TBL also shares principles with those adopted by the flipped classroom strategy (http://net.educause.edu/ir/library/pdf/ELI7081.pdf) although in TBL it is not just 'flipping' lectures that forms the basis of the out-of-class preparation, but also 'deliberate practice' (Wieman 2012).

Whilst small group teaching strategies such as problem-based learning (PBL) have been used within medical and other health care curricula for many years, TBL has only relatively recently been introduced into health care curricula but this has been predominantly within medicine. Whilst PBL is relatively resource intensive in terms of the numbers of PBL tutors required, one of the main advantages of TBL is

that one or two tutors can facilitate large groups of 200 students upwards whilst preserving the benefits of small group work (Sibley and Parmelee 2008). In the context of health care professional training, TBL is also important in the development of critical thinking and problem solving skills as well as effective team working; all of which are key competencies in health care curricula (Sibley and Parmelee 2008).

Changing a programme or module/course format to the TBL strategy requires a large amount of academic input at the outset (Hunt, Haidet et al. 2003; Mennenga and Smyer 2010; Andersen, Strumpel et al. 2011) and an understanding by the academic team of the teaching skills that are required to ensure a facilitative teaching and learning style with a focus on dialectical questioning techniques (Lane 2008). As health care professional programmes have become more competency based, it is of increasing importance to explore teaching and learning strategies such as TBL that are active, learner-centred strategies that can foster the development of communication and problem-solving skills, help promote effective team working as well as ensure that deep rather than superficial learning takes place (Sibley and Parmelee 2008). What follows is an overview of the literature relevant to the use of TBL in medical and nursing curricula which forms the context of this study.

Much of the early evaluative research was mostly descriptive, but nevertheless provided important insight into both the process of implementing TBL and also some broad outcomes. Studies of first year (Nieder, Parmelee et al. 2005), second year (Hunt, Haidet et al. 2003; Koles, Nelson et al. 2005), third year (Levine, O'Boyle et al. 2004) and fourth year medical students (Zgheib, Simaan et al. 2011) demonstrated higher levels of student engagement when compared with previous teaching methods such as lecture-based courses. Comparing exam results obtained from the TBL groups compared with previous exam results showed higher results for the TBL group (Levine, O'Boyle et al. 2004), and fewer ‘fails’ in the TBL group (Nieder, Parmelee et al. 2005). Zgheib et al (2011) demonstrated a higher level of achievement in their study of using TBL for 18 months in relatively small groups of students and high levels of satisfaction (Zgheib, Simaan et al. 2011). In their crossover design, Koles et al (2005) reported no differences between TBL and another active learning teaching method in terms of exam results but did note that the TBL students in the lowest academic quartile showed better exam results than others (Koles, Nelson et al. 2005). This latter finding was also reported in a descriptive study of 160 first year medical students on a medical ethics course

(Chung, Rhee et al. 2009). Chung et al also evaluated student perception of TBL using a Likert five-point scale and demonstrated relatively high scores for the promotion of student engagement, the learning of essential concepts and skills, increased reading by students, and effective co-operative learning. This finding is consistent with results reported from a small scale qualitative evaluation of 48 first year nursing students that involved student observations, and semi-structured interviews with ten students (Feingold, Cobb et al. 2008).

Results from a study of third year pharmacy students indicated that TBL students' exam scores were higher than students' results obtained prior to TBL; and that results revealed a higher percentage of A grades (23% compared with 9.5% for non-TBL courses), and no TBL students failed the exam (Letassy, Fugate et al. 2008). Results from a study that examined the effect of TBL on final exam grades, demonstrated a significant linear relationship between expected final exam grade and a positive perception of TBL with students who expected to obtain honours degrees achieving higher mean scores than those who expected to fail (mean scores of 9.75 compared with 3.45 respectively) (Vasan, DeFouw et al. 2009). All students, however, rated TBL positively. In a study of two cohorts of second year medical students, results showed a greater percentage of students obtained correct responses in TBL courses than non-TBL courses with regard to pathology based questions (83.6% compared with 77.7%, $p<0.001$) (Koles, Stolfi et al. 2010). Furthermore, when divided into highest and lowest quartiles, TBL students obtained higher scores than non-TBL students in both quartiles; but the difference between TBL and non-TBL students was greater in the lowest quartile (mean % difference of 3.8 compared with 7.9, $p<0.001$). Koles discussed the findings in the context of the multiple learning opportunities afforded by TBL including how the peer teaching was likely to result in greater benefit for those with less knowledge from the outset than others.

Deardorff et al (2010) reported some of the pedagogical benefits of TBL in a cohort of 94 first year medical students. The majority of these students reported that the TBL activity sequence helped to structure their time and was an effective use of study time. Furthermore more than three-quarters of the students reported that the concepts addressed during TBL were learnt more effectively, presumably through the stated benefit of team discussion. In addition more than 80% of the students

reported that TBL fostered critical thinking and problem solving more than other active methods of teaching and learning (Deardorff, Moore et al. 2010).

Results from a comparative study demonstrated that nursing undergraduate students enrolled on a TBL case management course (n=51) participated significantly more, but enjoyed the course significantly less compared with a pharmacology course (n=67) run simultaneously but with lecture format (Clark, Nguyen et al. 2008). There was a mixed response to TBL: 33% liked the method, 47% were neutral and 20% of the students did not like TBL. However it was not clear how well prepared the students were for TBL, and the authors acknowledged that the students were concerned about the preparatory reading suggesting a lack of understanding about the strategy. In terms of general commentary not quantified in the paper Clark et al commented …'students in the team-based learning pedagogy were more engaged in the learning process and used more communication skills to express their arguments for an answer' (p.116).

Using a method similar to Koles et al (Koles, Nelson et al. 2005), Thomas and Bowen (2011) undertook a crossover design of 112 (n=60 and n=52) medical students comparing TBL with small group lectures plus discussion. The study focused on ambulatory medicine and included students from second, third and fourth years. Outcomes focused on knowledge of the particular subject rather than final exam scores and revealed significantly higher scores for the TBL group compared with the small group lecture group (Thomas and Bowen 2011). This study is particularly interesting as the comparison is not a didactic method but small group teaching.

Tan et al (2011) used a modified version of the crossover design to explore duration of learning as well as differences between knowledge scores in a small group of 49 third year medical students randomly assigned to either a TBL group or a passive learning group. Similar to others, Tan et al showed significantly higher knowledge scores in the TBL group, and that the weaker students benefitted more than those considered academically strong. Of additional importance, however, was the finding that at the second post-test the passive learning group scores were lower than at the first post-test assessment, whereas the scores for the TBL group increased between the baseline and first post-test assessment, and also between the first and second post-test assessments. Similar to Deardorff et al (2010), Tan et al also focused on the pedagogical benefits of TBL suggesting that learning is

reinforced through the multiple learning opportunities which contributes to knowledge retention; and protects against knowledge attrition through the use of higher-level thinking skills (Tan, Kandiah et al. 2011).

Although the review of the relevant literature is based on research that is in the main descriptive, the findings suggest strongly that there is a benefit to TBL both in terms of developing general graduate skills such as critical thinking and team working; as well as pedagogically in preserving the benefits of small group teaching with large groups of students. In no case has there been a significant negative experience of using TBL. The purpose of this evaluation is to contribute to the knowledge base about the use of TBL within a pre-registration nursing undergraduate curriculum

TBL in a School of Nursing and Midwifery

The module selected for examining potential benefits of TBL was a second year evidence-informed decision making (EIDM) module. The main driver for the shift to TBL from a more didactic approach was the continued increase in the number of students (~300), the perceived complexity of the subject by students, and consistent reporting by the academic team of large numbers of students not engaging with the subject material and not undertaking preparatory work.

Aim

The aim of the evaluation was to explore the perception of TBL from the perspective of the academic team and the students in a second year pre-registration EIDM module within a BSc Nursing programme.

Methods

Design

A post-intervention evaluation involving (i) a cross-sectional questionnaire survey of students, (ii) structured interviews with a convenience sample of 10 students; and members of the academic team, and (iii) student test results and item analysis of the test questions.

Sample

(i) Survey: All second year pre-registration BSc Nursing students at a University in England were invited to take part in the evaluation (n=257). (ii) Interviews: Students willing to be interviewed were asked to indicate this on the consent form. The aim was to interview 10 students with at least two students from each nursing field. Members of the teaching team involved in both the development of the module and the implementation were also invited to take part (n=8 excluding the author JM).

