The Impact of a Problem-solving, Team-based, Team-taught, Interdisciplinary Learning Community on Nontraditional Technical Students at a Commuting Institution

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Abstract

This study focused on nontraditional, commuting, full-time students at a proprietary, technical, two and four year college in a large metropolitan area in central New Jersey and the impact of a problem-solving, team-based, team-taught, interdisciplinary learning community on these students [9]. Many of these students are older than traditional college students, and many are minority and international students.

The study consisted of a cohort of 25 students in the Electronic Technician (ET) Certificate Program that represented 25/26 students or 96% of the total population eligible for the study. As part of their first term experience, an experimental class of 16 students was part of the newly designed course Team 112 in its team-taught learning community model while a control group of nine students experienced the same class in the model taught by one instructor unlinked to any other class. The research hypotheses tested were that first semester students in the team-taught learning community model of Team 112 would have significantly higher levels of academic and social integration and more positive perceptions of their academic and social experiences than the control class as well as higher Team and Computer course grades and grade point averages, more contact with their classmates and instructors, and greater commitment to the college and persistence into the second semester. Both quantitative and qualitative research methodologies analyzing data from a student self-reported survey as well as institutional data were employed to compare the academic behaviors and outcomes of learning community and non-learning community students and to understand from the students' point of view their perception of the program.

Study results indicated that the team-taught learning community of Team 112 did, indeed, make a difference to the students in the experimental class. Study results yielded both quantitative and qualitative support for the hypotheses dealing with students' perceptions of their experiences. Experimental students indicated that they experienced higher levels of academic and social integration than did the control students. Study results failed, however, to provide support for most of the hypotheses dealing with actual student behaviors and outcomes with the exception of strong statistical and qualitative support for student commitment to the college.

Recommendations for further research include a longitudinal follow-up study to track students behaviors and outcomes, additional research to determine the reasons for second semester attrition, and studies both replicating the original design with the same student population and studies extending the research to other student cohorts with both the same and also different teaching teams in the same institution as well as other technical and non-technical colleges with similar student populations to confirm or refute the findings of this study and to determine their value in other settings.

I. Introduction

In his examination of college attrition, Tinto p. 1 began <u>Leaving College</u> with the words, "More students leave their college or university prior to completion than stay" [30]. Today with enrollment fluctuating in institutions of higher education, decreasing in some private liberal arts colleges and also in community colleges and increasing in public universities, the trend of students exiting college before graduation continues. The problem is even more significant at the two-year college level.   Today also, more non-traditional students, older, commuting, and part-time, are part of the many entering and leaving higher education than ever before. In fact, the number of nontraditional students increased from one in four undergraduates in 1986 to almost one in three in 1992 [19].

Much of the research on retention has been based on Tinto's model drawn from Durkheim's theory of suicide [10]. This conceptualization focuses on the social and intellectual integration of individuals into the community, i.e. in this application, the college community [30].   How much college students feel connected to their school, to their peers and to their instructors and how satisfied with these aspects of their college experience they are appear to be most significant in their decisions whether to stay or leave their institutions [2]. Astin showed that factors affecting students such as commuting to campus and having heterogeneous backgrounds with interest in vocational education lead to low involvement and resulting low student success [2].

The challenge, therefore, is to make the learning environment an environment in which students are actively involved both in the learning process itself as well as with those with whom they are learning: other students and faculty. When Chickering and Gamson reviewed research on how students learn and teachers teach, they identified the first three principles of good practice in undergraduate education as being student-faculty contact, encouragement of cooperation among students, and active learning [7]. In their study, <u>How College Affects Students</u>, Pascarella & Terenzini also noted the importance of student-faculty interaction, student academic and social involvement, interdisciplinary learning, active student participation in higher order thinking activities such as problem-solving activities, and the restructuring of classes into learning communities [24]. Just recently, the Carnegie Foundation for the Advancement of Teaching called for the need for more undergraduate interdisciplinary courses and courses centered around research and problem-solving as part of an effort to improve undergraduate learning [1]. Students need to be working together in collaborative settings engaging in shared discourse about their experiences. Also, they need to be involved in flexible curriculum relating to a wide range of disciplines causing them to think critically and apply what they are learning.

