

Transforming a Clinical Clerkship with Team Learning

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Background: *Team learning, an innovative educational method combining interactive small group learning with expert-based content delivery, was introduced into our psychiatry clerkship in 2002. The main goal was to increase classroom engagement and improve educational outcomes.*

Description: *Eight of 16 lectures were replaced with team learning activities, including prerequisite readings, readiness assurance tests, and application exercises. Data on students' performance and educational experiences were compared before and after curricular change.*

Evaluation: *Following implementation of team learning, students performed significantly better on the National Board of Medical Examiners (NBME) psychiatry subject test and scored higher on attitudes about working in teams. Students perceived team learning activities to be more engaging, effective, and enjoyable than conventional didactics.*

Conclusion: *Incorporating team learning into the psychiatry clerkship was associated with improved student performance and increased student engagement and satisfaction. Team learning is a promising educational strategy that may prove useful in other clerkships.*

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Background

A growing number of medical educators are looking for ways to incorporate active learning strategies into tra-

ditionally lecture-based teaching sessions. One such method, called "Team Learning," has shown great promise for improving educational outcomes in residency and basic-science curricula.^{1,2} In an effort to improve active

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learning and self-study among students in our psychiatry clerkship, team learning activities were incorporated into the clerkship lecture series. This article reports on our experience and the educational outcomes we observed.

Team Learning

Team Learning is an instructional strategy that fosters active learning through small-group interaction. Used for many years in business and science courses,^{3,4} team learning has recently been piloted in medical education.^{1-2,5-7} During team learning, groups are given problems to stimulate discussion about topics related to session goals. The problems are accompanied by a variety of reasonable solutions, and groups are expected to discuss the problems, select a solution, and defend their groups' answers in discussion with the entire class. Students pool their knowledge to develop a consensus and ultimately teach each other. Team learning promotes a high level of student cohesiveness, thought to be a powerful factor in the success of the method.³

Team learning is unique in its ability to facilitate effective small group learning in classrooms with relatively high student-faculty ratios (e.g., up to 200:1) without losing the benefits of faculty-led small groups with lower ratios (e.g., 7:1). It has particular potential in medical education. Because the learning takes place in a team, it reinforces the utility of "team-based" decision making, and experientially lends appreciation for the multidisciplinary teams characteristic of the medical environment. Team learning has economic advantages over other small group methods because it can be conducted with multiple teams and one "expert" instructor, thereby not requiring multiple facilitators.

In 2001, the research team became involved with an initiative by the Baylor College of Medicine to introduce team learning to other medical schools. Supported by a grant from the Fund for the Improvement of Post Secondary Education (FIPSE), Baylor had piloted and studied team learning in a number of areas. Findings at Baylor included effective stimulation of out-of-class study, high levels of in class engagement and "teamwork" among students, enhanced students attitudes about learning and working in teams, and student knowledge-based performance at least as favorable as traditional didactics.⁵ Based on the strength of these findings, team learning was piloted in our core psychiatry clerkship at the University of Texas Medical Branch (UTMB). The primary objective was to create a more rigorous and less "passive" curriculum than our traditional series of lectures and case conferences. Since adopting the NBME psychiatry subject test in 2000, the faculty had become concerned that the curriculum was not adequately preparing students for this exam. For example, the mean scores were below the national average, and nearly 5% of students had received a raw score less than 55. The faculty believed

that student scores on the NBME subject test could be improved by responding to school-wide encouragement to increase active learning and promote the teaching of clinical problem solving skills through the implementation of team learning.

In January 2002, several psychiatry faculty attended a workshop at the Baylor College of Medicine to learn the basic techniques of team learning. Team learning activities were piloted with students from the class of 2004 who took psychiatry during the last block of the academic year. Then in June 2002, team learning was introduced into the formal teaching portion of the 3rd-year psychiatry clerkship.

Program Intervention

During the 6-week psychiatry clerkship, approximately 20 students rotate through a variety of clinical psychiatric services on the UTMB Galveston campus, and come together three times a week for 16 1-hour sessions. In the prior curriculum, the sessions consisted of lectures and 2-3 case conferences. At the beginning of the 2002-2003 academic year, 8 of the 16 sessions were replaced with team learning activities, scheduled one to two times per week. Five faculty members took the responsibility for developing and administering the team learning activities. Each activity was piloted and reviewed by the psychiatry clerkship committee prior to introduction into the schedule. Except in a few instances, faculty members taught the activities that they developed.

The design of team learning activities was informed by previous applications of the method in medical and other graduate school curricula.¹⁻⁸ During orientation, students were assigned to teams consisting of 4-6 students and given an introductory exercise to familiarize themselves with the team learning method. Team assignment strove to equalize the amount of expertise in each team, as per Birmingham and McCord.⁹ Required reading was assigned as a prerequisite for all sessions.

