2006-483: MEASURING ENGINEERING CLASSROOM COMMUNITY: LEARNING AND CONNECTEDNESS OF STUDENTS

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Abstract

The Collaborative Learner-constructed Engineering-concept Articulation and Representation (CLEAR) model was used to explore how the introduction of visually represented materials and the use of blended instruction (i.e., online class sessions, group concept visualization projects, threaded discussions, etc.) impact the sense of community students experience with their peers in the classroom in comparison to a more traditionally taught class. Results reveal that implementation of some of these concepts can result in better retention in a sophomore level chemical engineering course, with student work and course satisfaction at or above the level of those completing a traditional version of the course. The use of online course work was also found to effectively replace some classroom experiences in the blended delivery section. However, an implication of this blended delivery was increased time requirements reported by both faculty and students.

Introduction

Fewer than 50% of students pursuing engineering degrees actually complete them[1]. Retention and success of engineering students hinge heavily on their academic performance in "gateway" classes, and all too often these classes are places where students drop out of the engineering pipeline. To solve engineering student learning problems leading to them dropping out of these gateway courses will require adoption of proven educational practices[2]. Major investments by the National Science Foundation, US Department of Education, and other agencies have been directed at understanding the issues and identifying solutions to student learning. For many, based on the research, students learn best when they set goals for their study, engage in active study, add meaning to what they are learning, explain their understanding to others, and self-monitor their success in achieving goals[3-6].

Accepting the challenge to address and understand retention issues of engineering students, the Collaborative Learner-constructed Engineering-concept Articulation and Representation (CLEAR) project has as its goal to develop a model for instructional implementation with core "gateway" engineering classes to significantly improve learning, social development, and sense of community in the classroom for engineering students. Outcomes of the model would be to increase retention of engineering students beyond the core classes through instructional methods using collaboratively developed, learner-constructed visual representations of engineering concepts, with each improving student satisfaction in engineering courses[7-9]. Steps in this instructional process include the learner-constructed visual representation of course material, presentation of their visualized concepts for peer feedback and discussion, receipt of expert critique to strengthen their understanding and correct misconceptions, and then solidify their understanding through reflective writing. In this paper, we will share with you the pilot study outcomes regarding student learning, retention, and satisfaction based on the implementation of the Collaborative Learner-constructed Engineering-concept Articulation and Representation

(CLEAR) instructional model. The study compared students from two sections (blended vs. traditional instruction) taking a sophomore level chemical engineering course.

Theoretical Framework

Social constructivists view learning as being a product developed from individuals interacting with each other and the environment[10-12]. One form of this social constructivists approach to learning is through collaborative learning that requires learners to develop teamwork skills and to see individual learning as essentially related to the success of group learning[13-16]. Kaufman, Felder, & Fuller[14] defined this type of instructional paradigm as one in which teams of students work on structured tasks that meet five criteria: "positive interdependence, individual accountability, face-to face interaction, appropriate use of collaborative skills, and regular self-assessment of team functioning" (p.133). There have been numerous research studies in higher education[15, 16] and with other student populations documenting the benefits of collaborative learning to developing a sense of a learning community[17-19], academic achievement [20], and student retention[21]. According to Tinto[22], the classroom may be the only place where staff and students actually meet, therefore, if social and academic integration or involvement is to occur, it must occur in the classroom, and the outcomes will have an effect on retention.

Forming a sense of community, where people feel they will be treated sympathetically by their fellows, seems to be a necessary first step for collaborative learning. Wegerif[23] found that without a feeling of community, people are on their own, likely to be anxious, defensive and unwilling to take the risks involved in learning (p. 48). However, according to Bess, Fisher, Sonn, and Bishop[24] those researchers in the field of sense of community have found the construct "elusive and frustrating" (p. 8). Astin [25] shares "the problems being studied are highly diverse but also that investigators who claim to be studying the same problem frequently do not look at the same variable or employ the same methodologies" (p. 297). Chipuer and Pretty [26] concluded that central to this disagreement is about whether sense of community is a cognition, a behavior, an individual affective state, an environmental condition, or a spiritual dimension, and Osterman[27] found that the subject of sense of community is often differently labeled as "belongingness", "relatedness", "support", "acceptance", or "membership" (p. 326). But according to Rovai [28], understanding a sense of community in the classroom is represented by two elements. The first is connectedness which encompasses students' feelings of communality, cohesion, trust, and interdependence with others in the class. The second element is learning representing the students' feelings regarding shared values and beliefs that the educational goals and expectations of the course are being met. But for several researchers, there is still a need to explore the construct of sense of community in more contexts and settings to more fully understand its implications to student learning, satisfaction, and retention[29-30].

