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Making the Most Out of What You're Already Doing

Molly Espey

John E. Walker Department of Economics

Clemson University

Clemson, SC 29634

mespey@clemson.edu

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I. Introduction

Among the goals of higher education are development of an informed and responsible citizenry and development of skills necessary for a productive and satisfying career. Over the years, opinions about how best to achieve these goals, as well as which skills are most important, have shifted. Currently, much attention is being given to online learning, particularly massive open online courses, blended learning, and the flipped classroom. Heavy weight is placed on science, technology, engineering, and math (STEM) education. Simply changing the method or focus, however, does not necessarily mean improved learning. The scholarship of teaching and learning is the systematic analysis of teaching and learning and can be useful in evaluating the effectiveness of approaches to teaching and the measurement of learning. As I implement changes in the classroom to enhance learning, I try to measure whether or not it actually impacts learning or if it impacts student attitudes about learning without detracting from learning. If what I am doing has a positive impact on learning and can be replicated by others, I can compound the positive impact by sharing my findings by making them public.

II. Background

My own work in the scholarship of teaching and learning began with small analysis of a single component of one class then grew to involve analysis of the overall structure of the teaching and learning process and how it impacts both attitudes and learning. For my first project, I joined forces with the Math Center at the University of Nevada-Reno (UNR) under its "Math Across the Curriculum" initiative. Under that initiative, I introduced a simple math competency quiz at the beginning of my introductory level course to determine if students' brushing up on or re-learning some basic math improved their scores later in the class. Students

were required to pass the quiz and were allowed to retake it if they did not. Math Center personnel administered the quiz and provided private tutoring to those students who did not pass the quiz.

In 2002, I began a gradual shift toward what became a significant change in my teaching methodology to team-based learning (TBL) where students work in the same group of 5 to 7 throughout the semester on in-class learning activities (see Michaelsen et al 2002 for more detail). Shortly thereafter, I had the opportunity to teach in a new classroom designed to provide flexibility for students of various sizes to work together. Prior to that, I had taught in a classroom with large rectangular tables and subsequently in a class with traditional desks but room enough to move them into circles to enable the students to work together. Fortunately, I had administered a survey about students' general feelings about TBL for several semesters already, so I was able to compare attitudes across the three classes. I also compared the average performance of individuals and the performance of each team on graded activities.

Thinking about student attitudes toward the learning process spurred me to think about how TBL might influence students' attitudes about working with others in general and led me to my next project. I gave students a twelve question survey at the beginning and at the end of the semester. The survey asked about their attitudes about working with others, both in a classroom environment and in a work environment, as well as demographic and academic information in order to assess how (or if) a semester in a TBL class affected their attitudes.

Finally, I have two ongoing projects related to TBL. The first attempts to measure the impact of TBL on development of critical thinking skills in comparison to a "typical" college course and to lecture-based courses. Students are surveyed at the beginning of the semester about how well the "typical" college course they've had has developed various critical thinking

skills, and they are surveyed again at the end of the semester with "the typical college course" replaced by "the use of TBL in this course". They are also asked directly to compare development of those same skills in a lecture course versus my TBL course. The second on-going project estimates the relationship between the composition of teams and both team and individual success using three different metrics of team success, two grade-based and one measuring team cohesiveness.

III. Overview of Past Projects:

Math Competency:

Students were required to pass a simple math competency quiz covering basic skills necessary for success in introductory microeconomic theory. The quiz was administered during the first week of the course; students who did not pass on the first attempt, received remedial tutoring at the UNR Math Center then were given repeated opportunities to pass the quiz. Not surprisingly, students who passed the quiz were more successful in the course than those who did not (Espey 1997). At least as significant, however, is that students who passed by a certain point in the semester, just before more mathematical skills became crucial, were more successful than those who didn't pass it by then, *regardless of the number of attempts*. Further, this outcome held even when accounting for other academic and demographic characteristics of the students, such as grade point average, class level, age, and gender.

Classroom Design:

The same intermediate level course was taught to students three subsequent years, each time in a different classroom with different degrees of flexibility for students to work in teams, a

daily part of the course. Individual performance, team performance, and students' attitudes about the team learning experience were assessed each semester. Neither average individual nor team performance varied in relation to the classroom design. However, students were significantly more positive about team based learning and their ability to work in teams in the classrooms that better accommodated team interaction (Espey 2008). Interestingly, student feelings about the class and their level of learning, as assessed through end-of-semester course evaluations, did not vary significantly across the semesters. These findings suggest that students are able to overcome physical challenges to team coordination and communication to make learning gains and that they are able to separate feelings about physical comfort and ease of group communication from their evaluation of course content and instructional quality.

Value of Working with Peers:

Student attitudes toward teamwork were assessed by analyzing responses to survey questions about working with others. As assessed by the change in responses from the beginning to the end of the semester, students were significantly more positive about working with peers after a semester of being engaged in a TBL environment (Espey 2010). Further, these more positive attitudes achieved over the course of the first semester of TBL carry over to subsequent courses. Student attitudes at the beginning of a second TBL course, even when taken as much as two years later, were not significantly different from attitudes of students at the end of the first TBL course. Finally, while there were a few differences in attitudes toward teamwork in relation to age, grade level, gender, and grade point average, all subgroups of students had more positive attitudes at the end of a semester of TBL than they did at the beginning.

