Critical Thinking and Collaboration: A Strategy to Enhance Student Learning

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ABSTRACT

In numerous studies relative to collaboration and critical thinking, an instructional strategy called Team-Based Learning has proven to be an effective approach to teaching and learning. Team-Based Learning utilizes a specific sequence of individual work, group work and immediate feedback to create a motivational framework in which students increasingly hold each other accountable for coming to class prepared and contributing to discussion. Using an action research conceptual model diffusion of innovation theory, the process of P-20 quality enhancement using Team-Based Learning is examined.

Keywords: Quality Enhancement, Critical Thinking, Collaboration, Action Research

INTRODUCTION

The process of quality enhancement is essential to improving student learning outcomes. Action research may serve as a framework for quality enhancement and provide a structure for the process. Diffusion of innovation theory provides insights regarding the dynamics of leading people through a quality enhancement process and corresponding organization change through the implementation of an innovation. Skills such as critical thinking and collaboration may be improved through the use of a quality enhancement process when Team-Based Learning, an innovative pedagogical strategy, is employed.

THE PROCESS OF QUALITY ENHANCEMENT

Framework

Action research represents investigations that educators conduct, either individually or in groups, about their own professional practice in order to understand and improve the nature and specifics of their work [1]. Action research is based on liberation from ideas imposed on institutions solely from outside, and seen as a way for institutional improvement based on internal factors [2]. It cannot be done in a laboratory setting and, as a result, must be field-based research. The concept is not new. It originated in Lewin's [3] work on the dynamics of social change in the United States in the 1940s [1, 4]. In a sense, action research constitutes an acknowledgment that education belongs to educators and that they, as experts on educational practice, are the ones most able to understand and refine their work. Action research is a logical process based an ongoing cycle of action that takes place in a spiral fashion [5, 6].

An action research model may be used as a framework for quality enhancement at level of an educational organization. To initiate the process of action research aimed at improving student learning, there is a preliminary phase beginning with a review of relevant student data, development of a plan informed by the data and implementation of the plan. Upon conclusion of the preliminary phase, a continuous process of planning, acting, and evaluating begins. Accordingly, the plan will be continually assessed and modified as it is delivered to ensure alignment with, and maximization of student learning (Figure 1).

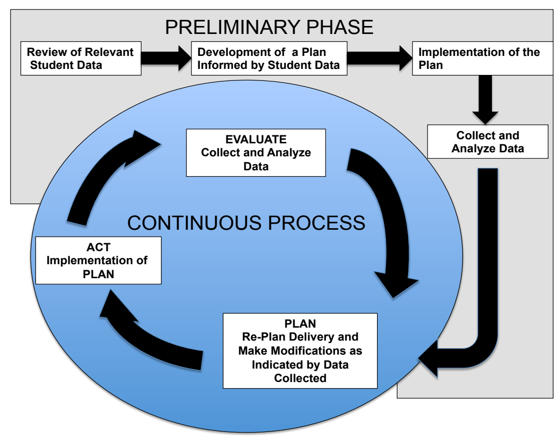

Figure 1. Research Design Concept Map

A multitude of options are presented for designing the data collection and analysis components of the action research cycle. Both quantitative and qualitative statistical treatments may be used.

Leading Change

Quality enhancement and organizational change are parallel concepts as it is impossible to enhance the quality of an organization without some type of innovation and resulting organizational change. Rogers [7] aligned Lewin's [3] change theory with his innovation theory and categorized organizational adoption of a new innovation into five stages. These stages were awareness (individuals are first exposed to a new innovation, but do not have any information regarding it), interest (individuals become interested in the innovation and seek out additional information), evaluation (individuals make a decision regarding the value or effectiveness of the innovation), trial (individuals use the innovation and determine its usefulness), and adoption (individuals finalize their decision regarding the innovation and continue or discontinue its use).

Rogers [7] also created categories for individuals within organizations consisting of Innovators, Early Adopters, Early Majority, Late Majority and Laggards. Innovators represent 2.5% of an organization. They tend to be the first to embrace change and may be engaging in practices not used by the majority of the members of the organization. They also do not communicate well with others within the organization. Early Adopters represent 13.5% of an organization. They tend to be positive, willing to change to improve practice, and have the respect of the majority of personnel in the organization. The Early Majority, 34% of an organization, is influenced greatly by the Early Adopters. The Late Majority, also 34% of an organization, is influenced greatly by the Early Majority. The Laggards represent 16% of an organization and are extremely resistant to change, even when it is seen as an improvement. Subsequently, the quality enhancement leader should initially focus efforts to involve faculty considered Early Adopters. Once Early Adopters become supporters of the innovation, the early majority will follow, and once the early majority become supporters of the innovation, so will be late majority. Laggards may or may not embrace the innovation.

