Fostering Interdisciplinary Collaboration to Improve Student Learning

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ABSTRACT

The purpose of this study was to compare the impact on student learning of those enrolled in courses where instructors participated in collegial coaching and peer mentoring. A nonequivalent group design methodology was employed along with an analysis of variance to analyze data. Findings indicated higher mastery levels of student learning outcomes, higher levels of perceived critical thinking and collaboration by students, statistical significance in critical thinking constructs, higher levels of persistence, and more A's and B's and fewer D's and F's in courses where faculty members were mentored as compared to courses where faculty members were not.

Keywords: Interdisciplinary Collaboration, Student Learning, Collegial Coaching, Mentoring

INTRODUCTION

Several professors involved in the university Quality Enhancement Plan decided the best way to ensure successful implementation of Team-Based Learning [1], a common instructional strategy used across multiple disciplines, was to support each other through collegial coaching. They had face-to-face meetings each week to discuss lessons learned, shared resources, and communicated via email and blogs. They also sought out support from the project director when needed. Their efforts were the impetus for mentoring along with coaching that would result in improved collaboration and student learning.

The subsequent mentoring and coaching promoted exploration, critique, and reflection to transform practice [2]. There was no preaching; only thoughtful, reflective questions aimed at guiding colleagues to the answers they sought. Collegial coaching created an environment of openness for peer mentoring. Professors provided each other advice, support, and encouragement by leading and guiding by example. They engaged in collaborative practices to enhance teaching and learning relative to the implementation of Team-Based Learning. They also frequently attended professional development activities with follow-up discussion [3].

Coaching and peer mentoring facilitated effective professional development and helped break down the cycle of instructor isolation. It also served as a communicative structure that allowed the flow of information to instructors regarding the Team-Based Learning techniques that were working [4]. Coaching sessions were productive conversations between faculty concerning student learning. They also served as acknowledgement of small wins as new innovations were being implemented [5]. Sessions fostered collegial teams that stimulated content innovation.

The collegial coaching method utilized for this project was based on a collaborative mentoring strategy called Learning Walks. Learning Walks are a professional development process designed to support thinking about instructional practice. They are designed to raise questions and promote self-reflection. The process leads to an instructional community concentrated on the examination of practice with no hidden agendas [6]. The project director introduced Learning Walks and provided training to peer mentor participants.

CONCEPTUAL FRAMEWORK

Learning Walks

Learning Walks [6] are a form of collegial coaching that provide a structure for interprofessional collaboration and were designed to help establish a common understanding of practice about the delivery of Team-Based Learning. Learning Walks help to open classroom doors and provide a collaborative professional culture offering a method for professional reflection. The focus of Learning Walks is on questioning strategies, classroom ecology (student-student & student-instructor interactions) and active student engagement.

A team consisting of 2 to 3 novice instructors, plus a veteran instructor, conducted classroom visitations twice a semester. Reflective questioning was used as a way to initiate dialogue about teaching and learning, as a way to look back at what happened and what was learned, and a way to look forward and resolve challenges that may arise. The classroom visitation phase of Learning Walks consists of four steps [6]:

1. Preparation. Including: a) Assembly of members of the Learning Walk team, b) Discussion of the Team-Based Learning Scorecard [7], c) Discussion of student learning outcomes, and d) Determination of the type of evidence required for mastery of learning outcomes.

2. The classroom visit. Team members: a) enter the classroom at the same time, b) do not speak to each other during the classroom visit, c) remain unobtrusive, but may speak with student or look at their work, and d) observe student-student and student-teacher engagement.
3. Team debriefing. Team members ask: Were students engaged in meaningful learning? b) Were higher order thinking and collaboration addressed? c) Were student-learning outcome(s) addressed?, and d) Was there something you observed that you would use in your classroom?
4. Closing Conversation between mentor and instructor. Mentor asks: Did it go as planned? b) Would you do anything differently? and c) What was observed. The conversation concludes with a discussion of ideas, strategies, and/or techniques that can be used in future classes.