Higher education has responded by instituting a number of innovations: interdisciplinary learning, increased use of team-teaching, emphasis on problem-solving and critical thinking, and the establishment of learning communities, ranging from a coordination of two or more courses to a complete integration of entire programs. All of these practices are designed to make education more meaningful and coherent as well as to strengthen students' ties to the learning community and, in fact, appear to achieve their objectives. In addition, not only do these innovations impact students positively, they also appear to enhance the faculty's experience in the teaching/learning process. Faculty frequently report increased enthusiasm for teaching, pedagogical change, and collegiality. Thus, the need to continue to strengthen students' sense of belonging and involvement with learning is clear. Recently, Tinto called for more research into the ways curriculum structure (e.g. learning communities) and pedagogy (e.g. cooperative teaching) shape both learning and persistence on the college campus [32].

II. The Study

This study focused on nontraditional, commuting, full-time students at a proprietary, technical, two and four year college of approximately 3600 students in a large metropolitan area in central New Jersey and the impact of a problem-solving, team-based, team-taught, interdisciplinary learning community on these students [9]. Many of these students are older than traditional college students, and many are minority and international students. The study consisted of a cohort of 25 Electronic Technician Certificate Program students. As part of their first term experience, 16 students in the experimental group were assigned to the newly designed Team 112 course in its team-taught learning community model while nine students in the control group experienced the same class in an unlinked model taught by one instructor. The experimental class was linked as a cohort to the same Computer Applications class, Comp.111, with the technical instructor of the Team 112 teaching team also teaching the linked Computer class. The control class taught by the General Education instructor of the Team 112 teaching team was an independent class not linked to any other class by means of a common instructor.

III. Hypotheses

The two sets of research hypotheses underlying this study were as follows:

Hypothesis Set I – Student Attitudes and Perceptions
1. The experimental students experienced a higher level of academic and social integration than the control students.
2. The experimental students perceived their academic and social experiences more positively than the control students.

Hypothesis Set II – Academic Behaviors and Outcomes
1. The experimental students earned higher Team and Computer course grades than the control students.
2. The experimental students earned higher grade point averages than the control students.

3. The experimental students indicated a higher level of commitment to the college than the control students.
4. The experimental students persisted, i.e. continued into the second semester, at higher levels than the control students.
5. The experimental students worked with their classmates outside of class and e-mailed each other more often than the control students.
6. The experimental students interacted with their instructors, in-person and through e-mail, more than the control students.

IV. Research Design

This study employed both quantitative and qualitative research methodologies to compare the perceptions and behaviors of learning community and non-learning community students and also to understand from the students' point of view their perception of the program. The study employed a post-test only control group design comparing groups only at the posttest, assuming randomization to make groups comparable [14]. The total number of participants represented 25/26 or 96% of the population eligible for the study.

Both groups of students were asked to complete in class the First Semester Student Experience Survey (FSSES), a student self-reported questionnaire containing 44 survey items with two open-ended questions for the control group and five open-ended questions for the experimental group. The survey was developed from a number of other sources including the University of Arkansas at Little Rock (UALR) [25], Scales to measure Academic and Intellectual Achievement and Institutional Commitment developed by Pascarella and Terenzini [23], the University of Washington's Beginning student Survey [35] and the Temple University Student Experience Survey [27]. The survey was administered at the end of the semester in June 2000. In addition, institutional data regarding Team and Computer course grades, grade point averages, and persistence into the third week of the second semester was also collected.

The First Semester Student Experience Survey consisted of four sections: Student Information, Social Experiences, Academic Experiences, and Additional Student Information to measure institutional commitment and the number of student/student and student/faculty interactions. The number of items each section contained was as follows: I - Student Information, 16 items; II -Social Experiences, 11 Likert-like items and one open-ended question; III - Academic Experiences, 11 Likert-like items and one open-ended question; IV -Additional Student Information, six items with three additional open-ended question for the experimental group. This last section contained three additional open-ended questions for the experimental group to elicit their perceptions about the learning community.

The students involved in the study were first semester day full-time ET students randomly assigned to two classes. According to the criteria established by the National Center for Educational Statistics, all of the students in the study were classified as nontraditional [19]. Of the total of 25 students, only two or .08% were female, and both of

these students were in the control class. Although the student cohort was composed of students of varying ages, the experimental class was a much younger class than the control class with a mean age of 21.8 compared to a mean of 29.4 for the control class.