Outcomes

The focus of the evaluation was on the processes involved with TBL; and the outcomes in terms of the perceptions of TBL and team working, and the students' test results. Process data was collected during the interviews with the academic team, and outcome data from the students in the form of a questionnaire detailed below; supported by data from interviews with ten students. The overall results from the module were compared with summative assessment scores obtained in the previous year when the module was run using more didactic methods. Item analysis was undertaken on the results from two of the five student groups to explore level of question difficulty, discriminatory ability and the appropriateness of the distractors.

Data Collection

A 50 item questionnaire was developed for the student survey (Appendix 1). This consisted of (i) a modified version of a 21 item validated scale (three questions were omitted as they were not relevant to our student group) designed to measure perceptions of TBL and teamwork (questions 6-23) (Vasan, DeFouw et al. 2009); (ii) the 18 item team performance scale (questions 27-44) (Thompson, Levine et al. 2009); (iii) eight questions that related to the organisation of the module, and overall experience of TBL (questions 1-5, and 24-26); and (iv) six questions that asked about the students' profile; and access to the online support provided for the module (questions 45-50). A Likert response format was used for questions 1-26 that ranged from 'strongly agree (2)' to 'strongly disagree (-2)'; so that higher scores reflected a more positive attitude to TBL (Vasan, DeFouw et al. 2009). Four questions (9, 12, 16 and 24) were phrased negatively in an attempt to avoid response bias; and so the scores for these questions were reversed. Questions 27-

44 were scored on a 0 to 6 scale where 0 reflected ‘none of the time’, 3 ‘some of the time’, and 6 ‘all of the time’ (Thompson, Levine et al. 2009).

Structured questions for the academic and student interviews were developed at the end of the module when it was clear what the focus needed to be. The interview questions developed for the students were reviewed by two members of the academic team (Appendix 2); and those for the academic team by a member of the professorial team not involved with the delivery of the module, and by a member of the team who was involved with the development and delivery (Appendix 3). The main focus of the student interview was on their perception of the influence of TBL on their learning; and for the staff the main focus was on the process of implementing TBL. All interviews took place on the University campus.

Data Analysis

The questionnaire data were analysed using SPSS version 20 for Windows. Data entry was undertaken by the research assistant and JM. The focus of the analysis was on the students’ perception of TBL and team working. Differences between nursing fields were explored where the sample size for the three nursing groups (adult, child and mental health) was large enough.

The interviews were undertaken by the research assistant and were digitally recorded to aid documentation and interpretation. The research assistant used thematic analysis guided by the questions asked. Atlas.ti 6 was also used to aid the information sorting process.

The overall results for the summative assessment obtained using TBL were compared to those obtained from the student group in the previous academic year although it should be noted that in the previous year the student groups were adult, child and midwifery and not mental health.

The level of difficulty and discriminatory ability of the test questions was assessed using the results from two of the student groups. This information was analysed using SPSS version 20 for Windows. Question difficulty was determined from the percentage of students who answered each question correctly (Collins 2006). In this context, given the scoring system used, question difficulty was defined as the proportion of points that could have been awarded that were awarded; that is the total number of points awarded divided by the total number of points possible (McGhee 2013 personal communication; Office of Educational Assessment 2005

http://www.washington.edu/oea/services/scanning_scoring/scoring/item_analysis.html [accessed 10 January 2013]). The ideal index of difficulty for a four-response MCQ question is .62; values above .90 indicate very easy questions that should be removed, and below .20 very difficult questions (http://www.utexas.edu/academic/ctl/assessment/iar/students/report/itemanalysis.php). Question discrimination reflected the difference in correct responses between the scores of the top 27% of students and those in the bottom 27% (Birnbaum 2008). The mean scores for each item were calculated and then divided by four to reflect the proportion of points awarded. The discrimination index was the difference in the proportion of scores between the two groups. Values of .30 or above are considered good, fair between .10 and .30, and poor if below .10 (Office of Educational Assessment 2005 http://www.washington.edu/oea/services/scanning_scoring/scoring/item_analysis.html [accessed 10 January 2013]). In criterion referenced tests however, it is important to note that if questions have a low discrimination index, this does not mean the question is not useful as it might reflect the fact that all or the majority of the students obtained the correct response (Rahim 2010). The quality of the distractor options was considered by examining the extent to which the distractor options were selected by the students. Good distractors are those selected by at least some students (Considine, Botti et al. 2005). In the absence of information available a decision was made to review any distractor selected by 5% or less of students on the basis that it was likely to be easily discounted as a plausible response option.

TBL Structure

Team Size and Formation

The total number of students was 257. As this was the first time TBL was used in the programme, a decision was made to divide the students into five groups each of which would be facilitated by two academics (Letassy, Fugate et al. 2008). The number of groups was largely influenced by the size of the teaching rooms available for the length of time needed. In advance of the module start, teams of 5-7 students per team were formed by the module lead (JM) ensuring a balance of nursing field and gender across the teams. Students were made aware in advance of how the

teams were formed and that the teams could not be changed. There was a total of 44 teams.

Readiness Assurance

The module was divided into four Units and was scheduled over 13 days between the end of October 2012 and the end of January 2013. Resources were identified for each of the four Units and these were made available online using software available through the University library so that the students could access the resources from any location and at any time. A mixture of resources was identified that included PowerPoint presentations, journal articles, book chapters, interactive resources, and a podcast. Objectives were included to ensure the students understood what was expected; and dedicated module time was allocated for this independent study (Banfield, Fagan et al. 2012). The number and length of resources was determined by the aims of the Units, the time available for study as well as noting the experience of others (Letassy, Fugate et al. 2008; Klatt and Klatt 2011).

Each Unit session ran for three hours and was held at approximately fortnightly intervals to give time for the students to undertake the preparatory work. The individual and team tests took approximately one hour, as did the application activities and this timeframe was informed by the experience of others (Nieder, Parmelee et al. 2005; Feingold, Cobb et al. 2008; Letassy, Fugate et al. 2008; Banfield, Fagan et al. 2012). The remainder of the time was used for discussion and/or feedback about the process.

At the start of each session, team members were allocated a role by the group facilitator. These roles were managing the team folder and documentation, managing time, facilitating the team discussion during the team readiness assurance test (tRAT), submitting and reporting responses from the team tests, reporting and defending the team decision from the application activities, and submitting the appeal. An attendance register was maintained for each team.

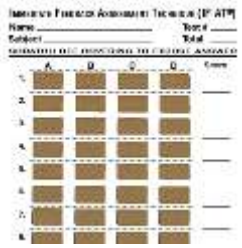
Unit tests comprised multiple choice questions based on the resources, each of which had four response options only one of which was correct. Students could allocate a maximum of four points across the four response options which enabled them to demonstrate confidence in their knowledge (Sweet and Michaelsen 2012). The first test included 12


Answer Sheet for Hand Scoring

Name John Smith Team 3

Q. #	A	B	C	D	pts.
1	4				
2			2	2	
3			3	1	
4					
5					
6					
			Total Points		

questions, and the remaining three 15 questions. Students were allowed 25 minutes to complete the individual test (iRAT) which included five minutes for those with registered extra time requirements in accordance with University regulations. Students handed in their answer sheets and then immediately undertook the same test in their teams (tRAT); forty minutes was allowed for the team test. Both iRATs and tRATs were closed book. IF-AT (immediate feedback assessment technique) cards were used for the tRAT where students respond until they get the correct answer with the result that immediate feedback is provided about the correct response. This techniques has been shown to benefit learning (http://www.epsteineducation.com/home/about/uses.aspx; (Epstein and Brosvic 2002). Four points were awarded if the teams obtained the correct answer at the first attempt, two points for the second attempt, and one point for a third attempt.



As with the iRATS, this approach rewards partial knowledge. When the students had completed the tRAT the IF-AT cards were handed in; and when all the team forms had been handed in the team results were made available to the whole group. Discussion around questions that teams had not scored correctly then took place; and finally students were able to discuss in their teams any questions they wanted to appeal.

Following a short break, students undertook the application activities in their teams. These were based on two problems related to the concepts studied in each unit; and approximately 30 minutes was allocated to each problem although in practice less time was required. The 4-S structure was used: significant problem, same problem, specific choice and simultaneous reporting (Pelley and McMahon 2008; Sweet and Michaelsen 2012). The group facilitators used dialectical questioning to promote discussion around why the teams had selected and rejected the various choices (Sibley 2012). Following the application activity the group facilitators summarised the objectives for the Unit and the learning that should have occurred; and how the Unit fitted into the module as a whole.

Questions could be appealed in the tRATs only on the basis of question ambiguity or incorrect readings. Any appeals against incorrect answers were required to be emailed to the group facilitators by 5pm two working days following the unit test. The appeals were considered by all members of the academic team.