Peer Mentoring

The growth of any craft depends on shared practice and honest dialogue among the people who do it. We grow by trial and error, to be sure—but our willingness to try, and fail, as individuals is severely limited when we are not supported by a community that encourages such risks [8, p. 144]. Engaged professionals who collaborate in learning teams hold themselves to a higher standard, improve their practice, and lift student achievement [9]. Instructors were divided into teams representing several disciplines across campus. They also received Learning Walk training.

Peer mentoring was defined as collaboration between experienced person who provides information, advice, support, and encouragement to a less experienced colleague by leading and guiding by example. Mentors engaged in an active, collaborative, year-long program aimed at enhancing teaching and learning through regular coaching, mentoring, and professional development activities. Mentors asked thoughtful, reflective questions that helped guide colleagues to the answers they sought. The purpose of mentoring was to provide a supportive environment for members of the improvement plan, facilitate collegial coaching, stimulate scholarly dialogue, provide assistance and opportunities for professional growth, provide opportunities for practice and guidance pertaining to the acquisition of Team-Based Learning strategies in a non-evaluative environment, and to develop learning communities constructed around professional improvement.

Mentors invited member of their cohort into their classroom for observation and coaching, organized and facilitated discussion sessions, and coordinated Learning Walks as relative to the implementation of Team-Based Learning. They were asked to be good listeners, avoid situations with other members of the cadre that they were not qualified to deal with or direct them to someone who could, be approachable, available, follow up on commitments, be realistic and encouraging, maintain confidentiality, and maintain accountability throughout the mentoring process. Most importantly, mentors were asked to coach and not judge [10].

Mentoring required a substantial time commitment to attend training and to facilitate Learning Walks. As a gesture of appreciation, mentors were allocated up to $1,000 for presentations at peer-reviewed professional conferences. Mentors also received training and support from the project director. Furthermore, those involved as mentors received a special Certificate of Collegial Coaching and Mentoring.

Team-Based Learning as a Common Pedagogy

Team-Based Learning [1] is a special form of collaborative learning using 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. Team-Based Learning was the common instructional strategy utilized by those who participated in the Quality Enhancement Plan. It was selected prior to the initiation of the plan by an advisory committee based on a review of student assessment data.

Deutschlander**,** Suter and Lait [11] developed a model for interprofessional education called the *IP Enhancement Approach.* This approach was developed to improve program reach, implementation and sustainability. It included the use of existing class schedules along with common content, pedagogies or instructional techniques. One could consider the use of Team-Based Learning as an IP Enhancement since it was used as a common pedagogy linking multiple disciplines to boost problem-solving, decision making and higher order thinking required for interdisciplinary endeavors.

Team-Based Learning Scorecard. Michaelsen and Sibley [7] developed a scorecard to help ensure fidelity of Team-Based Learning implementation. This scorecard was used as a collective starting point to stimulate conversation leading to observation of classes and subsequent discussion. The scorecard addressed focus, team formation (selection, composition and process), orientation of students (rationales and grade weights), readiness assurance process (frequency, focus of questions, feedback, appeals and link to activities), application activities and assignments (problem significance/relevance, problem selection, deliverables and reporting), individual accountability (accountability to instructor and peers), and team accountability (impact of team assignments and feedback on team assignments).

METHODOLOGY

This was a descriptive quantitative study framed by a modified action-research cyclical framework beginning with data collection, initiation based on the data, evaluation of outcomes, revisions; and finally a continuous planning, acting, and evaluating cycle. The study explored differences between variables in mentored and non-mentored courses. Student assessments utilized in this study included the Student Learning Target Mastery Report, Critical Thinking and Collaboration Pre- and Post-Tests, and the California Critical Thinking Skills Test (CCTST). Withdrawal and grade distribution data were also gathered from the university data management system and utilized for analysis. Additionally, the faculty feedback survey contained three questions pertaining to mentoring and collaboration.