IV. Ongoing Analyses:

Critical Thinking:

This study evaluates the impact of TBL on students' perceptions of the development of critical thinking skills. While critical thinking may be difficult to define, development of critical thinking skills is a principle goal of education, particularly higher education. Critical thinking skills include the ability to ask relevant questions, define a problem, examine evidence, analyze assumptions, synthesize information, draw inferences, and make reasoned arguments. These skills do not improve without practice; effective teaching methods engage students with course material and each other, challenging them to think through issues and problems relevant to the real world. Student activities that help develop these skills include applying concepts and tools to real world problems, interacting and communicating with others, developing arguments, critically evaluating arguments of others, considering different interpretations or points of view, and drawing conclusions based on evidence.

At the beginning of the semester, students rated the extent to which they agree that the typical college course they've had developed or enhanced their abilities in terms of four general academic skills and six critical thinking skills. At the end of the semester, students rated the extent to which they agreed that the use of team-based learning in the class had developed or enhanced their abilities in these same areas. Finally, students rated how much the use of team-based learning developed or enhanced their abilities in each area compared to lecture-based courses at the same level.

TBL was rated statistically significantly higher than the "typical" college course for all critical thinking skills except "drawing conclusions after researching a topic". As research was not a focus of team-based activities in any of these classes, this finding was not unexpected.

TBL was rated higher than the "typical" course in terms of enhancing students' ability to solve problems relevant to course material but lower in terms of developing individual responsible for learning. Finally, TBL was rated as more effective than lecture-based courses in developing or enhancing ALL of the general academic skills as well as ALL of the critical thinking skills, on average.

Composition of Teams:

Literature related to team composition and team effectiveness tends to fall into two general categories: teamwork in organizations and teamwork in specific course activities. Both of these veins of analysis consider the impact of surface-level variables, readily detectable or overt features such as age, gender, and/or race, with mixed findings (Deeter-Schmelz et al 2002). Deep-level variables, including attitudes, beliefs, or values, are generally found to have a more significant impact on team success over time (Bell 2007) but are typically much more difficult to measure.

Team performances of 89 teams in a total of nine sections of an introductory microeconomic theory course taught between 2006 and 2011 were analyzed to determine what observable characteristics of teams appear to influence team success and individual success. Surface-level variables available for each student include gender, class level, major, and whether the student is from in-state or out-of-state. Deep-level variables include grade point average, used to measure student effort and/or value of education, and group cohesiveness, measured by variance in end-of-semester peer evaluations for each team. Control variables include team size and class size.

Team grades include beginning-of-unit readiness assessment tests (RATs) and in-class team activities. Teams also worked on numerous ungraded activities daily. Over the course of the semester, teams took five RATs covering basic concepts related to the readings for each unit. These tests were taken first as individuals, then as teams. Each team also completed 12 to 13 graded in-class activities over the course of the semester. The overall team grade was a weighted average of these two components, 25-30% weight given to the RATs and 70-75% weight given to the activities. Individuals' grades were a weighted average of individual activities (homework and tests) and the team grade, weighted by the peer evaluations. Peer evaluations completed at the end of the semester require students to rate their teammates in terms of their contribution to learning throughout the semester.

Preliminary results suggest that team success is not significantly influenced by team size, class size, the mix of in-state and out-of-state students, the mix of class levels, or the average team GPA. The GPA of the top individual on the team, team cohesiveness, and the percent of females on the team are all significantly and positively correlated with team success. Individual performance is not significantly affected by team success but is positively and significantly influenced by team cohesiveness.

Awareness of characteristics of team composition that contribute to team success can help faculty members more carefully design teams to enhance outcomes and learning. For example, more effective teams will have members with complementary skills, but effectiveness also appears to be enhanced by team cohesiveness, thus faculty should be attuned to divisions or conflicts on teams and attempt to alleviate such problems to the extent possible. Explaining to students the value beyond the classroom of learning to work in teams helps students see the bigger picture. Businesses use teams for many projects; the literature addressing the team

composition in organizations often addresses who not to put on a team, yet in the classroom, everyone must participate if an instructor chooses to use teams or groups. Knowing what team components matter and what don't, in terms of team or individual success, can help instructors focus energy and attention on the appropriate variables in designing teams and working to maximize outcomes. If improving team performance in the classroom can help students better learn to work in teams, it could ultimately improving their employability and work productivity as well.

V. Conclusions:

The scholarship of teaching and learning entails systematic reflection and analysis of aspects of teaching or teaching methods and their impact on student learning. When effective teaching methods can be identified and replicated by others, scholarship shared through publication has the potential to enhance teaching and learning on a wider scale. Whether it is analysis of a small aspect of a single course or a complete overhaul of the course structure or method of delivery, the scholarship of teaching and learning has the potential to significantly impact higher education.

My work in this area began small and has grown to consider a variety of aspects of the learning process. Introduction of a math competency quiz is easily replicable by other instructors. The study shows the value of adequate preparation for higher level course work, and that such preparation need not necessarily involve complete semesters of remedial work when targeted review may suffice. Several years after this study, after a complete overhaul of my courses to TBL, I analyzed the impact of the physical classroom environment on student attitudes and learning, how TBL influences student attitudes toward working with others,

whether or not students feel TBL enhances critical thinking skills, and finally what impact, if any, the composition of teams has on learning.

Whether it is development of critical thinking skills, teamwork skills, or understanding what contributes to positive learning outcomes for students individually or in groups, careful analysis of the teaching process and learning outcomes can lend credibility to the idea that alternative teaching methods enhance learning and skill development. Knowing what works and what doesn't can help instructors focus energy and attention on the most effective teaching techniques and work to maximize student learning and success.

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