Blended Learning

As engineering programs continue to recognize the need for their students to be more closely aligned with the essential professional learning outcomes necessary for the world of work in the 21st century, a further increase in the use of online resources for fostering collaborative learning situations will be used[31-32]. One context using online supplemented material for learning is known as blended instruction[33]. It is a mix of traditional face-to-face and online learning by

which instruction occurs both in the classroom and online. In this blended instructional environment, the online component becomes a natural extension of traditional classroom learning and instruction. Blended learning and instructional communities have basically two assumptions. First, deep personal relationship between learners creates richer collaborative learning experiences and second, relationships between learners can be strengthened through structured group interactions that employ technology before and/or after face-to-face learning. For many, blended instruction provides a novel approach for course design, providing flexibility in teaching and learning while still affording the opportunity and benefits of face-to-face contact. Research regarding blended instruction has also suggested benefits that include increased student access to course supporting material, student engagement, and more efficient use of class time[34]. By using blending instruction, instructors are providing an alternative to their teaching style that provides the opportunity for students to experience and learn course material in different ways.

For the field of engineering education, there has not been an embracement in the use of online education. Following an extensive review of engineering online programs, Bourne, Harris, & Mayadas[31-32] found that a large number of them were available for master's level, but there were few bachelor's degrees. A reason often noted to not developing engineering courses online is the challenge of replicating hands-on laboratories over the internet, even though a great deal of module development has been done in this area[31-32]. For these same engineering education researchers, they recommend that field of engineering learn more about methods for blended learning (in-class and online), different pedagogies for teaching and learning in online engineering education, and assessment methodologies[31-32]. For some engineering programs, a blended instructional environment could provide the initial step towards the development of an online learning experience for students and faculty[31-32]. However, additional research into the blended learning environment for engineering students' learning, satisfaction, and retention is needed to assist these programs in using the technology wisely[31-32].

Purpose

The purpose of the present study was to compare blended instruction to a traditionally taught sophomore level chemical engineering material and energy balances course (a traditional introductory course in the chemical engineering curriculum). Specific research questions to this study were:

1). How does the use of blended instruction impact student learning when compared to those in a traditionally taught course?

2). Does the use of blended instruction yield a greater retention rate compared to a more traditionally taught course?

3). Would student satisfaction in the blended instruction course be greater when compared to that of those taking the traditional course?

Study Context

A quasi-experimental research design was used in the present study by using two sections of a sophomore level material and energy balances course (ChE 201) taught during the fall 2005 semester. The course was titled "Chemical Process Principles and Calculations" and can be considered the traditional introductory course in the chemical engineering curriculum. The same

faculty person, with over 30 years of experience in the field of chemical engineering education, taught both courses. Each section had a graduate teaching assistant providing homework grading support for the course. Both sections covered the fundamental concepts of chemical engineering; problem solving techniques and applications in stoichiometry, material and energy balances, properties of materials, and phase equilibria. Course objectives included: 1) students develop a fundamental understanding of the basic principles of chemical engineering processes and calculations; 2) students can examine and select pertinent data, and solve material and energy balance problems; 3) students can select and/or evaluate problem solution methods, for example, between analytic and numerical solution techniques; 4) students can give examples of important applications of material and energy balances in chemical engineering processes; and 5) students can evaluate their own solutions and those of others to find and correct errors. The traditional section met MWF at 2 pm, with the experimental section MWF at 3 pm in the same classroom. Identical exams were given.