In the event of a successful appeal the team marks were upgraded as necessary as were the individual test results for the team members.

Peer Feedback

At the end of the module the students were required to complete a peer feedback form for each of their team members to highlight perceived team performance. This was undertaken using PebblePad, an e-portfolio system supported by the University. This was used for formative feedback following guidance from Koles that peer evaluation should not be used as part of a summative assessment if teams spend less than 15 hours together doing TBL in the course (Koles, personal communication January 2013); and the experience of others (Nieder, Parmelee et al. 2005).

Module Assessment

The four iRATs and tRATs formed the module summative assessment. The iRATs were weighted at 70% and the tRATs at 30% to ensure that students could not pass the module on the basis of their team scores. The four Unit tests were differentially weighted according to level of difficulty: Units 1 and 4 at 20%, and Units 2 and 3 at 30%. The application activities were not graded.

Ethics

Approval for the study was granted by the University Faculty Ethics Committee.

Results

The results are presented in three sections: (1) Results obtained from the questionnaire survey, (2) findings from the student and staff interviews, and (3) student performance.

1. Results from Questionnaire Survey

1.1 Response Rate

Two hundred and fifty-seven students completed the evidence-informed decision making (EIDM) module; and questionnaires were received from 196 (76%). The characteristics of the students are shown in Table 1. The percentage responding according to the different nursing fields is consistent with the overall numbers of students enrolled on the different nursing fields for the BSc Nursing programme.

Table 1: Student Characteristics (do not total 196 due to missing data)

	n	%
Nursing Field		
Adult	121	62.4
Child	25	12.9
Mental Health	48	24.7
Gender		
Female	170	88.5
Male	22	11.5
Age Group		
18-25	104	53.9
26-35	54	28.0
35+	35	18.1

It was noteworthy that attendance was high across all five groups; the majority of students who did not attend submitted extenuating circumstances which were all upheld.

1.2 Module Organisation

Five questions related specifically to the organisation of the module using TBL. The results showed that 58% strongly agreed/agreed (25% were uncertain) that the TBL approach was appropriate for the module; 46% (21% uncertain) that the preparatory information provided during the induction week at the start of the year and in the module handbook prepared them for what to expect; 77% (11% uncertain) that the division of the module into four units worked well, and 48% (19% uncertain) that the timing of the Unit sessions was appropriate; and 62% (21% uncertain) that the tutors facilitated the sessions well.

1.3 Perceptions of TBL

The first stage of this element of the analysis was to check the similarity of the scale structure with that reported by Vasan et al. (Vasan, DeFouw et al. 2009). Principal components analysis (PCA) of the 18 items was undertaken; the Kaiser-Meyer-Olkin value was .805; and Bartlett's Test of Sphericity reached statistical significance. PCA revealed four components with eigenvalues exceeding 1 explaining 24.95%, 15.18%, 8.77% and 7.02% of the variance respectively. An inspection of the scree plot revealed a clear break after the third component. Only four items with correlations >0.3 loaded on to the third component, two of which also loaded on to

the first and second components. Three items did not load on either component: 'I have completed 100% of the required reading'; 'I learn better from lecture presentations than in team work'; and 'I did not think that the individual readiness assurance tests (iRATs) were useful learning activities'. Consequently a decision was made to retain two components for further investigation. Varimax rotation showed that the two component solution explained 40.13% of the variance. Nine items loaded on to the first component, and eight items on to the second component; two of which loaded on to both components. The results are shown in Table 2.

Table 2: Item Loadings Following Varimax Rotation

	Component	
	1	2
TBL helped me increase my understanding of module material	.751	
I learned useful additional information during the TBL sessions	.740	
The TBL format was helpful in developing my information synthesising skills	.739	
The team RAT discussions allowed me to correct my mistakes and improve my understanding of the concepts	.666	
Discussions of the issues that were the focus of the tests and application activities were useful learning activities	.663	
I generally felt prepared for the iRATs	.629	
Solving problems in a team is an effective way to learn about evidence-informed decision making	.599	.391
Learning outcomes helped me to focus on the core information	.522	
There was mutual respect for other teammates' viewpoints during TBL		.764
The ability to collaborate with my peers is necessary if I am to be successful as a health care professional		.710
I paid attention most of the time during the TBL sessions		.689
Most students were attentive during TBL sessions		.658
Solving problems in a team is an effective way to practice what I have learned	.479	.619
I did not contribute meaningfully to the TBL discussions		.587
I do not have a positive attitude about working with my peers		.386

The structure is similar to that reported by Vasan et al.: Perception of TBL (component 1) and perception of teamwork (component 2). The two items that loaded on both components were included in the perception of teamwork subscale as this was the best fit. The item 'I paid attention most of the time during the TBL sessions' was removed as this did not fit well with either subscale and was not one of the original items used by Vasan et al. The two subscales each consisted of

seven items. Cronbach's alpha was 0.81 for the perception of TBL subscale; and 0.72 for the perception of teamwork subscale.

The summary results from each subscale and the overall scale are shown in Table 3 from which it can be seen that the mean score for the perception of teamwork subscale was higher than that for the perception of TBL subscale. Paired sample t-test revealed statistically significant differences with a mean difference of -7.11, 95% CI (-7.88, -6.33), t=-18.13, df=183, p<0.0001. Subscale mean scores were 2.44 (SD=5.03) for the perception of TBL subscale, and 9.55 (SD=3.24) for the perception of teamwork subscale for the sub-sample included in the analysis (n=183).

Table 3: Perceptions of Team Based Learning (each item score ranged from -2 to +2 with a maximum subscale score of 14)

	n	Mean	SD	95% CI
Perception of TBL Subscale (7 items)	190	2.43	4.97	1.71, 3.14
Perception of Teamwork Subscale (7 items)	188	9.59	3.23	9.12, 10.05
Overall TBL Perception Scale (18 items)	178	14.01	7.61	12.88, 15.14

Responses to items that were not included in the subscales are shown in Table 4.

Table 4: Attitudes to Team-Based Learning (%)

Statement	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
TBL approach was appropriate for this module	50 (25.5)	83 (42.3)	49 (25.0)	10 (5.1)	4 (2.0)
I did not think iRATs were useful learning activities	20 (10.2)	43 (21.9)	51 (26.0)	71 (36.2)	11 (5.6)
I learn better from lecture presentations than in team work	38 (19.4)	40 (20.4)	61 (31.1)	44 (22.4)	12 (6.1)
Overall I did not enjoy the TBL approach	26 (13.3)	32 (16.3)	44 (22.4)	64 (32.7)	30 (15.3)
TBL is an effective, motivating learning strategy	37 (18.9)	82 (41.8)	53 (27.0)	15 (7.7)	8 (4.1)
I recommend using the TBL approach in future courses	27 (13.8)	80 (40.8)	57 (29.1)	24 (12.2)	8 (4.1)

The information presented in Table 4 indicates that between 22 and 30% of the students were ‘uncertain’ about TBL. This most likely reflects the fact that this was their first experience of TBL and they were used to more didactic/lecturer led methods of delivery; and also not having to prepare for each ‘taught’ (scheduled) session in order to succeed. Over 50% of the students, however, were positive in that they considered TBL to be an appropriate approach for the module; was an effective and motivating learning strategy; and would recommend using TBL in future courses. Approximately 30% indicated that overall they did not enjoy the TBL approach.

1.4 Perceptions of Team Performance

The results from the Team Performance Scale are shown in Table 5 from which it can be seen that the students rated their teams as performing well. As demonstrated by Thompson et al. the scale had high internal consistency with a Cronbach’s alpha of 0.94. The scale results were comparable to those reported by Thompson et al who reported mean scores that ranged from 4.87 (SD=1.39) to 5.49 (SD=0.89); and an overall mean scale score of 96.0 (SD=14) (Thompson, Levine et al. 2009).