Research Questions

This study examined student achievement in courses where faculty were mentored as compared to courses where faculty were not mentored. The research questions guiding the study included:

RQ 1: Will faculty members perceive mentoring as having a positive impact on relationships, communication and collaboration with their colleagues?

RQ 2: Will there be a difference in mastery of student learning outcomes in courses where faculty members were mentored/coached as compared to student learning outcome mastery in courses where faculty members were not mentored/coached?

RQ 3: Will there be a difference in perceived levels of critical thinking and collaboration among students enrolled in courses where faculty members were mentored/coaches as compared to courses where faculty members were not mentored/coached?

RQ 4: Will there be a difference in critical thinking constructs in courses where faculty members were mentored/coaches as compared to courses where faculty members were not mentored/coached?

RQ 5: Will there be a difference in student persistence in courses where faculty members were mentored/coached as compared to courses where faculty members were not mentored/coaches?

RQ 6: Will there be a difference in student grades in courses where faculty members were mentored/coached as compared to courses where faculty members were not mentored/coached?

Participants

Mentoring participants consisted of 17 self-selected instructors from the colleges of Allied Health, Arts and Sciences, and Continuing Education. Four mentoring participants (23.5%) were male and 13 (76.5%) were female. Mentoring participants served 543 students in 22 undergraduate and graduate classes. Non-Mentoring participants consisted of 33 instructors from the colleges of Allied Health, Arts and Sciences, Business, Continuing Education, Education, Engineering, Medicine, Nursing and the School of Computing. Fifteen (45.4%) non-mentoring participants were male and 18 (54.6%) were female. These instructors served 970 students in 46 undergraduate and graduate classes.

Assessments

Student Learning Outcome Target Mastery Report. The Student Learning Outcome Target Mastery Report consisted of 3-6 student-learning outcomes that were matched with assessments and a target mastery level, or benchmark, established by the instructor. These outcomes were connected with one of the four following domains: analyzing, applying, creating, or evaluating. The report was developed by instructors and submitted to the project director for feedback at the beginning of the semester. At the end of the semester, instructors reported the target mastery levels for each domain that were met and those that were not. A brief narrative was provided for all benchmarks that were not met including a rationale and improvement strategy. Student learning outcomes found in the Target Mastery Report were based on higher order thinking aligned with Bloom's Taxonomy of Revised Cognitive Domains [12].

Critical Thinking and Collaboration Pre- and Post Tests. The Critical Thinking and Collaboration Pre- and Post-Tests consisted of 20 likert scale survey questions. Likert questions used the following rating scale: 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree. Nine questions pertained to critical thinking and 11 pertained to collaboration. For both critical thinking and collaboration, the respective items were summed and then divided by the total number of scores to get a mean score in each domain. Students enrolled in participant courses were sent the survey at the beginning and again at the end of the semester using a web-based software system called Class Climate.

California Critical Thinking Skills Test. The California Critical Thinking Skills Test, created by Insight Assessment [13], is a standardized test normed with other four-year universities located in the United States. It was administered at the end of the semester. The California Critical Thinking Skills Test provides return scores on the following scales: analysis, evaluation, inference, deduction, induction, interpretation, evaluation, and overall reasoning skills.

Persistence and Grade Reports. Persistence was determined through the calculation of course withdrawals of students enrolled in the mentoring participants' courses and non-mentoring participants' courses. Course grades were obtained and utilized to compare grades from the mentoring participants' courses and non-mentoring participants' courses.

Faculty Feedback Survey. The Faculty Feedback Survey consisted of 4 sections, 1) Project Overview, 2) Instructor Recognition and Professional Development, 3) Implementation of Team-Based Learning, and 4) Project Improvement. Each section of the survey contained both Likert and open-ended questions. Likert questions used the following rating scale: 5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree. Items cited in the findings of this study were contained in the Project Overview section.