Four of the team learning sessions consisted of "readiness assurance tests" (RATs) that were first taken individually (I-RATs) and then as a group (G-RATs). Each RAT consisted of approximately 12 multiple-choice questions derived from the assigned reading. The questions are constructed to demonstrate students' advance preparation, comprehension, and readiness to apply the prereading material. The I-RATs enabled us to hold students individually accountable for their preparation. Taking the same closed-book test as a group (the G-RATs) facilitated the process of students teaching each other. After each G-RAT, the faculty facilitator reviewed the answers with the students, clarified concepts, and emphasized key points.

The remaining four team learning sessions consisted of application exercises that emphasized chal-

lenging clinically oriented problems written in a multiple-choice question format. Students were given a description of a clinical case and a question prompting them to choose between methods of further assessment, diagnosis, or treatment. After discussion within each team, team representatives simultaneously held up a lettered card corresponding to their final answers. The multiple-choice format of the problems allowed the teacher and students instantaneous feedback about various teams' answers. The facilitator then led a discussion in which teams defended their answers and debated the choices. Readiness assurance tests alternated with application exercises over the course of the 6 weeks. For both activities, teams were encouraged to submit written appeals if they believed that an answer other than the stated "correct" answer was valid. When teams provided an adequate rationale for their answers, demonstrating understanding of the underlying concept, we granted the appeals and gave the students on that team full credit.

Evaluation Methods

Overview and Data Collection

The psychiatry core clerkship is repeated eight times over the course of an academic year with successive cohorts of 3rd-year students. In this article, reference to the "class of 2004" constitutes the cohort of students that took the clerkship during one of the blocks in the 2001–2002 academic year, and the "class of 2005" includes the cohort of students that took the clerkship during the 2002–2003 academic year. Although the research team planned a priori to track NBME psychiatry subject exam scores as the primary

comparison between previous and revised curricula, several additional outcome measures were added to the evaluations. The UTMB Institutional Review Board approved this research.

Measurement Instruments

Table 1 details demographic results and evaluation methods. The primary endpoint consisted of a comparison of the average NBME psychiatry shelf exam scores between the classes of 2004 (prior curriculum) and 2005 (revised curriculum). Block 8 was excluded from the class of 2004 in this analysis because a team learning pilot was conducted during that block. Student self-perceptions of in-class engagement were measured during selected lectures or team learning activities that dealt with similar content for the classes of 2004 and 2005. For this measurement, two items were used from the Classroom Engagement Survey, Baylor College of Medicine.¹⁰ These two items ("most students were actively involved" and "I contributed meaningfully to class discussions") used a 5-point Likert response scale anchored by "strongly agree" and "strongly disagree." Higher scores indicate higher levels of engagement.

Students' perceptions of the value of learning in teams was measured using an instrument also developed at Baylor College of Medicine. The "Value of Teams" survey contains 17 items in two dimensions, called "value of group work" and "working with peers." All items are scored on a 5-point Likert scale anchored by "strongly agree" and "strongly disagree." Higher scores indicate perceptions of greater value of learning in teams. Sample items include "group decisions are often better than individual decisions" and "collaborating with my peers will help me be a better

Table 1. Demographic Data and Evaluation Methods

Cohort	I: Class of 2004	II: Class of 2004	III: Class of 2005
Blocks	1–7	7–8	1–7
<i>N</i>	131	42	133
Percent of students who were men	58.0	71.4	65.4
Percent first time takers of clerkship	97.0	100	97.7
Instructional methods	Lectures only	Lectures (block 7) and team learning pilot (block 8)	Team learning activities
NBME	End of blocks 1–7	Block 8 not included in analysis because of impact of pilot	End of blocks 1–7
Classroom Engagement Survey	Block 7 only	Blocks 7 and 8 lectures (5 lectures, <i>n</i> = 42 students, 71 surveys)	Team learning activities (6 sessions, <i>n</i> = 133 students, 281 surveys)
Value of Teams Survey	End of Block 7 only	End of block 7 (prior curriculum, <i>n</i> = 22) Beginning of block 8 (prior curriculum, <i>n</i> = 20)	Beginning of blocks 4–7 (prior to exposure to team learning, <i>n</i> = 80) End of blocks 1–7 (after exposure to Team learning, <i>n</i> = 133)
Clerkship Conference Evaluation	Not done	Not done	End of blocks 1–7

student." In normative samples, the two dimensions of the Value of Teams survey had internal consistencies of 0.79 and 0.81, respectively.¹¹ The Value of Teams Survey was administered to students before and after they had experienced Team Learning. Scores on the Value of Teams survey were compared both between cohorts of students pre- and postcurricular revision, and in the same students (blocks 4–7, class of 2005) before and after they experienced team learning.