The experimental class was the team-taught learning community Team class linked to a Computer Applications class, and the control class was the group assigned to an individually taught Team class unlinked to any other class. The experimental learning community class was taught by both a General Education professor, the researcher, and a technical professor who also taught the linked computer class. The control class was taught by the General Education professor of the learning community teaching team. Both the experimental and control classes experienced the same curriculum and were required to fulfill the same course requirements. The format of both groups included small group collaborative learning activities, a cooperative learning capstone project (written and oral), individual assignments and reflections, some lectures, and class discussion as well as individual and group conferences.

V. Data Analysis

For this study, several forms of analysis were performed on the data. The statistical techniques used were selected because they provided a way to measure differences between two groups. The post-test control group design enabled the researcher to measure differences between groups for treatment effects and key outcomes.

First, descriptive statistics, simple frequency, percentage, and cross-tabular calculations, were employed to describe and compare the characteristics, experience, and outcomes of students in the experimental and control classes.

Then, a series of one-tailed t-tests were performed on Survey Section II - Social Experiences, Section III - Academic Experiences, and Section IV- Additional Student Experiences as well as on student team and Computer grades, grade point averages, and persistence into the second semester to look for significant differences between the experimental and control classes.

After analyzing the quantitative data, the researcher developed a coding system to organize the responses to the five open-ended questions on the survey. Bogdan and Biklen suggest searching through the data for regularities and patterns as well as for topics, writing words and phrases to represent patterns and topics which become the coding categories [5]. The coding families that proved most valuable were categories dealing with subject perspectives, activities, and strategies to achieve objectives.

VI. Summary of Results

The research question asked if participation in the team-taught learning community of Team 112 linked with Computer Applications 111 made a difference to students in both their perceptions of their first semester academic and social experiences as well as actual behaviors and outcomes. As such, the two-part research question underlying the study

was divided into two sets of hypotheses: Hypotheses Set I dealing with students' perceptions of their experiences and Hypotheses Set II dealing with actual student behaviors and outcomes. The results of the study yielded both quantitative and qualitative support for the first set of hypotheses; in other words, students in the experimental section indicated that they experienced higher levels of both academic and social integration than did the students in the control section. Table 1 presents a summary of the FSSES items of significance. T-test values for FSSES – Section II item #1; Section III items #5, 8, 10, and 11; and Section IV item #6 were negative because of the construction of the Likert scale with response #1 being strongly agree and thus indicated the overwhelmingly positive response of the experimental students to the item. In contrast, the t-test value for Section II item #6 was positive, but this result indicated that a significantly higher number of experimental students disagreed with the negatively worded item than did the control students.

Two key items in the FSSES Section II – Social Experiences were found to be of statistical significance, item #1 dealing with the ease students made friends during the semester and item #6 questioning the difficulty and/or ease with which students could schedule out-of-class meetings to complete course assignments with their peers. Since a primary objective of the learning community was to provide both an academic and social community for commuting students in an institution where students usually attend classes and return to their out-of–school communities and commitments, providing a venue for students to become connected was critical. Item #6 was significant at the .05-level, as was item #1which strongly supported the research hypothesis that the experimental students would experience a higher level of social integration than the control students. Along with connecting with each other during class, though, students needed to continue the connection outside of class to complete course requirements. The experimental students clearly indicated that they were able to accomplish such meetings.

FSSES Section III – Academic Experiences yielded four items of statistical significance at the .05-level. Item #5 queried the students about how important it was to them to apply what they learned in one class to other classes. The learning community connecting the Team class with Computer Applications was designed to allow for reinforcement of concepts learned in one class to the other and opportunities to practice application of newly learned skills in settings other than the original one. The experimental students strongly indicated that they were cognizant and appreciative of the opportunity to do exactly that. In addition, the team-taught learning community was also planned to encourage the students to connect with their professors by providing more opportunities within the academic environment for them to interact. Again, student responses to item #8 indicated that they felt it easy to seek out their professors for help when they needed to do so. The remaining two items of significance, items #10 and 11, dealt with students' perception of how much they looked forward to continuing their studies the following semester and how well they thought they would do at the college. Additionally, item #6 in Section IV – Additional Student Information asking if students would reenroll at the campus if they were able to register for college proved significant at the .05 level. Clearly, students in the experimental section felt academically successfully connected to the college.