For the traditionally instructed course (control group), several of the course tasks already involved some elements of the CLEAR methodology and were maintained as elements for both sections. For example, small group discussions were already a part of the curriculum to stimulate learning through independent thinking, communication with peers, and interaction with the instructor. Voluntary peer tutorials were held each week by outstanding juniors in chemical engineering who took the course the previous year. Also, short writing assignments were used to provide the instructor with background information about each student, provide midterm feedback to the instructor, and to stimulate student thinking about certain tangential aspects of the course; like careers, history and famous women in engineering.

For the blended instruction course (experimental group), new elements included the following: 1) course was set up under university-licensed software as a web-based course using WebCT (even though it was delivered in mixed mode); 2) formal groups were assigned (three students each) and each group prepared three short projects (PowerPoint visualizations of key course concepts); 3) students were required to post on-line writing assignments and some homework (including individual critiques of all group postings for one of the PowerPoint projects); 4) six on-line interactive sessions replaced normal classroom meetings (each focused on one or more artifacts, such as homework problems, example problems, or project submissions); and 5) the instructor was available for a few Sunday night chats, usually attracting (20-30)% of the class, and these focused on homework due the next day.

Participants

A total of 66 students initially enrolled in the ChE 201 course; 42 signed up for the traditional section and 24 students signed up for the blended instruction section. However, attrition (i.e., dropping out because of lack of prerequisites or background for the course) prior to the first exam reduced the participants for the traditional course (n =36) and the blended instruction course (n =21). It is important to note that students were not aware of which course was going to be the traditional or blended instruction section when they signed-up, and this information was only known by the faculty member teaching the course.

For those students participating in this study, they were all either chemical engineering (60%) or bioengineering students (40%). More females were a part of the traditional section (27% females) than were represented in the experimental section (17% females). However, average college GPA's for the students starting each section were found to be identical (3.1 GPA) and a pretest on applications of basic chemical and physical sciences resulted in nearly identical scores for the traditional section (68%) and blended instruction section (67%). Based on these results, the faculty of the course concluded that the two groups were fairly similar regarding entry level knowledge and problem solving ability, but that demographically the traditional section of the course did have more females than the blended instruction course and that interpretation of any results regarding this demographic variable would need to be acknowledged.

Instrumentation

The Classroom Community Scale[28] is a survey instrument developed to measure a sense of community in the classroom and is included in the Appendix. The instrument consists of 20 items (half reverse scored) with ratings on a 5-point Likert scale with responses: strongly agree, agree, neutral, disagree, and strongly disagree. The scale is composed of two sub scales, connectedness and learning. The first sub scale connectedness represents the feelings of student's cohesion, community spirit, trust, and interdependence in the classroom. Some of these questions were "*I feel that students in this course care about each other*", "*I feel connected to others in this course*", "*I do not feel a spirit of community*", "*I trust others in this course*" and "*I feel confident that others will support me*". The second subscale is learning which represents the feelings of students regarding the degree to which they share educational goals and experience educational benefits by interacting with peers in the class. It includes questions like "*I feel that I am encouraged to ask questions*", "*I feel that it is hard to get help when I have a question*", "*I feel uneasy exposing gaps in my understanding*", "*I feel that other students do not help me learn*", and "*I feel that this course does not promote a desire to learn*". Each subscale score ranges from 0 to 40, with higher scores reflecting a stronger sense of classroom community. A Total Classroom Community score is derived by the sum of the two subscales and ranges from 0 to 80 with higher scores representing a greater sense of community in the classroom. Validation of the Classroom Community Scale was done using a study of 314 graduate student on-line distance learners encompassing 28 courses. Factor analysis confirmed that the two subscales of connectedness and learning were latent dimensions of the classroom community construct. Cronbach coefficient alpha's for the total Classroom Community Scale in the present study were .93 and internal consistency estimates for the connectedness and learning subscales were .92 and .87, respectively. In the present study, Cronbach's coefficient alpha for the full classroom community scale, the connectedness, and learning subscales ranged from .88 - .89, .86 - .87, and .85 - .86, respectively.

Data Analysis

A mixed method approach to data analysis and collection was used in the present study. Both quantitative and qualitative measures were used to understand student learning, retention, and satisfaction between the traditional and blended classroom experiences. Quantitative analysis included the use of the Classroom Community Scale and subscale scores comparing beginning to end of term, exam scores, final grades, and consisted of simple descriptive statistical analysis using any currently available statistical packages. Qualitative analysis used data sources which included comments on observations, student online discussions, and faculty reflections.