Table 5: Team Performance Scale

Item Scoring: 0=None of the time; 3=some of the time; 6=all of the time	**n**	**Mean**	**SD**	**95% CI**
All team members made an effort to participate in discussions	196	5.62	0.76	5.51, 5.73
When members had different opinions, each explained his/her point of view	196	5.61	0.78	5.50, 5.72
Team members encouraged one another to express opinions and thoughts	196	5.65	0.73	5.54, 5.75
Team members shared and received criticism without making it personal	196	5.66	0.79	5.55, 5.77
Different points of view were respected by team members	196	5.70	0.67	5.60, 5.79
Often members helped fellow team member to be understood by paraphrasing what s/he was saying	195	5.50	0.90	5.37, 5.63
Team used several techniques for problem solving (such as brainstorming) with each team member presenting his/her best ideas	196	4.62	1.59	4.39, 4.84
Team members worked to come up with solutions that satisfied all members	196	5.47	0.93	5.34, 5.60
All team members consistently paid attention during group discussions	195	5.53	0.86	5.41, 5.65
My team actively elicited multiple points of view before deciding on a final answer	196	5.65	0.70	5.55, 5.75
Team members listened to each other when someone expressed a concern about individual or team performance	190	5.60	0.94	5.47, 5.73
Team members willingly participated in all relevant aspects of the team	196	5.61	0.82	5.49, 5.72
Team members resolved differences of opinion by openly speaking their mind	196	5.56	0.88	5.43, 5.68
Team members used feedback about individual or team performance to help team be more effective	194	5.32	1.19	5.16, 5.49
Team members seemed attentive to what other team members were saying when they spoke	196	5.61	0.77	5.50, 5.72
My team resolved many conflicts by compromising between team members, with each one giving in a little	195	5.39	1.17	5.23, 5.56
Members who had different opinions explained their point of view to the team	196	5.66	0.86	5.54, 5.78
Team members were recognised when something they said helped the team reach a good decision	196	5.62	0.85	5.50, 5.74
Overall Scale (maximum score possible: 108)	186	99.68	11.52	98.01, 101.34

1.5 Differences Between Nursing Fields

The mean scores for the TBL scales and the Team Performance Scale by nursing field are presented in Table 6. Differences between groups were investigated using one-way ANOVA with Tukey HSD test. Results showed a statistically significant difference between groups on the Perception of TBL subscale. As the assumption of homogeneity of variance was violated the Welch F-ratio is reported: $F(2, 55.18)=3.28$, $p<0.045$. The difference was between the mental health and child students with a mean difference of 3.09, 95% CI (0.16, 6.02), $p<0.036$ which represents a medium effect size (Cohen's $d=0.59$). The large standard deviation and wide confidence interval for the data from the child field students, however, indicates a large degree of variability likely to be reflected by the relatively small sample size. The minimum score for the child field students on this subscale was -12 and the maximum score was 7; for the mental health students this was -10 and 14.

Table 6: Mean Scores by Nursing Field

Scale & Nursing Field	N	Mean	SD	95% CI
Overall TBL Perception Scale				
Adult	115	14.90	6.87	13.63, 16.17
Child	21	10.67	8.36	6.86, 14.47
Mental Health	40	13.50	8.86	10.67, 16.33
Perception TBL Subscale				
Adult	118	2.63	4.70	1.77, 3.48
Child	24	0.08	4.85	-1.97, 2.13
Mental Health	46	3.17	5.51	1.54, 4.81
Perception Teamwork Subscale				
Adult	120	10.06	2.77	9.56, 10.56
Child	23	9.35	3.44	7.86, 10.84
Mental Health	43	8.58	4.03	7.34, 9.82
Team Performance Scale				
Adult	115	99.96	11.91	97.76, 102.16
Child	25	102.04	8.36	98.59, 105.49
Mental Health	44	98.00	12.06	94.33, 101.67

The χ^2 test was used to explore differences in attitude between nursing field and the results are presented in Table 7. The only statistically significant difference between student groups was for the statement 'TBL is an effective, motivating learning strategy' to which more adult field students (67%) strongly agreed/agreed with this

statement compared with 40% child and 60% mental health students (χ^2=9.529, df=4, p=0.049). The numbers in the child field group were, however, relatively small.

Table 7: Attitudes to Team-Based Learning by Nursing Field (%)

Statement	Strongly Agree/Agree			Uncertain			Strongly Disagree/ Disagree		
	A	C	MH	A	C	MH	A	C	MH
TBL approach was appropriate for this module	69	64	69	26	28	21	6	8	10
I did not think iRATs were useful learning activities	27	40	42	28	20	23	45	40	35
I learn better from lecture presentations than in team work	38	40	42	31	36	32	31	24	26
Overall I did not enjoy the TBL approach	25	40	35	20	28	25	55	32	40
TBL is an effective, motivating learning strategy	67	40	60	25	32	27	8	28	12
I recommend using the TBL approach in future courses	58	36	58	27	40	25	15	24	17

A=adult (n=121); C=child (n=25); MH=mental health (n=48)

1.6 Summary of Questionnaire Results

The results obtained from the questionnaire survey showed a mixed pattern. The data that related to the organisation of the module using TBL were positive in that the majority thought the division of the module into four Units worked well, and that the tutors facilitated the sessions effectively. Examination of the data from the TBL perception and TBL team working subscales indicated that overall the students were more positive about team working than the TBL process. The results from the TBL perception subscale, however, were inconsistent with the students' overall perception of TBL indicating that the majority of students considered it to be an effective and motivating strategy; and would recommend use of TBL in other modules. There were no notable differences between nursing fields with regard perception of TBL.

2. Results from Interviews

2.1 Student Interviews

Fifteen students agreed to be interviewed and 10 were selected by the RA to ensure students from each field were interviewed. The final sample was seven adult field students, one child field student and two mental health field students. The results from the interviews are grouped according to the sequence of activities used throughout the TBL process.

2.1.1 Preparatory Work

First Day of the Module - Practice Day

In order to prepare for the TBL approach which was new to both students and the academic team, the first day of the module was set aside to run through the process. The majority of interviewees found the practice day very helpful; and were pleased to be given the opportunity to meet their teams and tutors. The practice day prepared the students for how the process would work and they said that this meant they were less anxious about the first tests. One student who was dyslexic was particularly enthusiastic about the practice day because it gave an opportunity to forewarn the tutors about the difficulty she had with the layout of the test paper. The layout was changed following this practice day. The same student also noted:

> *Int. 3: It allowed me to put strategies in place to deal with things. Like I brought in a highlighter. If we went straight into the tests I couldn't have done that, there would have been no time for strategies.*

Some of the students also mentioned the pre-arranged teams which were welcomed as it allowed them to work outside their own normal friendship group, and even cohort. All the students thought this aspect was a good preparation for their future career giving practice in communication skills.

Accessing Resources for the Preparatory Work

The flexibility and the easy access to a set of materials which covered all the key aspects of their module were appreciated by all students:

> *Int. 3: I really liked the self-learning. I really liked the way we were given the resources and we knew exactly which resources to read and we could go*

away in our own time and read them. I liked having that direction you know because you can do it at your own pace then.

All students interviewed had managed to access and read the majority of the resources and found them helpful. One student said that she and a friend had shared the task of accessing online resources, and like a couple of the other students, had also used YouTube as a study aid:

Int. 9: I accessed all – every single one. Me and a friend …shared the downloading. It was difficult at first to get e-books but later they changed to PDFs I think. I liked the Podcast – It was quite nice to sit back and listen - I would have liked more. I did access YouTube for p-values and confidence intervals. I did not understand until I had seen it on YouTube… The chap drew a graph and fully and basically explained it in a way I could understand. I needed that, I couldn't grasp it just from the reading.

The majority of students had not had any difficulty accessing the resources, except for the e-books which due to a licensing issue were only accessible to one student at a time. As indicated, however, pdf copies of the e-book chapters were obtained after the first Unit test and made available on the University module site.

Amount and Type of Resources

The resources were varied including podcasts, PowerPoint presentations and readings; and this variety and choice was appreciated by many but the volume was seen as daunting by a few:

Int. 2: It is easier to understand and concentrate when there is a variety of resources (audio/interactive/reading) a combination helped.

Int. 5: I thought the information collected together for the students was fantastic. The visual and audio and presentation there was such a good variety that it was very good for someone like me who is dyslexic.

Some students felt pressured by the amount of reading and learning required because of other priorities such as essays to complete and attending placements**:**

Int. 2: Having so much to read in such a short time when there were other things to do. There was not enough time to revise what was read.

Int. 4: The reading. It was overwhelming the amount we had. Some of the articles were hard to read and understand and it took a lot of time to understand.

Int. 7: I read all of them. My only problem was that there was a large amount of them and I felt I had to memorise them as I did not know what would be in the tests and I felt I might miss the relevant sentence.

Understanding the Resources

A few students mentioned that they would have liked a little help with understanding some of the concepts:

Int. 3: Some of the parts of the reading were hard and could be confusing – like the p-values; things like that could be difficult so some teaching or seminars around that would be good.

Int. 4: I would have liked more help at the start with a few taught sessions.