In addition, a survey was developed for students in the class of 2005 to rate the educational effectiveness and enjoyment of lectures, case conferences, readiness assurance tests, and application exercises at the end of the clerkship. The instructions for this item were worded as follows: "Please rate on a scale of 1 to 5 the following components of your program in Psychiatry in terms of HOW EFFECTIVE you believe each component was in helping you learn Psychiatry" and "Please rate on a scale of 1 to 5 the following components of your program in Psychiatry in terms of HOW ENJOYABLE you believe each component was in helping you learn Psychiatry." The ratings for lectures and case conferences were combined in order to calculate a composite "lecture-based" score; the RATs and application exercises were combined to calculate a composite "Team Learning" score. The means of these composite scores were compared for the class of 2005.

Statistical Analyses

Student's *t*-tests were used to compare the means of continuous survey variables. Mean NBME scores were compared by using a one-way analysis of variance with a post hoc Duncan's multiple comparison test. For these comparisons we also calculated Cohen's effect size (d = difference in means/pooled standard deviation). Chi-square tests were used to compare the relative proportions of categorical variables. Cronbach's alpha statistic was calculated for all perceptual scales (Classroom Engagement, Value of Teams subscales, Clerkship conference evaluations) to examine internal consistency.

Results

Characteristics of the cohorts of learners are displayed in Table 1. No statistically significant differences between cohorts in terms of gender or numbers of students taking the clerkship for the first time were found. A trend was noted toward higher numbers of male students in the class of 2004 taking the clerkship during the final two blocks.

Table 2 illustrates comparisons between cohorts before and after curricular change. Regarding NBME subject test scores, a one way analysis of variance indi-

cated significant differences between groups, $F(2,407) = 5.492, p = .004$. Post hoc Duncan multiple comparisons indicated that the NBME scores for the class of 2005 (revised curriculum; $M = 72.9, SD = 8.32, N = 133$) were significantly higher ($p < .05$) than the scores of the class of 2003 ($M = 70.3, SD = 8.18, N = 147, d = .31$), or 2004 ($M = 69.6, SD = 9.35, N = 130, d = .37$), which did not differ significantly.

The mean overall classroom engagement scores for five session topics (psychosis, personality disorders, child psychiatry, substance abuse, and cognitive disorders) was compared pre- and postconversion from traditional lectures to team learning activities. The overall engagement score was significantly higher ($p \leq 0.001, d = 1.13$) for the team learning activities ($M = 4.24, SD = .61, N = 281$) compared to the replaced lectures ($M = 3.46, SD = .95, N = 71$).

The Value of Teams Survey results show significant increases in the "value of working with peers" (WP) and "value of group work" (VGW) subscales between students who were not exposed to team learning activities and those who had participated in team learning activities. Significant increases were noted when comparing class of 2004 students (prior curriculum) with class of 2005 students (revised curriculum; WP: $p = .003, d = .56$; VGW: $p = .001, d = 1.01$) as well as when comparing class of 2005 students at orientation with the same cohort at the end of the rotation (WP: $p = .018, d = .40$; VGW: $p = .001, d = .63$).

Student ratings for the conventional lecture sessions of the clerkship (lectures and case conferences) were compared to ratings for the team learning components (RATs and application exercises) on the scales of effectiveness and enjoyment. Although the mean responses on both scales was 3 or higher (indicating moderate perceptions of effectiveness and enjoyment for both types of learning activities), comparisons show that the students perceived the team learning activities to be significantly more effective ($p < 0.001, d = .55$) and enjoyable ($p < 0.001, d = .55$) than traditional didactics.

It should be noted that of the eight effect sizes reported in Table 2, two are small, four are medium, and two are large using Cohen's overall convention of classifying effect sizes (small [.20], medium [.50], and large [.80]).¹² The effect sizes in Table 2 are also very close to those reported in prior reviews of statistical power levels with emphasis on the education domain (e.g., small effect = .13, medium effect = .47, and large effect = .73).¹³

Cronbach's alpha coefficients calculated for the classroom engagement survey ($\alpha = .81$); the value of teams "working with peers" subset ($\alpha = .83$); the value of teams "value of group work" subset ($\alpha = .53$); the value of team total ($\alpha = .81$); and the clerkship session evaluations ($\alpha = .79$) indicated very good internal consistency.