Data Analysis

Descriptive statistics were reported for items in the Faculty Satisfaction Surveys, Student Learning Outcome Target Mastery Report, the Critical Thinking and Collaboration Pre- and Post-Tests, and the California Critical Thinking Skills Test. Other various analyses including Pearson chi-square tests, one-way analysis of variance (ANOVA) tests, and a one-way multivariate analysis of variance (MANOVA) were conducted. Appropriate tests were selected for each research question to determine statistical significance of items found in these assessments.

FINDINGS

Faculty Perceptions of Mentoring

As seen in Figure 1, there were three questions pertaining to the mentoring experience included on the faculty satisfaction survey administered at the end of the academic year. Mean scores indicate positive perceptions of mentoring/coaching for all three items with scores approaching o exceeding a score of 4.0.

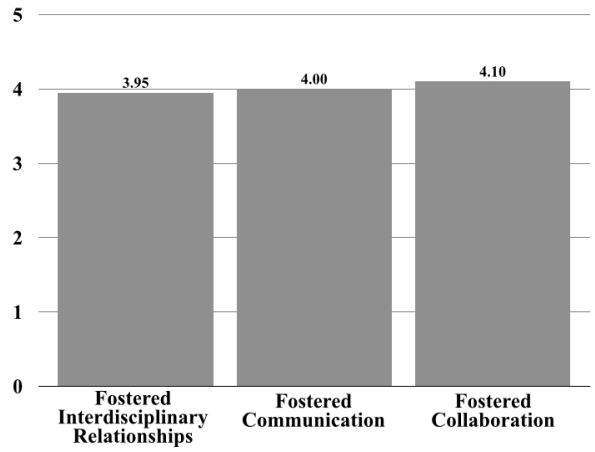

Figure 1. Faculty Satisfaction Survey Results, $N = 17$. The minimum score was 1.0 and the maximum score was 5.0 on all three items.

Mastery of Student Learning Outcomes by Faculty Group

To complete the Student Learning Outcome Target Mastery Report, instructors developed student-learning outcomes addressing higher order thinking skills, linked each one with appropriate assessments and then determined whether mastery levels were met. Data were disaggregated by Cognitive Domains (analyzing, applying, creating, and evaluating) relative to higher order thinking found in Bloom's Revised Taxonomy [12]. Comparisons of categorical variables were made using Pearson chi-square tests. As seen in Table 1, the percentages of mastery levels met were significantly different for each domain. Mentoring/coaching participants' courses reporting higher levels of mastery level percentages met were: analyzing, χ^2 (1, N = 681) = 91.52, $p < .01$; applying, χ^2 (1, N = 454) = 63.80, $p < .01$; creating, χ^2 (1, N = 500) = 19.31, $p < .01$; and overall mastery, χ^2 (1, N = 500) = 62.60, $p < .01$. In the evaluating domain percentages were also significantly different. However, percentages of mastery levels met were higher for non-mentoring/coaching participants' courses, χ^2 (1, N = 468) = 102.12, $p < .01$.

Table 1

Student Learning Outcome Target Mastery Percentages

	Group 1	Group 2
Cognitive Domain	% Met	% Met
Analyzing	84.4	47.6
Applying	97.0	70.5
Creating	95.2	82.6
Evaluating	19.7	70.7
All Domains	81.0	65.3

Note. All percentages significant at the .01 level. Group 1 = Mentored/Coached, Group 2 = Non-Mentored/Coached

Critical Thinking and Collaboration Scores by Faculty Group

Students in courses with mentored/coached and non-mentored/coached faculty completed a critical thinking and collaboration pre- and post- test. Because pre- and post-test scores could not be matched, these scores were treated independently. A one-way analysis of variance (ANOVA) was conducted to determine differences between mentored and non-mentored group scores, differences in pre-and post-test scores, and the interaction of these two variables for both critical thinking and collaboration. Each will be discussed below.