Int. 9: Eventually I understood the key concepts. But not just from the reading. Reading can back up what is explained. I am quite a physical hands-on person. I would have needed a lecture or something to explain. Like someone explaining and drawing diagrams. A mix of the two, lectures and tests, would be good. Even just a couple of lectures would have helped.

Int.10: It is very hard to teach yourself to apply material from reading material alone. I found that very hard, well challenging……Using the resources, themselves, I found the learning quite difficult. Just on its own. I found that when we sat the exam I came away knowing more but I don't necessarily feel that my mark reflected that…I don't think my mark reflected my knowledge, because I found that discussing the questions with the group afterwards, helped cement some of what I thought I knew.

How the Resources were Used

Some of the students read the articles through once, and then a second time making notes from which they intended to and did revise. Others made notes as they read:

Int. 1: I made notes on the computer as I was reading.

Int. 2: By the second Unit I started writing flash cards on key points from each article. That helped my revision.

Int. 6: I read each separately then sat down and read again before the test and made notes.

Int. 8: I tended to – if time – have a first read through. I wouldn't try to remember it; I wouldn't try to do notes. I would just read through from beginning to end, in one sitting, maybe two, depending on other factors. Then I would go back to it and write core concepts and notes. Make a crib sheet, and then from that I would do final revision. If I didn't give myself time, entirely my choice. I would then just go through in one session and write the crib sheet and then learn it.

Few of the students had discussions about the resources with team members or friends because there was little time for this. Most lived a distance from colleagues and meetings, other than those timetabled, were not arranged. Two made comments when asked about discussions with their team members:

> *Int. 8: It's not really how I study as a rule and I tend to fit my studying time around my family and other commitments, which tended to mean that I would be studying late at night or early in the morning which obviously made it more hard but I certainly didn't really feel the need (to consult colleagues). If I didn't understand a concept I would generally find a web site or local resources where I could find it out. And then work my way back from there.*

> *Int. 9: No. I didn't discuss because, mainly because I live in Cornwall, so that made discussions a bit difficult. But in my cohort a couple of people that I was friendly with, I did, we did discuss occasionally.*

2.1.2 Individual Tests

All of the students felt that studying the resources prepared them for the tests, but two students mentioned using YouTube as a 'back-up'. A further student indicated that one seminar per Unit would have helped make sure one had 'got it'. Most students felt that having the individual tests gave them the incentive to ensure that they read and understood the materials provided:

> *Int. 2: It made me more focussed; there was no 'drift' possible, because you had to focus for each test.*

> *Int. 6: They should use it more as people have to pull their weight and cannot hide behind others and say ' I found that too'. Having read nothing!*

> *Int. 7: Because of individual test first you had to work and learn. If there had not been an individual test first you might depend on the team.*

> *Int. 8: You knew you had to turn up or be penalised and I think that worked. Individual exams as a motivational tool really worked.*

> *Int. 9: It's you on your own, with your own knowledge base. I think it probably gives the impetus to really try and grasp the concepts. I suppose the added pressure (of tests) makes you get off your backside! ….I am not saying I didn't find it stressful but the motivation is different isn't it, when you are being tested, – you try to know what you learnt and also to retain what you learnt.*

> *Int. 10: Probably doing the test did make me do the reading.*

One person thought that the questions were too varied:

> *Int. 5: But questions were so varied and you almost felt as if you hadn't read at all. They were ambiguous questions.*

2.1.3 Team Tests

When asked about the team tests the students were very enthusiastic about how this aspect of the process contributed to learning:

> *Int. 1: Team tests were the best thing, it was good to discuss topics. Team members telling each other things if they were not understood by some of the team. I really enjoyed that. Our teachers were really on the ball with group marks which made us more competitive (which the student liked).*
>
> *Int. 2: It helped having two versions of the test. You learnt from the team. The team worked well. There were discussions on the BEST answer. If no-one knew the best answer – we agreed on a consensus answer.*
>
> *Int. 3: You didn't want to let the team down. You wanted to be able to contribute so that was a huge motivation to come prepared for the test. There was lots of team discussion. But it's difficult to say if it was useful. You debate answers but you didn't know which elements were useful (she meant that someone might persuade you they were correct, but be wrong, then teamwork wasn't helping!) (until you saw the answers). It helped communication skills, as you had to put across your answer to others.*
>
> *Int. 4: The TBL enhanced learning for the module. It makes you study hard as you don't want to let the group down.*
>
> *Int. 9: The whole process of listening to others and giving your own feedback and your own ideas about what things meant, and either being backed up or others saying 'I'm not sure that is quite right, you know, this is my perspective on it.' It really did help me to understand some concepts. You know there were some things I really had not grasped and didn't realise that until the team based tests. When everybody was saying 'well no it's not that, it's this way'. And I think through that discussion um, yes it did, it did really help. I found that the most helpful bit really. I came away you know thinking 'now I get it'.*
>
> *Int. 10: Team tests helped a lot more than the individual actually. I think, because it allowed you to hear other people's reasoning and it allowed you to discuss the topic in greater detail. And then understand as a group why the answer was as it was.*

The Process of Teamwork

All the students commented on how they enjoyed working in a team and all stated how good their team was. Additionally most of the students indicated how much they liked having a team that contained students from other nursing fields, and varied ages:

> *Int. 1: I really liked it – I was in a good team. Everyone worked. If all did not! (inferring that would not be so enjoyable). Working in a team was the best thing about the module. You made friends – we used Facebook for our small team.*
>
> *Int. 2: Really enjoyable. I normally work alone but working towards a mark with a team was good. The team mark was better than the individual so it paid to work together. The team worked well.*
>
> *Int. 4: I liked team working especially with our course. It was really helpful hearing other people's views on things. There were 'light bulb' moments. It was useful to reinforce and build teamwork and practice communication and listening skills.*
>
> *Int. 9: Great. Loved it. So nice to work with different people. I know it's lovely to work with your friends, but I think it is important to work with different people. Especially with the work that we are going into. You know, you have to learn to listen to different people maybe people you don't necessarily get on with or gravitate towards in your life. But that's life isn't it. You have to find a way to get on with people. I think it was brilliant. TBL is really useful – six heads are better than one, most of the time.*

Many students also indicated that they liked being allocated to teams by the tutors who made sure there was a good 'mix' of students from different nursing fields and different age groups:

> *Int. 5. The team allocation was also very helpful and positive for me. I really liked it as it takes out the group dynamics of student life; i.e. age location cliques. It should be applied to other modules using group work so people are not isolated in their cohort. Also it is a good idea as when you work choice of who you work with is taken from you. It was helpful to have cross branch (field) so that it was like a work situation*
> *– a real life environment as opposed to picking and choosing. Also as a mature student who is not in halls or able to mix socially, one can be excluded from cliquey (young) groups.*

2.1.4 Application Activities

There were mixed views on the timing of the team application activities in that they came after the individual and team tests; highlighting the emphasis the students put on the test element.

> *Int. 3: If they were on a separate day – or before the test – then students would be more receptive. It was all so intense and too long a time so you wanted to get out and talk to friends about the tests and compare answers.*

> *Int. 9: Mixed views on that really. It was a relief that the tests were over that you were actually being marked on, and so people relaxed but then had to wind up again. But on the other hand, some of the things helped me cement what I had learnt…. So, although some people in the team were,' can't be bothered I just want to go', I was quite keen to do them as I found them helpful.*

The purpose of the application activities was to give the students an opportunity to apply the concepts learned in the context of a problem and it was clear that some students found this aspect beneficial:

> *Int. 2: You do learn from other people so being given an active way to do that made sure you were on the right track. Independent learning (working alone) you can completely miss the point. But here you could make sure you were thinking the right thing.*

> *Int. 4: They were very useful and I have used my knowledge since. I have been able to justify readings etc.*

The ten students were generally in favour of TBL and thought the method should be used for other modules as appropriate.

> *Int. 2: You do learn from other people so being given an active way to do that sure you were on the right track…..I think it should be repeated, but not in every module. It is a good way of learning.*

> *Int. 3: If they could do it for other modules, I would like that. It could be used in many things we learn, even biological stuff.*

> *Int. 4: Definitely useful for nursing care module. Huge grey areas – so problem solving is involved and that would be best in a team.*

> *Int. 6: For anatomy and physiology brilliant and long term conditions. Have seminars now and everyone getting same old stuff. Great for this. Saves a lot of time….Just really enjoyed it. And wish most of the modules could be like this. Knowledge has sunk in my brain and I know it now. You do not*

forget as you do if you just learn it for an exam….They should use it more as people have to pull their weight and cannot hide behind others and say 'I found that too' having read nothing.

Int. 7: Made me more confident in my own knowledge and I learnt more.