The quality enhancement leader should align his/her quality enhancement implementation strategies with organizational change by employing an approach to organizational change developed by [8]. This approach includes 1) helping to create a sense of urgency and convince organizational members of the need for change; 2) identifying and involving Early Adopters first in the process of implementing the innovation; 3) celebrating success; 4) analyzing implementation and making modifications to the innovation as appropriate; and 5) institutionalizing the use of the innovation.

IMPROVING STUDENT LEARNING

Critical Thinking

Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action [9]. Benjamin Bloom [10] divided the way people think into three domains, the Cognitive, Affective and Psychomotor. The cognitive domain emphasizes intellectual outcomes. This domain is further divided into 6 levels: 1) Knowledge (recall), 2) Comprehension (the ability to prove understanding through explanation or rephrasing), 3) Application (application of information), 4) Analysis (division of information into smaller parts to achieve greater understanding), 5) Synthesis (designing a plan and set of operations, and combining parts to form a whole) and 6) Evaluation (making judgments and forming opinions). Analysis, synthesis, and evaluation are regarded as the outcomes associated with critical thinking, and knowledge, comprehension, and application are regarded as the outcomes associated with content competencies [11]. In 2001 a former student of Bloom, Lorin Anderson changed the 6 categories from nouns to verbs. Student learning outcomes addressing critical thinking skills may be written using keywords, action verbs, connected to each level.

Collaboration

Collaboration is the act of working in a group on a joint project [12]. A small group may be defined as two or more individuals who (a) interact with each other, (b) are interdependent, (c) define themselves and are defined by others as belonging to the group, (d) share norms concerning matters of common interest and participate in a system of interlocking roles, (e) influence each other, (f) find the group rewarding, and (g) pursue common goals [13].

Collaborative learning is associated primarily with constructivism in that learners create their own knowledge. It is connected to social learning theory when considering the interaction between team, and is more age appropriate for college students [14, 15, 16]. Collaborative learning techniques can be loosely categorized by the skill that each enhances. Collaborative models of instructional include Think-Pair-Share, Reciprocal Teaching, Think-Aloud Pair Problem Solving, Group Grid, and Group Writing Assignments [17]. Cooperative Learning is a common form of collaborative learning and is associated primarily with Bandura's social learning theory as team experiences facilitate learning and development through observing and modeling behaviors. It is primarily based on existing knowledge delivered primarily in a teacher-to-learner format and is more age appropriate for younger students [18].

Team-Based Learning

Team-based learning (TBL) is a practice taken by educators from the world of business. TBL is organized around team activities and may be enhanced with the use of various technologies [19]. TBL is a form of collaborative learning and has been proven to improve student achievement by increasing student reasoning, problem-solving and critical thinking skills, encouraging more scientific thinking and developing a deeper understanding of course content [20, 21, 22, 23, 24, 25, 26]. TBL strategies are based on the conceptual model called "Backward Design" [27] which is centered on the development of sophisticated insights and abilities, reflected in varied performances and contexts. Backward Design is a technique used by instructors in which they first determine the goal (end result) of the lesson and work backward to develop specific learning activities.

Instructors, who are able to discern students' level of thinking and use it to construct knowledge, help them to develop a better understanding of content [28]. TBL has been suggested to help students who seem disinterested in subject material, do not do their homework, and have difficulty understanding material. Team based learning can transform traditional content with application and problem solving skills, while developing interpersonal skills [19].

With TBL, substantial amounts of class time are used for working teams. Finally, courses taught with TBL typically involve multiple group assignments that are designed to improve learning and promote the development of self-managed learning teams [29, 30]. Learning how to learn, work, interact, and collaborate in a team is essential for success in this kind of an environment [31]. Required skills include listening, questioning and persuading, members must respect each other, and there must be a spirit of helping, sharing and participation. Team-Based Learning offers training experiences that are similar to the real world, provide applications to course content, helps students understand course concepts, allow students to work on complex intellectual tasks and offers students the opportunity to move beyond their individual capabilities. TBL components are listed in Table 1.