Table 1.		
Summary of FSSES Items Attaining Statistical Significance		
Section II – FSSES –Social Experiences	t-test	p-value
Item #1. It has been easy for to meet and make friends with other students this semester at this campus.	-2.984**	0.003**
Item #6. With my commitments off-campus, I have difficulty finding time to schedule meetings with the group to complete course assignments.	1.727*	0.049*
Section III – FSSES –Academic Experiences		
Item #5. It is important to me to apply what I am learning in one class to another.	-2.199*	0.019*
Item #8. It is easy to ask my professors for help when I need it.	-1.980*	0.030*
Item #10. I am looking forward to taking classes next semester at this campus.	-2.202*	0.019*
Item #11. I feel I will do well here at this college.	-3.278**	0.002**
Section IV – FSSES –Additional Student Information		
Item #6. If you could start over again, would you enroll at this campus?	-2.686**	0.007**

Note. One-tailed t-tests with the lower tail critical were performed on all items except for Section II - #6 which was analyzed with a t-test with the upper tail critical.

*p < .05.

**p < .01.

Qualitative data, too, strongly corroborated the quantitative findings. Student responses to the five open-ended survey questions exploring what made them comfortable about becoming part of the college and what helped them to succeed academically as well as their responses to being part of the team-taught learning community indicated a much more positive response from the experimental students than the control students.

Study results did not, however, provide support for most of the hypotheses in Set II dealing with actual student behaviors and outcomes. Of the six subsidiary questions, only question #6 dealing with student commitment to the college yielded a statistically significant result at the .05-level. Item #6 dealing with institutional commitment asked students if given the opportunity if they would reenroll at the college. Again, since a key goal of the learning community was to establish a connection to the school, this result supports the research hypothesis that the experimental students would feel a higher level of both academic and social integration. FSSES items #8 and 10 in Section II – Academic Experiences discussed earlier provided additional support for the level of institutional commitment indicated by the experimental students as did the experimental students' qualitative responses to the open-ended questions asked them. Student integration and commitment to the college did not, though, translate into measurable

student behaviors such as the outcomes investigated in questions #1, 2, 4, 5, and 6 in Hypothesis Set II. No significant differences were found in Team and Computer course grades, grade point averages, actual persistence to the second semester, and amount of in-person and e-mail contact with classmates and instructors between the experimental and control sections.

VII. Conclusions

What the results of this study indicated is that it is indeed possible to create a sense of community within the classroom for commuting nontraditional students, students for whom connection within the classroom is probably their main and, in some cases, only contact with faculty and other students. The team-taught learning community of Team 112 provided an environment able to create a level of academic and social integration and also commitment to the college significantly higher than the control section experienced. What the study results did not, however, indicate was a significant effect on actual student academic behaviors and outcomes during the first semester.

Why the statistically significant quantitative and also positive qualitative support of the first set of hypotheses, Hypotheses Set I, Student Attitudes and Behaviors, did not translate into the specific measurable academic behaviors and outcomes of Hypotheses Set II is a question of some concern. The most obvious explanation is that one semester is too soon to expect to affect perceptions, attitudes, and also behaviors and outcomes in a student population unaccustomed to the pedagogical practices of a team-taught learning community; in fact, in a population unaccustomed to higher education. Most students are first-generation college students with working class backgrounds. Students entering the ET program are generally students with similar academic and life experiences, students to whom education has not been a particularly high priority in the past. To expect a dramatic change in their academic achievements after only one semester is, perhaps, premature at best. To have been able to positively affect their sense of belonging to a specific community at the college and to have affected their expectations about academic success and their levels of academic commitment when many ET students, in fact, have not experienced a high level of academic commitment and success in the past is, to be sure, an accomplishment.