2.1.5 Peer Feedback

Students were required to complete a feedback form for each team member at the end of the module and post this using the University e-portfolio system. Whilst the academic team were not able to monitor the process, it was clear from both email exchanges between some students and JM; and the information from the student interviews that this process was completed. Consistent with the survey data, the students were positive about their team members, and most appeared to complete the process in the way intended; although one comment suggested collusion in how feedback would be provided.

Int. 4: The feedback was fine and what I gave out was okay. Not one person in our team who did not pull their weight. I guess I was really lucky. I think it makes you address how you work in a team.

Int. 7: Agreed to be nice! Agreed on same feedback.

Int. 8: . …And yet there is also the issue of not upsetting people if I thought they did particularly badly. But equally to be brutally honest I think for our group we all did actually sort of get on and do things and say things and chat and did well but whether that is a 4 out of 5 or you know, extremely well or extremely badly…But to be honest we were feeding back, I mean as you do in a little group, you always pick up on peoples you know how they are talking, whether they are quiet, their non verbal cues and seeing how they are doing, so in that sense we were feeding off each other I mean if someone was not saying anything they were asked their opinion.

Int. 9: I think it kind of made – it cemented what I knew already in a way. We all took it seriously. I think because everyone knew they were giving feedback and receiving feedback from the team. I think it made everyone sit up straight and do it properly. My team all turned up and got on with it. If someone had not turned up the feedback would not be good. But as it was I don't know if it was luck or whatever, my team always all turned up and we all got on with it.

One student highlighted that they s/he not feel prepared for this element:

Int. 2: *Helped but didn't know how to provide the feedback and none of us were experienced enough. It was confidence boosting to know you could work with people you had never met before. It would be good to be given examples of the kind of feedback you could give.*

2.1.5 Summary of Results from Student Interviews

It was evident that the students benefitted from team working in terms of learning about the subject concepts; and also from working with students from the different nursing fields and across different age ranges. They recognised the importance of learning to work with individuals outside their selected friendship groups; and the communication skills developed as a consequence. Whilst it was clear that the majority of the students thought there were too many resources to study, it was evident that their learning strategies evolved and became more efficient and effective during the course of the preparatory work. The students appreciated the ease of access and variety of the resources used and the direction given for their study. It was also clear, however, that they did not view the testing and application activities as equally valuable as part of the readiness assurance process. This was not surprising as it was only the tests that formed part of the summative assessment. Despite this it was clear from the comments made that the students also appreciated the learning opportunities provided by the application activities. Overall the TBL strategy was viewed positively with an appreciation of the learning opportunities afforded; the students were able to identify where TBL could be used elsewhere in the programme which also indicates a positive reaction to this teaching and learning strategy.

2.2 Academic Team Interviews

All eight members of the academic team who were part of the module development and implementation agreed to be interviewed. The findings are grouped according to the key issues addressed during the interview.

2.2.1 Initial Thoughts about TBL and the Preparation Required

The lecturers referred to previous difficulties associated with students not engaging with the subject material, nor undertaking required reading and therefore coming unprepared to sessions; and considered whether this method would result in more engagement and consequently deeper learning. Whilst all interviewed made positive comments about the idea of using TBL despite none having had previous experience of the strategy either as student or educator; there was also a degree of

apprehension because the strategy was new. It was evident that preparing for the facilitated sessions was central to successful implementation:

> *Int. 1: I had not heard of it before but my first impressions of it were good. It empowers students. There is potential for use with other modules.*

> *Int. 2: It was exciting, nice to do something different. The module leader was so enthusiastic it was motivating. Also the students sometimes struggle with this topic and so it seemed a good idea to try something new*.

> *Int. 6: I was actually quite worried because I didn't understand that TBL was different from things like problem based learning and so on which I had encountered previously…But when I understood what TBL was actually all about I changed my mind and I thought it was a great idea.*

All of the lecturers prepared for the sessions in some way; for example by familiarising themselves with the resources provided for the students, and the questions and answers for the tests and application activities:

> *Int. 1: I went through all the literature and resources given.*

> *Int. 2: I went through the tests to pre-empt any questions asked by students. I teach this subject anyway so it complements my regular work. One needs to be very familiar before doing RATS*. …… *I read all the 'readings' and papers prepared for students. I looked at each Unit and refreshed my mind about the content.*

> *Int. 4: I made sure I was familiar with the materials, we had the tests in advance and I certainly made sure I had run through the test questions without looking at the answers. I had to check that I knew the answer myself. And if there were any areas that I was uncertain about, I made sure that I did some background reading. Part of that I think was anxiety that I might get caught out.*

> *Int. 7: I read all the material..sent on TBL. Also read the majority of the student readings. I met with my co-tutor for about an hour.*

> *Int. 8: I read about TBL. I met with my co-facilitator before each session and sorted out our responsibilities.*

One lecturer, however, thought that the method did not involve much work for the academic team:

> *Int. 3: It was all pretty pre-set. It didn't involve a lot of preparation for lecturers. I looked at the questions involved before starting the module. It was a module where I didn't have to do much work. It was all prepared on our behalf.*

2.2.1 Facilitating the TBL Sessions

One of the key features of TBL with regard teaching is that the lecturer acts as both content expert and facilitator. Whilst to a large extent this is true for most teaching strategies, lecturers would not normally use PowerPoint presentations or a prepared structure for teaching with TBL but would need to rely on their knowledge for probing students' level of understanding during the application activities as well as answering student questions. Most of the lecturers did not find this a problem but did recognise the challenges of moving from imparting information to eliciting information from the students:

> *Int. 1: It was okay…It is challenging to keep quiet and not answer the questions. You have to be thinking how to turn the questions around. It is a learning curve.*
>
> *Int. 2: I did not see any problem. Although there could be a problem in that one could have a tendency to teach instead of 'standing back'. But students do not always engage which makes difficulties.*
>
> *Int. 5: Because in a sense it's not different to facilitating other research based modules and as a researcher I have got research knowledge – so maybe I am an expert. I am used to facilitating discussion around research*.
>
> *Int. 6: I didn't find that too difficult anyway because that is the way I like to teach. I don't necessarily tell them everything.*

2.2.3 TBL and EIDM

The majority of the lecturers felt that due to the sequence of activities, TBL helped address some of the traditional challenges associated with teaching EIDM such as students not preparing for sessions, and not engaging or applying the concepts learned. The method of individual testing for each Unit was seen as beneficial because it meant that students had to keep up with the reading and work on their understanding of the concepts ready for each test. The team working process was seen to help those struggling to understand particular concepts; and also give confidence to those who were able to explain concepts to others:

> *Int. 1: Really well – students struggle as EIDM is a completely new subject for them. It is a difficult module and this helped a lot. Students had to engage with the subject.*
>
> *Int. 2: …In this method of teaching the students have to use the 'language' themselves from the beginning and so this should result in deeper learning.*

Also the tests that are used during the course ensure that they are keeping up with the work and should consolidate the learning.

Int. 4: One of the strengths of the TBL approach is you are not just imparting knowledge, the students have to engage directly in acquiring that knowledge.

Int. 6: It puts the onus on the students to engage with materials and do the work and to motivate themselves to learn….I think the actual working in a team and having the opportunity to discuss..because there would often be one or two that didn't quite get it but there would be somebody else in the team that could maybe explain it in a different way.

The preparatory work and team-based discussion was considered to help students familiarise themselves with the research-based jargon with the consequence that it would be less threatening and therefore less of a barrier to learning. It was suggested that through the application activities TBL helped contextualise EIDM in clinical practice which is essential if students are to understand the centrality of EIDM to the provision of efficient and effective health care:

Int. 5: Gets students to think about the material but also how it relates to practice. In some sessions the students were extrapolating their learning to other areas.

2.2.4 General Perceptions of TBL

The academic team thought that TBL worked well, particularly the focused preparatory work and the method of individual and team testing. The preparatory work meant that students had to take responsibility for their learning which as well as being beneficial for the module learning, was also seen as aiding the development of lifelong learning skills. All the team emphasised how the strategy ensured that students engaged with the material:

Int. 2: I think as a learning strategy it is excellent. The students cannot just come in and sit and fall asleep! They have to engage.

Int. 5: There was a real buzz in the room so we could tell as facilitators it was going well and when the students were doing the team MCQs (scraping off answers) they would shout hooray. There was just a sense of engagement, a real buzz.