Critical Thinking. Results of the one-way ANOVA indicated no difference in critical thinking scores based on group, F (1, 3) = .51, p = .30. A statistically significant difference in pre- and post-test critical thinking scores was found regardless of group, F (1, 3) = 5.32, p = .01. Additionally, a significant interaction was found between mentored/coached and non-mentored/coached group and pre- and post- tests, F (1, 3) = 5.36, p = .01. As evidenced in mean score data presented in Table 2, the mentored/coached group's critical thinking post-test scores showed significant improvement as opposed to the non-mentored/coached group.

Table 2

Critical Thinking Pre- and Post-Test Mean Scores

Group	Test	Mean	Std. Deviation
1	Pre	3.57	.65
	Post	3.83	.70
2	Pre	3.74	.66
	Post	3.74	.74

Note. The minimum score was 1.0 and the maximum score was 5.0 on both the pre-and post-test. Group 1 = Mentored/ Coached, Group 2 = Non-Mentored/Coached

Collaboration. Results indicated no difference in collaboration scores by group, F (1, 3) = .22, p = .64. However, pre- and post-test collaboration scores were significantly different regardless of group, F (1, 3) = 19.03, p = .01. Additionally, there was a statistically significant interaction between mentored/coached and non-mentored/coached groups and pre- and post- tests with the mentored/coached group having significantly higher levels of improvement in pre- and post- test collaboration scores over the non-mentored/coached group, F (1, 3) = 3.50, p = .02. As seen in Table 2, while both mentored/coached and non-mentored/coached groups showed improvement in mean scores on post-tests, mean collaboration scores for the mentored/coached group were much better than those of the non-mentored/coached group.

Table 3

Collaboration Pre- and Post- Test Mean Scores

Group	Test	Mean	Std. Deviation
1	Pre	3.26	.69
	Post	3.55	.68
2	Pre	3.35	.80
	Post	3.43	.84

Note. The minimum score was 1.0 and the maximum score was 5.0 on both the pre-and post-test. Group 1 = Mentored/ Coached, Group 2 = Non-Mentored/Coached

Critical Thinking Constructs by Faculty Group

The California Critical Thinking Skills Test (CCTST) was administered at the end of the semester to measure the critical thinking skill level of each student. The CCTST measures test-taker's reasoning skills on the following scales: induction, deduction, analysis, inference, evaluation, interpretation, explanation, and overall reasoning skills. Students in both the mentored/coached faculty courses as well as the non-mentoring/coached faculty courses were asked to take the CCTST. A one-way multivariate analysis of variance (MANOVA) was conducted to determine whether a difference existed in critical thinking scales in courses where faculty members were mentored/coached as compared to courses where faculty members were not mentored/coached. Results indicated a statistically significant difference in CCTST scales based on group course placement (mentored/coached or non-mentored/coached), Pillai's Trace = .258, F (7, 45) = 2.24, p = .05. The univariate F tests showed there was a statistical difference between mentored/coached and non-mentored/coached group scores for deduction, F = 12.25, df = (1), p = .01; analysis, F = 5.91, df = (1), p = .02, and inference, F = 12.87, df = (1), p = .01. Table 4 provides means and standard deviations for each of the CCTST scales.

Table 4

CCTST Scale Mean Scores

Subscale	Group	*N*	Mean	*SD*
Induction	1	19	75.92	8.79
	2	34	73.39	6.93
Deduction	1	19	74.82*	6.43
	2	34	68.72*	5.88
Analysis	1	19	74.74*	6.12
	2	34	70.44	6.20
Inference	1	19	77.01	4.13
	2	34	71.26	6.25
Evaluation	1	19	71.73	9.94
	2	34	68.29	7.23
Interpretation	1	19	77.76	10.68
	2	34	74.19	7.92
Explanation	1	19	72.63	12.56
	2	34	68.65	8.83

Note. All scores are on a 100-point scale. * indicates significance at $p < .05$. Group 1= Mentored/Coached, Group 2 = Non-Mentored/Coached

Additionally, reports provided from Insight Assessment [13] compared group (mentored/coached or non-mentored/coached) scores to an aggregate sample of CCTST Four Year College Students. The assessment indicated that student scores within the mentored/coached faculty group were in the 37th percentile while student scores within non-mentored/coached faculty group were in the 20th percentile.