Table 1

Components of Team-Based Learning

Team Formation
• Instructors purposefully select team members • Diverse Composition • Teams are held strictly accountable for their products
Readiness Assurance
• Students must read and prepare assigned materials • Individual Readiness Assurance Tests (iRATs) • Team Readiness Assurance Tests (tRATS) • Appeals (team can appeal answers with appropriate evidence) • Instructor gives clarifying lecture focusing on areas of weaknesses as identified by test results
Application
• Students make decisions to solve discipline-based problems using cases, data, or other evidence determined by the instructor • Immediate student feedback

Many faculty simply put students in small groups and call it collaborative learning. Without incorporating specific structural components of TBL, the method is likely to fail, and students and instructors become frustrated and abandon this approach. Additionally, in-class application activities are based on the 4 S's consisting of **S**ignificant Problems--teams work on a relevant, significant problem; the **S**ame Problem--teams work on the same problem; **S**pecific Choice--teams are required to make a specific choice; and **S**imultaneous Reporting--teams report simultaneously [32].

Impact on Student Learning

Critical Thinking and Collaboration. Carmichael [33] sought to examine the viability of TBL strategies when applied to large-scale biology classes. In particular, he wanted to determine if student-centered TBL methods were an effective alternative to traditional instructor-centered lectures by comparing student performance in each section. He incorporated TBL into one of two Introductory General Biology classes averaging 200 students per class. The first group used traditional lecture-based techniques and the second class used TBL. Data indicated the TBL class scored higher on all tests during the semester than the traditional class, with the exception of the final exam in which students performed at comparable levels. Grades for the TBL class were significantly higher than the lecture-based class with TBL students earning more A's and B's and fewer D's and F's. Carmichael also found TBL students responded to exam questions that included data-interpretation with significantly more accuracy than the lecture-based classroom students, indicating increased critical thinking skills. End of semester surveys also indicated students from the TBL class demonstrated more critical thinking ability than students in the lecture-based environment. Furthermore, Carmichael also found that student engagement in classroom settings was more pronounced where TBL was used and students appeared to be more inclined to ask meaningful questions in class. Student comments recorded on the instructor's evaluation form suggested that a majority of students believe TBL improved learning of general biology. Results also endorsed the implementation of TBL as a beneficial tool in increasing student performance and engagement in a large-enrollment, undergraduate introductory science course.

In *Using Team Learning to Improve Student Retention*, Kreie, Headrick, and Steiner [34] applied TBL methods in an introductory Information Systems (IS) course with the intention of increasing student achievement and retention. The results were compared to the same class taught with traditional lecture-based instruction. Researchers sought to decrease not only the amount of students who dropped the course but took into account the number of students who stopped coming to class as the semester progressed. Therefore, researcher's final measure of retention only included the percent of students taking the final examination. Retention of the TBL students was significantly higher than that of traditionally instructed students, with 85.5% of TBL students taking the final as compared to 71.6% of students enrolled in the traditional lecture section. Instructors noted that students were more motivation to attend class on group activity days due to team commitment. Kreie, Headrick and Steiner concluded that TBL was an advantageous pedagogy to aid in the engagement and retention of students.

Baepler, Cotner, and Kellerman [35] incorporated the Immediate Feedback Assessment Technique (IF-AT) into large-enrollment introductory general biology classes. Aside from producing immediate feedback, researchers expected IF-ATs to highlight misconceptions for correction and promote group discussion. Course structure incorporated mini-lectures coupled with group assignments that included IF-AT activities. Groups were randomly set at the beginning of the semester, and students remained in those groups for the entirety of the course. Student perceptions regarding usefulness of the IF-AT were measured using survey instruments. Researchers were especially interested in the reception of IF-AT incorporation by female students. Data indicated that a compelling portion of students thought that IF-AT activities enhanced exam performance and recognition of misconceptions about subject matter. While overall responses from both genders remained positive, survey responses indicated that female students appreciated immediate feedback as an advantageous comprehension tool significantly more than male students. Consequently, Baepler, Cotner and Kellerman noted that techniques such as the IF-AT may provide a way to enhance engagement and thus retention of females in science disciplines, a consequential and persistent problem in the sciences. Results also indicated that use of the IF-ATs facilitated constructive group discussion, provided crucial corrective feedback and promoted overall student collaboration.

In a study conducted in 2010, Gomez [36] found that traditional TBL methods could successfully be implemented in a hybrid Information Systems (IS) courses that incorporated both face-to-face and online components. Students participating in the course expressed improved enjoyment and interest in course material. As indicated by student survey data, students believed that TBL methods (particularly iRATs) resulted in increased knowledge of course material. While this study did not measure student performance, Gomez did find a significant correlation between student perceptions of "motivation and enjoyment" to perceptions about the quality of their learning experience. Gomez concluded, "team activities may help students enjoy more what they need to learn, eventually achieving higher learning" [36, p. 389].