The appeal process was well received by the majority, although one member of the team thought it was too much work for little benefit for the students. There was a mixed response to the application activities with some indicating they worked well

and that the students engaged with this element; but three members of the team did not see the benefit of this part of the process. A team review meeting scheduled halfway through the module indicated that this might in part be due to the fact that the Socratic questioning approach and facilitation process were not being implemented as was needed to get the students engaged. Furthermore, the application activities did not contribute to the summative assessment and in some groups the students were keen to leave after the tests which made it difficult for the academics to get them to engage. It was also the case that this was the most difficult element to prepare and the area where most improvement is needed to ensure that the activities are more closely aligned to the Unit outcomes and challenge the students:

> *Int. 2: But application activities were not so easy to facilitate. There is real scope in the method but some students do not want to take responsibility for their own learning…… We need to look at application activities and see if we can improve their interest to students.*
>
> *Int. 6: They quite enjoyed talking through the things and then when they all had to hold their cards up, and they were looking round to see which team had put up what, and then having to justify why they did or didn't chose a particular response, that did seem to work quite well.*
>
> *Int. 7: I liked application activities and thought they worked well but they should have been more closely linked to the team and individual tests… Many students would not engage because it did not contribute to their marks/grade. They did not see the point of it.*

Having now run a module using TBL, some key learning about the process had taken place. Preparing for the sessions was seen as key, as was using Socratic questioning to probe students' knowledge and understanding rather than providing answers. Working in pairs was seen as advantageous; and having a strong and engaged teaching team was highlighted by one member of the team.

2.2.5 Summary of Results from the Academic Team Interviews

In general the eight members of the academic team were positive about TBL in the context of this module and indeed could see the benefit for use in other parts of the programme. The extent of the preparatory work undertaken by the module leader and how much more developmental effort is associated with TBL compared with other teaching strategies was recognised. However once completed some of the

team highlighted that the process would be easier to implement a second time around. The main advantages of TBL to the students in the context of this particular module were around the level of engagement during the team work, and importantly that they had to read around the subject in order to be prepared for the tests and application activities. Consequently the students completed the module having read far more than they have done previously for an EIDM module. The benefits of team working were highlighted and the advantages associated with the teams being organised by the academics and not the students.

This is the first time we have implemented TBL and it was clear from the comments made that as a team we need to improve the application activities to make them more challenging and engaging for the students. Meetings held during the module and a review meeting held once the module had finished highlighted the importance of the team following the TBL process particularly with regard use of Socratic questioning to ensure good inter-team discussion during the application activities; and using time following the team test to clarify any misunderstandings; and providing an overall summary of the Unit following the application activities.

3. Test Results

3.1 Student Results

The mean score for the individual tests was 52.64, and 82.67 for the team tests. The overall pass rate for the module was 89% which was 10% higher than the results for the EIDM module for the previous year; and 20% scored over 70% and a further 39% between 60-69%. What was of most interest, however, was the change in scores between the lowest quartile for the two modules. The lowest quartile was 56% for the TBL module (median 62%), compared with 40% for the non-TBL module (median 50%) held in the previous year. Clearly it is not possible to draw too firm a conclusion from this result as the methods of assessment were different: the TBL assessment was on-going throughout the module and completed on the last day of the module, whereas the exam for the non-TBL module was held six weeks following the last day of the module.

3.2 Quality Assessment of Test Questions

The results from the test question analysis for each Unit were based on approximately 42% of the students. The results for the Units 1 and 3 questions

indicated that all questions were within the moderate range of difficulty (desired range); one question in each of Units 2 and 4 fell into the ‘very difficult’ range. Questions for Units 1, 2 and 3 showed acceptable levels of discrimination; one question for Unit 4 shown to be ‘very difficult’ was also a poor discriminator. Responses to the distractor options fell below the threshold of 5% for three questions in Unit 2, one question in Unit 3, and two questions in Unit 4.

4. Overall Summary

The results obtained from the questionnaire survey indicated that the students were more positive about team working than the TBL process; although the majority considered it to be an effective and motivating strategy and would recommend use of TBL in other modules. The data obtained from the student interviews highlighted the perceived benefit of team working in terms of learning about the subject concepts; and also from working with students from the different nursing fields and across different age ranges. Perhaps the greatest change required of students from the TBL process is the requirement to undertake the focused independent study to prepare for the readiness assurance process activities. Although there was some suggestion that we had provided too many resources to study, the ease of access, variety of resources and clear direction for study was appreciated by the students. It was also clear that their learning strategies became more efficient and effective during the process. Overall the TBL strategy was viewed positively with an appreciation of the learning opportunities afforded supported by the fact that the students were able to identify where TBL could be used elsewhere in the programme. The members of the academic team were also positive about TBL, and could see the benefit for use in other programme modules. The level of student engagement was highlighted by all those interviewed, as was the fact that the process resulted in students having to undertake preparatory work prior to sessions. It was also clear from the academic interviews that the application activities need to be improved so that these are more challenging for the students; and that the academic facilitation process results in a greater level of engagement than was observed this first time of using TBL. In terms of student performance, it was encouraging to note that there was a 10% increase in the overall pass rate when compared with a similar module assessment the previous year. Overall the test questions for the Units showed acceptable levels of difficulty and discrimination; areas for improvement were noted.

Discussion and Conclusions

This was the first time that TBL was used in the BSc Nursing programme, and indeed within any programme in the wider University. Introduction of the strategy represented a radical departure from teaching methods used previously (including problem-based learning) because of the emphasis on out-of-class preparation and the readiness assurance process. The strategy was implemented in a second year EIDM module which is the module often least enjoyed by students due to the general lack of understanding of the relevance of the subject to professional practice. Implementation with this second year module occurred at a stage in the programme when students were used to 'receiving' information from lecturers, and were able to successfully complete modules without having to read widely around the subject.

The high achievement rate of 89% together with an overall increased percentage of students obtaining marks in the higher mark bands, plus the relatively positive evaluation demonstrates the effectiveness of TBL for large groups of students as reported by others (Koles, Nelson et al. 2005; Chung, Rhee et al. 2009; Koles, Stolfi et al. 2010). The weighting of 70% for the individual tests and 30% for the team tests worked well in that students could not pass the module on the strength of the team test results; as did the individual Unit test weightings whereupon the differential Unit weightings reflected the varying level of difficulty within the Units. The finding that the team results were higher than the individual results was consistent with results published by others and reflects the benefits of team learning (Chung, Rhee et al. 2009; Tan, Kandiah et al. 2011).

Part of the success of TBL is due to the out-of-class preparatory work which students have to undertake to ensure they have acquired the knowledge necessary to successfully complete the tests and participate in the application activities. An unexpected reported benefit of this stage was that some students reported how they developed more effective learning strategies throughout the process. From the outset, students knew that their knowledge was going to be tested in an on-going process throughout the module, both individually and as a team member and so were highly motivated to prepare. It was evident from the student interviews that students wanted to do well for themselves, and also did not want to let their team members down, a finding reported elsewhere (Hunt, Haidet et al. 2003). It was clear however that whilst dedicated time was scheduled for the independent study, we had included resources that a small minority of students perceived as repetitive. We had

deliberately included material that addressed the same concepts but using different approaches (e.g. PowerPoint presentation and a journal article) to suit different learning styles; and were surprised that this was considered repetitive rather than reinforcing learning. Furthermore, it was evident that some students believed they had to memorise the material on the resource list rather than gain an understanding of key subject concepts despite the purpose of the independent study being explained at the start of the module, and reinforced by email communication throughout the module. The amount of resources identified will be reviewed for the next module delivery, and more explicit guidance will be provided about what students are expected to learn. To support this a study sheet has been developed for students to use to monitor their progress throughout the module. We will also be including tutorial support prior to each Unit so that students have the opportunity for discussion with tutors around key concepts prior to undertaking the Unit tests.

It was clear that significant learning took place as a consequence of the readiness assurance process. The students were appropriately challenged by the test questions and particularly liked the scoring method in which they were rewarded for partial knowledge. It was evident from the interviews with both students and the academic team that substantial learning took place during the team tests, with lecturers reporting high level of engagement and discussion between students including reporting how students were helping each other (Feingold, Cobb et al. 2008; Banfield, Fagan et al. 2012).

The aspect of the TBL activity sequence that worked less well, however, was the application activities. This was due to a combination of the fact that this element was not formally assessed and many students did not want to engage following the tests; plus a lack in some of the academic team to fully engage with the process using dialectic questioning to ensure good discussion took place between the teams. However discussion with both novice and expert TBL users at the annual TBL Collaboration conference in February 2013 confirmed that this aspect was the most difficult element to design and implement in the TBL activity sequence.