What this study has done is to contribute to the literature examining curricular innovations, specifically learning communities, and persistence in college based on nontraditional commuting students. The study's findings corroborated earlier findings confirming the importance of academic integration to students at commuter institutions in contrast to the influence of social integration at residential colleges [20, 21, 22]. In addition, this single institution experimental design study has advanced study on minority student populations to support institutions to "address their own unique challenges" [18] and to correctly operationalize academic and social integration for each student population [13].

Tinto's theory of student departure provided a theoretical framework for the study, and the results of the study affirm the validity of Tinto's work. Importantly, the study with its

emphasis on a population often underrepresented in studies of higher education addressed some of the criticisms of Tinto's model.

Tinto has along with others acknowledged the shortcomings of his model regarding students of different gender, race, and social status backgrounds as well as adults and those at two-year and commuting institutions [4, 6, 17, 28, 29, 30]. Other major criticisms of Tinto's model have been its assumption that in order to be successful, minority groups must accept the dominant culture of the institution [3, 28] and that the model has not addressed the racial-ethnic dimension of "integrating experience" for minority students [6]. Tinto has maintained that the concept of membership is more useful than integration because of its implication of participation [31]. Additionally, Hurtado and Carter point to the concept of membership as students in peer groups acquiring skills necessary for college such as use of study groups in and outside of the classroom as promoting a "broader sense of group cohesion " and "enhancing an individual's sense of affiliation and cohesion with college" [11].

This study examined the application of Tinto's model to nontraditional commuting students of different ages and ethnicities and affirmed its applicability to a diverse student population. Its findings have added support for Tinto's assertion concerning commuting students that "If academic and social involvement or integration is to occur, it must occur in the classroom" [32]. Because of the college's multicultural nature, pluralism rather than an abandonment of minority culture is the dominant force on campus. Minority students in the study did not have to accept a particular culture dominant in the college, for, in fact, none exists. What they did do was to create their own culture and community within the classroom.

Also, all study participants were assigned membership in one of two models of a first-semester class in which participation was an essential requirement, but it was membership in the learning community that produced academic and social integration and commitment to the college. Thus, the study also provided support for Hurtado and Carter's concept of membership theory as promoting students' affiliation with the college [11].

Additionally, the study's findings supported earlier learning community research about the affective benefits of learning community membership; that is, of what students value about their experiences and what differences such programs make to them. The students involved in this study clearly indicated that they felt more comfortable and a part of the college, had friends to support them, and were able to approach problems from a broader perspective. Their responses echoed the responses of students in earlier studies [8, 12, 15, 16, 26, 32, 33, 34, 35, 36, 37, 38, 39].

Where the results of this study diverge, however, from most of the earlier research is in the area of specific gains in student academic behaviors and outcomes. Most of the literature has indicated that participation in learning communities has positively affected students' academic outcomes and persistence [8, 12, 15, 32, 36, 37]. Perhaps, greater gain in academic achievement in other studies could have been a result of more tightly structured

learning communities; in other words, a higher level of coordination among several classes along with additional support from other programs in the college such as the Advising Office, First Year Experience Programs, Student Personnel and Counseling Office, and Student Peer Advising and Mentoring Programs. In comparison, the learning community in this study involved only two loosely connected classes with two professors – a curricular restructuring which may not have provided sufficient academic support to affect higher grades and persistence. Perhaps also the treatment outcomes were limited to the selection of the instructors, so that another study with other instructors might result in different academic outcomes. Not all other studies have shown positive student academic achievement and persistence though. Therefore, additional research examining student academic behaviors and outcomes in differently structured learning communities is certainly warranted. Also, even though the study participants represented, in essence, the entire population of electronic technician students eligible for the study, the total sample was small which is yet another factor supporting the need for additional research.

VIII. Recommendations for Further Research

The study's findings suggest opportunities for additional research in the fields of pedagogical innovations and learning communities, especially for nontraditional commuting students. The following are areas warranting further examination.