Table 2. Summary of Results

Evaluation Method and Comparison Groups	<i>M</i>	<i>SD</i>	<i>p</i> Value	<i>d</i> Value
NBME Subject Test				
I: Blocks 1-7, 2004 (<i>n</i> = 130)	69.6	9.35	< .05	.37
III: Blocks 1-7, 2005 (<i>n</i> = 133)	72.9	8.32		
Classroom Engagement Survey				
I&II: Blocks 7 & 8, 2004 (<i>n</i> = 71)	3.46	0.95	< 0.001	1.13
III: Blocks 1-7, 2005 (<i>n</i> = 281)	4.24	0.61		
Value of Teams Survey				
Working with Peers Subscale				
I&II: Blocks 7 & 8, 2004 (<i>n</i> = 40)	4.09	0.54	0.003	.56
III: Blocks 1-7, 2005 (<i>n</i> = 133)	4.38	0.51		
III: Blocks 4-7, 2005 at orientation (<i>n</i> = 74)	4.18	0.53	.018	.40
III: Blocks 4-7, 2005, end of clerkship (<i>n</i> = 74)	4.38	0.48		
Value of Group Work Subscale				
I&II: Blocks 7 & 8, 2004 <i>n</i> = 40	3.35	0.45	0.001	1.01
III: Blocks 1-7, 2005 (<i>n</i> = 133)	3.78	0.42		
III: Blocks 4-7, 2005 at orientation (<i>n</i> = 74)	3.50	0.40	0.001	.63
III: Blocks 4-7, 2005, end of clerkship (<i>n</i> = 74)	3.76	0.43		
Effectiveness "lecture" versus "team learning" (<i>n</i> = 128)				
Lectures and case conferences	3.21	0.76	< 0.001	.55
RATs and application exercises	3.68	0.95		
Enjoyment "lecture" versus "team learning" (<i>n</i> = 127)				
Lectures and case conferences	3.18	0.78	< 0.001	.55
RATs and application exercises	3.69	1.05		

Note: NBME = National Board of Medical Examiners; RAT = Readiness Assurance Test.

Discussion

To the best of our knowledge, this study is the first to empirically investigate the utility of incorporating team learning activities into a core clerkship for 3rd-year medical students. The results suggest that team learning activities could be an important addition to traditional clerkship didactic programs in medical education. Attainment of core knowledge, as determined by NBME subject test scores, was significantly higher than in the previous curriculum. Student perceptions of engagement were significantly higher with team learning activities compared to traditional lectures on similar content. Student attitudes about the value of working in teams increased following their experiences with team learning. Whereas the traditional lectures that remained in the curriculum were considered effective and enjoyable, team learning activities were perceived to be significantly more effective and enjoyable.

Although the increase in NBME subject test scores in association with the introduction of team learning is an encouraging finding, inferring causal relationships from the results should be considered with caution. Because so many students had failed the NBME test in the previous academic year, students undergoing the revised curriculum were repeatedly warned about the difficulty of the NBME test, the high failure rate, and the need to pass the test in order to pass the clerkship. It is possible that these warnings motivated students to prepare more conscientiously than their predecessors. Nevertheless, one could also assume that several as-

pects of the team learning experience would be expected to improve students' preparedness for the NBME test. For example, the required readings followed by readiness assurance tests provided continuous incentive to keep up with reading during the rotation, rather than "cramming" at the end. In addition, the effect of peer pressure may have fostered independent study during the clerkship. A student who did not adequately prepare for his team learning exercise faced the dual consequence of both getting a low grade on his individual readiness test and not "pulling his weight" in the team. Furthermore, the process of struggling with a complex clinical problem in a team setting helped reinforce content objectives and possibly brought students to a higher level of understanding which translated into better NBME test performance.

A surprising finding was the significant change in students' attitudes toward teams following team learning activities. Students at UTMB have plentiful experience in small group learning during their preclinical years; the increase in attitudes about the value of working in a group and working with peers was not due to small group work being a new experience. One of the unique aspects of the small group teamwork in our clerkship was the work of the teams themselves. Team learning not only gave students tasks to solve as a group, but also directly rewarded them as a team for high learning performance.

Our study has several limitations. Gathering controls from the end of the previous academic year is not ideal because the experience of having undergone difficult clinical rotations might in and of itself alter stu-

dent attitudes and the experience of engagement. Attitudes to the team learning activities could easily have been influenced by the faculty who were trying a new and promising method of teaching for the first time. Finally, students' test scores on the NBME could have been influenced by a multitude of factors other than their prior experience with team learning activities. Nevertheless, we are encouraged by the favorable performance of our students and the fact that team learning was so well received on our first attempt at incorporating it into a clerkship.

In conclusion, this study represents the first attempt to incorporate team learning into a clinical clerkship. Our results suggest that team learning is an instructional method that is worth further study. The nature of team learning activities makes them ideal for not only teaching clinical content, but also practicing clinical problem solving skills, fostering team communication skills, and ensuring high levels of classroom engagement. Future studies should concentrate on replicating our results in other disciplines and identifying those elements of team learning that are most powerful in producing favorable learning outcomes.

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