In terms of the students' overall perception of TBL, it was not surprising that ~30% reported that they did not enjoy the TBL approach, and that 40% indicated that they learnt better from lecture presentations than in team work. Attending (face to face or virtual through webcasts etc.) lectures is what many students are used to and prefer as it can give a confidence that they have the information needed as it has

been ‘given’ to them. What many students are missing, however, is the issue around converting information given (assuming it has been ‘received’) into knowledge. It is this knowledge acquisition through the out-of-class preparation, readiness assurance process and engaging in the application activities that can make TBL such a success.

The design utilised in this study was a post-intervention evaluation which is clearly not the most rigorous of research designs. It was not practical, however, to consider a randomised controlled trial both because of the logistics in identifying a large enough teaching team that could deliver the module using TBL and non-TBL strategies; and more importantly because of the likely ‘contamination’ between TBL and non-TBL student groups in terms of the resources that were provided for the TBL students. To enhance the rigour of the post-intervention design used, outcome measures were used that had been developed by others and where validity and reliability had been demonstrated. In addition the interviews were undertaken by a research assistant to ensure that the participants gave their opinions freely. It has to be considered however that the students who volunteered to be interviewed were most likely those who enjoyed TBL and that those who felt particularly negative about the strategy might not have felt comfortable expressing such views. As the focus was on the process and outcome of implementing TBL, the post-intervention design was considered appropriate.

In conclusion, this first implementation of TBL can be judged to have been a success. The TBL strategy was implemented as outlined in the literature; and as experienced by JM at TBL workshops. The student results were good; and feedback from the students emphasised in particular the benefits of team learning and included recommendations for other modules in which TBL would be appropriate. Working with a large academic team was challenging to ensure implementation occurred as outlined across the five student groups but overall worked well. Significant learning took place throughout the course of the module for all members of the academic team and changes will be made for the next delivery that will include more tutorial support for the students prior to the Unit tests; reworking the application activities to ensure these are sufficiently challenging to engage the student teams in discussion; and some reworking of test questions as a consequence of the question analysis. There is interest from other academic teams and the aim is to introduce TBL into a first year module so that students become familiar with the strategy early in the programme.

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Appendix 1: Team-Based Learning Questionnaire

Part 1: Team-Based Learning as a Teaching and Learning Strategy
Please answer the following questions as best as you are able so that we can gain an understanding of how students view the effectiveness of team-based learning (TBL) as a teaching and learning strategy. Place a tick in the box to indicate whether you 'Strongly agree (SA), Agree (A), Uncertain (U), Disagree (D) Strongly disagree (SD)' with the following statements:

A. Module Organisation	**SA**	**A**	**U**	**D**	**SD**
1. The TBL approach was appropriate for this module					
2. The preparatory information (during induction and in the handbook) prepared me for what to expect					
3. The division of the module into four units worked well					
4. The timing of each of the four Unit sessions was appropriate					
5. The tutors facilitated the discussions well					
B. TBL Approach					
6. TBL helped me increase my understanding of module material					
7. I have completed 100% of the required reading					
8. Learning outcomes helped me to focus on the core information					
9. I did not think that the individual readiness assurance tests (iRATs) were useful learning activities					
10. I generally felt prepared for the iRATs					
11. Discussions of the issues that were the focus of the tests and application activities were useful learning activities					
12. I learn better from lecture presentations than in team work					
13. Solving problems in a team is an effective way to learn about evidence-informed decision making					
14. I learned useful additional information during the TBL sessions					
15. The team RAT discussions allowed me to correct my mistakes and improve my understanding of the concepts					
16. I do not have a positive attitude about working with my peers					
17. The ability to collaborate with my peers is necessary if I am to be successful as a health care professional					
18. Solving problems in a team is an effective way to practice what I have learned					
19. I did not contribute meaningfully to the TBL discussions					
20. Most students were attentive during TBL sessions					
21. I paid attention most of the time during the TBL sessions					
22. The TBL format was helpful in developing my information synthesising skills					
23. There was mutual respect for other teammates' viewpoints during TBL					
C. Overall Experience					
24. Overall I did not enjoy the TBL approach					
25. TBL is an effective, motivating learning strategy					
26. I recommend using the TBL approach in future courses					

Part 2: Team Performance Scale
Based on your **OVERALL** experience with your team during this module, please estimate **HOW OFTEN** the following events occurred by placing a tick in the box where **0=None of the time; 3=Some of the time; 6=All of the time.**

	0	1	2	3	4	5	6
27. All team members made an effort to participate in discussions.							
28. When team members had different opinions, each member explained his/her point of view.							
29. Team members encouraged one another to express their opinions and thoughts.							
30. Team members shared and received criticism without making it personal.							
31. Different points of view were respected by team members.							
32. Often members helped a fellow team member to be understood by paraphrasing what he/she was saying.							
33. My team used several techniques for problem solving (such as brainstorming) with each team member presenting his/her best ideas.							
34. Team members worked to come up with solutions that satisfied all members.							
35. All team members consistently paid attention during group discussions.							
36. My team actively elicited multiple points of view before deciding on a final answer.							
37. Team members listened to each other when someone expressed a concern about individual or team performance.							
38. Team members willingly participated in all relevant aspects of the team.							
39. Team members resolved differences of opinion by openly speaking their mind.							
40. Team members used feedback about individual or team performance to help the team be more effective.							
41. Team members seemed attentive to what other team members were saying when they spoke.							
42. My team resolved many conflicts by compromising between team members, with each one giving in a little.							
43. Members who had different opinions explained their point of view to the team.							
44. Team members were recognized when something they said helped the team reach a good decision.							

Part 3: General: Please tick the boxes below as appropriate:

45. Field: Adult ☐ Child ☐ Mental Health ☐

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46. Gender: Female ☐ Male ☐

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47. Age Group: 18-25 ☐ 26-35 ☐ 36-45 ☐ 46+ ☐

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48. Did you access: (a) the module Facebook group page Yes ☐ No ☐

(b) the Tulip discussion board Yes ☐ No ☐

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49. Did this help with your learning?

(a) Facebook

To a great extent ☐ To some extent ☐ Not really ☐ Not at all ☐ N/A ☐

(b) Tulip Discussion Board

To a great Extent ☐ To some extent ☐ Not really ☐ Not at all ☐ N/A ☐

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50. Module Group Number: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Appendix 2: Student Interview Questions

1. Can you tell me about aspects of the module that you particularly liked?

2. Can you tell me about aspects of the module that you found particularly challenging?

3. Can you tell me whether you found the first practice day useful (prompt for how or why not)

4. You were given links to online resources and provided objectives for the readings. Can you tell me about these – did you access them (some of them, all of them?)?

5. Can you tell me about accessing the resources? (prompt for ease or difficulty as necessary)

6. Can you tell me how you used the resources? (prompt for just read through in one sitting; made notes; discussed with colleagues)

7. Can you tell me about the learning you think occurred through using the resources? (prompt for understanding the key concepts)

8. An essential element of TBL is the readiness assurance process. How did the individual tests influence your learning? (prompt for whether felt prepared from studying the resources)

9. How did the team tests influence your learning? (prompt for team discussion and clarification that took place)

10. How did working on the team application activities influence your learning?

11. How did you feel about working as part of a team on this module?

12. Did receiving feedback from your team members influence your understanding of how you worked in a team?

13. What effect do you think TBL had overall on your learning for this module?

14. Do you have any suggestions for improving the way in which TBL was used for this particular module?

15. Having completed this module using TBL what do you think of this teaching and learning strategy?

16. Would you like to see TBL used in other modules in your programme?

Appendix 3: Academic Team Interview Questions

1. What were you initial thoughts when TBL was first proposed for this module?

2. What if any preparation did you do in advance of the TBL sessions?

3. How did you manage being both the facilitator and content expert?

4. What did it feel like when/if the session went well?

5. What do you think contributed to a session that went well?

6. What did it feel like when/if the session did not go well?

7. What do you think resulted in a session not going so well?

8. How do you think TBL addressed the challenges associated with teaching EIDM?

9. Did you think any part of the TBL process worked particularly well? (preparation, testing, application activities, appeals, peer feedback)

10. Did you think any part of the TBL process did not work well? (preparation, testing, application activities, appeals, peer feedback)

11. What important things have you learned about how to do TBL?

12. What things do you wish you had known about TBL when you started?

13. What have you come to appreciate about TBL as a learning strategy?

14. What advice would you give to a new TBL lecturer?

15. What in particular do you think a TBL facilitator needs to do differently from any other small group facilitation?

16. Overall what do you think is the value of TBL for this module?

17. Would you recommend the strategy for wider use within the programme?