1. As the study's findings indicated that the experimental students experienced a higher degree of academic and social integration and commitment to the college than the control students but did not provide support for particular behaviors and outcomes, a longitudinal follow-up study to track students' progress, specifically to track behaviors and outcomes such as grades and persistence, is warranted.
2. Next, further research to determine exactly why students did not register for their second semester would provide insight as to the efficacy of the learning community model of Team 112 to influence persistence, especially in light of the overwhelmingly significant institutional commitment indicated by the experimental students.
3. A follow-up study with other ET students would test the model's application to other ET cohorts at the college, particularly since one of the study's limitations was its small sample size.
4. Also, an expansion of the program to include other majors, both associate degree majors as well as baccalaureate students and more female students would verify its generalizability to other populations in the college.
5. Replicating the study with the same faculty would add validity and be valuable to test if the findings could be repeated.
6. As one of the study's limitations was that the outcomes could be limited to the selection of instructors, replicating the study with other faculty would examine whether the study's findings were dependent on a particular faculty team or if other faculty might evoke the same response.
7. Additional studies examining different types of learning communities with different classes linked together or a different number of linked classes with additional types of institutional support would extend the learning community research.

8. Finally, additional studies at both other technical and non-technical colleges with similar student populations would confirm or refute the findings of this study and determine their value in other settings.

Today universal access to higher education promises a vast array of benefits to its participants, but the large number of students, particularly nontraditional students, leaving higher education before the completion of their degrees gives pause to how available higher education truly is to these students. In order to affect genuine opportunity, higher education must actively involve students in their learning and enable them to connect with both their classmates and their instructors. Learning communities are one avenue to support our students. Continued research into better serving the needs of our students, especially first-semester students, may lead us to yet many more.

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Addendum - Reflections of an Electrical/Electronics Engineer Team-teaching Faculty Member, W. T. Lin

The ultimate goal of collegiate education is to help students mature into skilled and responsible problem-solvers. For years, potential employers of our graduates have expected their new college hires to be socially mature and communicative team players in addition to being capable and efficient problem-solvers. Team 112 was designed to answer this mandate with the uniqueness of bringing together the expertise of both technical and General Education faculty members. One reason for this model was to bridge "content learning" with "non-content learning" and to permeate this learning vertically throughout the curriculum.

At the inception of this newly designed course, some administrative concerns were raised. Above all, the concern about cost effectiveness was the most intricate and pressing one. Was the investment of double resources for a "problem-solving" course worthwhile? Could the outcome be measured vertically throughout the curriculum? Certainly, these are the most important questions to ask from a business point of view. However, the true impact of this particular course on students is somewhat difficult to see and measure in a short period of time. The session paper summarized the quantifiable results of the team-taught section. In addition, these reflections, the personal observations of a technical instructor of a Team 112 teaching-team, can provide some qualitative assessment as well.

The first and the most important task for a technical faculty member team-teaching Team 112 was to overcome the traditional mentality of content-based teaching and to focus more on the non-content learning aspects. Indeed, this shift has been the source of much of the resistance to change from technical faculty. In the beginning of the semester, many Team 112 students commented that not only would the course be a "fun course" for them, but that it would also provide them an opportunity to observe the interactions and varied responses of technical and General Education faculty in problem-solving situations. In addition, students in non-team-taught sections voiced regret at having missed the opportunity. What these comments indicated is that the mentoring aspect of learning is inherently built into the course, and that it was the first outcome students expected to observe. Certainly, mentoring is one of the most effective learning techniques of all. Without its team-teaching component, Team 112 could eventually answer some of the concerns of our graduates' potential employers but surely would not deliver the unique impact of this mentoring process. The learning environment that the team-taught course provides to its students simulates the true problem-solving environment in industry today. Not only does the course enhance problem-solving skills, it also provides students with the opportunity to develop an ability to recognize alternatives from other perspectives.

Numerous comments from students at the end of the semester attested to the merits of Team 112. Besides the general responses about the benefits of the problem-solving techniques, critical thinking aspects, and teambuilding focus of the course, some of the most interesting comments centered on the team-teaching aspect of the course. This unique teaching format provided students in technical programs with new perspectives on learning and thinking through the modeling of such behavior by both faculty members. With its focus on the processes of learning rather than just immediate observable results, the problem-solving interdisciplinary Team 112 course can facilitate varied opportunities for technical students to develop into the thinkers so needed by industry today, which is, to be sure, an investment well worthwhile.

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Barbara M. I. Goldberg is a Full Professor in General Education at DeVry Institute in North Brunswick, New Jersey. In addition to teaching developmental reading and writing, composition, and college success classes, she was one of the coordinators of the Team problem-solving curriculum and has been involved

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