Student Persistence by Faculty Group

Student withdrawal rates were calculated for all courses in the study. A Pearson chi-square test was conducted to determine if course withdrawal rates were significantly different based on faculty group (mentored/coached or non-mentored/coached). Results of this analysis show no difference of withdrawal rates by group, χ^2 (1, N = 1511) = .89, $p < .35$. Although no significant difference was found, there was a slight decrease in course withdrawals with 2.3% (N = 13) in mentored courses and 3.1% (N = 29) in non-mentored courses.

Student Grades by Faculty Group

Student course grades were obtained and utilized to determine whether course grades differed by faculty group (mentored/coached or non-mentored/coached). A Pearson chi-square test was conducted and indicated no difference of course grades by group, χ^2 (4, N = 1489) = 2.21, $p < .70$. While only one faculty group received mentoring, both groups were trained on Team-Based Learning, which is an evidence-based instructional strategy. The lack of statistical significance may be a result of training and recurring professional development geared toward improving instruction.

CONCLUSIONS

In this study, student critical thinking and collaboration competencies, student persistence, student grades and faculty perceptions were compared between two groups of faculty members participating in a university-wide improvement plan called a Quality Enhancement Plan (QEP). One group, consisting of 17 faculty members, participated in peer mentoring and coaching using a collegial coaching strategy called Learning Walks. The other group, consisting of 33 faulty members, participated in the QEP but received limited mentoring only by the project director.

Learning Walks were the focal point of the mentoring/coaching strategy. The strategy helped faculty members develop collegial relationships through structured classroom visitation and conversation centered on the pedagogical use of Team-Based Learning. Mentors served as facilitators of 2 to 3 faculty instructors who remained together in the same group all year. They engaged in reflective questioning with members of the group, and helped them develop and internalize instructional improvement personalized to their individual needs. Learning Walks, along with similar strategies called walkabouts, instructional walks, and focused walks, are not commonly used in university settings and represent a new way to foster professional dialogue and learning communities meant to enhance classroom instruction and student learning.

Although statistical significance was not found throughout all of the assessment data, overall, findings indicated higher assessment scores in courses where faculty participated in peer mentoring and coaching. The lack of significance may be a result of the informal mentoring that took place between instructors and the project director, and between each other during numerous professional development activities held throughout the year. Fidelity of implementation may have also been a factor as there was no system of checks and

balances to ensure compliance with the Learning Walk model. Additionally, course grades may have improved in both groups because they utilized the same instructional strategy, Team-Based Learning, which has been shown to improve grades in several studies [14, 15, 16].

Faculty indicated that mentoring improved interdisciplinary relationships, and fostered interdisciplinary communication and collaboration. These findings are consistent with similar research that found faculty peer mentoring beneficial [17, 18, 19]. Utilization of Learning Walks at the university level represents a promising method for instructional improvement. As a result, this method of mentoring and coaching should be furthered explored through additional research.

Moreover, Team-Based Learning, because of the use of application activities as culminating instructional events, may be employed as a common instructional strategy across multiple disciplines to enhance interprofessionalism and interdisciplinarity. Team-Based Learning application activities are designed around instructional techniques using case studies or scenarios with embedded problems and decision points to facilitate enriched discussion, collaboration and higher order thinking. The comprehensive nature of this types of application activity implies the integration of content from multiple disciplines.

RECOMMENDATIONS FOR FUTURE RESEARCH

It is recommended that this study be replicated in other university settings to help assess the effectiveness of the peer mentoring/coaching model used in this study. It is also recommended that the study go beyond instructors participating in university improvement plans and include those in the other general faculty populations.

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