Citing inadequacies in the traditional lecture-based approach to organic chemistry instruction, using a slightly modified TBL method, Dinan and Frydrchowski [37] evaluated the effectiveness of team-based learning on an introductory organic chemistry course. Students were placed in a team of 5 or 6 the group remained the same throughout the semester. Instructors utilized other aspects of TBL including mini-lectures, the appeal process and readiness assurance. Instructors observed that student response was very positive in the team-learning atmosphere as students arrived to class early and began working within their groups immediately. Students also needed little to no coaxing ask questions or engage in discussion. Preparation, participation, and attendance by students all increased within the team-learning environment. At the end of the semester, surveys indicated that an overwhelming majority of students felt accountable to their team to be prepared for and attend class sessions. Instructors also observed that with increased group exposure, individual performance increased for all ethnicities. While data was limited, minority students enjoyed a higher success rate as opposed to traditional lecture methods, with 100% minority student retention and 80% of those students making a B average or above in the course. In addition to increased student participation and preparations, more chapter content was covered using the TBL method than content covered in past lecture-based sections. Eighty-four percent of students in the class responded that team learning was a successful technique for learning organic chemistry.

Drummond [38] examined the effects of utilization of Team-Based Learning techniques on student's critical thinking skills in an engineering entrepreneurship class. He analyzed 3 semesters of student data using the Critical Thinking Skills (CTS) rubric created by Washington State University as a measure of improvement. During one semester TBL strategies were used, and during the other 2 semesters traditional lecture-based strategies were used. Data generated by CTS activities coupled with instructor observations indicated a correlation between TBL and increased critical thinking skills. The CTS category measuring the ability to develop an individual hypothesis showed significant improvement among TBL students versus students in the non-TBL classes. Drummond noted this particular aspect of CTS measurement was used to exemplify typical results across all dimensions due to the large amounts of data collected. Other outcomes of TBL implementation included improved student participation and class preparation. Data showed that in the non-TBL environment student participation peaked at 25%. However, in TBL classes student participation averaged approximately 70%. Instructors also observed increased participation among English as Second Language (ESL) students, along with other students who were usually reluctant to participate in class activities.

Banfield, Fagan and Janes [39] conducted a study for registered nurses for the Registered Nurses Professional Development Centre's Critical Care Nursing Program. Instructors implemented TBL methods in their classrooms to measure its impact on critical-thinking skills among their students. Data indicated TBL helped to provide effective preparation for real-world experiences by engaging students in critical thinking not possible during traditional lecture. Through their comments, students expressed a belief that TBL methods resulted in greater retention of course material while also providing greater opportunities to exercise critical thinking. There was no significant difference in student performance across methods, but instructors did observe higher levels of student engagement and team-centered problem solving.

In 2009 Kalaiam and Kasim [40] conducted a meta-analysis of 193 studies to determine the effectiveness of group-based instruction (cooperative learning, collaborative learning, problem-based learning, team-based learning, peer learning, and inquiry-based learning) as compared to traditional lecture-based instruction in college STEM classes. The purpose of the project was to produce scientific evidence that could help determine whether the use of small-group learning strategies was more effective than lectures for improving student learning and persistence, along with attitudes toward STEM subjects. Results indicated that in varied degrees, all forms of small-group learning methods had a positive impact on student achievement, attitude, and persistence. These findings are consistent with other meta-analytic findings [41, 42] about the effectiveness of small-group learning methods in increasing students' achievement in STEM college classrooms.

CONCLUSION

One should not view quality enhancement as a static process. It is active and ever changing process because of the complex natures of organizations. Personnel, resources, technology and policies, just to name a few organizational factors, are constantly in a state of flux. Quality Enhancement is easily framed by the concept of action research. The roots of quality enhancement are aligned with the action research's cyclical components of evaluation, planning, acting, and re-evaluation.

Understanding and addressing the dynamics of change regarding personnel should not be underestimated when dealing with quality enhancement. The identification of the proper constituents, Early Adopters, to initiate change and the ability of the quality enhancement leader to engage them early in the quality enhancement process is essential to successfully navigating through the change process. Put another way, focusing energy and effort on the wrong constituency can ensure disappointment as without the correct people in the organization championing the change initiative, it is destined to fail.

Exchanging ideas within small groups is one of the primary behaviors that help foster critical thinking [43] as small group conversation among students stimulates thought while also promoting collaboration. Furthermore, research indicates that taking responsibility for learning helps students become critical thinkers [44]. These strategies, group work, conversation, student-to-student interaction, and taking responsibility for learning are some of the primary tenents of Team-Based Learning. As such, it could be reasoned that TBL strategies lend themself well to the development of both critical thinking and collaboration. Furthermore, the design of Team-Based Learning, the 4 S's, provide an infrastructure that promotes not only collaborative learning and critical thinking, but also the exchange of course content, collegial teaching and student engagement.

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