Results

Student Learning

During week five of the term an initial administration of the Classroom Community Scale was administered to the students in both sections of ChE 201. The purpose was to develop a baseline for the students in each one of the courses and see whether there was a difference between the sections relating to a sense of community in the classroom. An independent t-test was used to compare the two sections regarding their total Classroom Community Scale score, connectedness, and learning subscale scores.

Initial term results for the blended and traditional sections are provided in Table 1. No statistically significant differences between the two sections were found for the two sections of the ChE 201 class regarding total Classroom Community Scale, traditional (M =48.83, SD = 9.03) and blended (M =50.52, SD = 14.18) with equal variances not being assumed t(29.65) = -.491, *p* =.627. A similar no statistically significant difference was found regarding connectedness of traditional (M =22.69, SD = 5.62) and blended (M = 24.10, SD = 7.88) sections with equal variances assumed t(55) = -.781, *p* =.438. Finally, learning was also not found to be statistically significantly different between traditional (M = 26.14, SD = 5.91) and blended (M = 26.43, SD = 7.85) sections with equal variances assumed t(55) = -.158, *p* =.875.

TABLE 1
Initial Results for Classroom Community Scale Mean, Standard Deviation, and Standard Error for Blended and Traditional Sections.

	ChE 201 Section						
	Traditional (n = 36)			Blended (n =2 1)			
Scale	M	SD	SEM	M	SD	SEM	*p*
Total Classroom Community	48.83	9.03	1.51	50.52	14.18	3.09	NS
Connectedness	22.69	5.62	.94	24.10	7.88	1.72	NS
Learning	26.14	5.91	.99	26.43	7.85	1.71	NS

End of term measures regarding sense of community in the classroom were done during the 15th week of the term. Administration of the Classroom Community Scale instrument at this time was to both sections of the ChE 201 course, and completion of the instrument was requested by the faculty, but it was still voluntary. The purpose of this administration was to assess changes in the student's sense of community in the classroom after experiencing the courses for the majority of the term.

Results of the end of term data are shown in Table 2 and were compared using an independent t-test regarding their total Classroom Community Scale score, connectedness, and learning subscale scores. Results reveal that for the two sections of the ChE 201 course regarding total Classroom Community Scale, there was not a significant difference between traditional (M =51.91, SD = 11.57) and blended (M =44.19, SD = 14.66) with equal variances being assumed t(32) =1.671, *p* =.104. The same result of no statistically significant difference was also found

regarding the connectedness scores of traditional (M =23.09, SD = 7.15) and blended (M = 21.36, SD = 6.00) sections with equal variances assumed t(32) = .690, *p* =.495. However, for learning there was a statistically significant finding with traditional (M = 28.83, SD = 6.41) reporting a greater sense of community with regard to learning than those students in the blended course (M = 22.82, SD = 9.27) with equal variances assumed t(32) = 2.21, *p* =.035, *d* =.75 resulting in a medium effect size.

TABLE 2
End of Term Results for Classroom Community Scale Mean, Standard Deviation, and Standard Error for Blended and Traditional Sections.

	ChE 201 Section						
	Traditional (n = 23)			Blended (n = 11)			
Scale	M	SD	SEM	M	SD	SEM	*p*
Total Classroom Community	51.91	11.57	2.41	44.19	14.66	4.42	NS
Connectedness	23.09	7.15	1.49	21.36	6.00	1.81	NS
Learning	28.83	6.41	1.34	22.82	9.27	2.80	.035

Projects to measure learning and the ability to apply principles of chemistry were identified for the groups. The groups were asked to illustrate several course concepts in PowerPoint slides, starting with simple ones like material balances for filling their automobile gas tank at a service station and then burning the same number of gallons while driving at a steady 60 mph. The second project involved web-based research and construction of a process flowchart for the production of ammonia from natural gas and atmospheric nitrogen. For the third project, they were to illustrate more difficult course concepts such as steady-state and batch material balances for reacting systems and the steady-state energy balance. These projects for the blended instruction section of the course resulted in large differences in the quality of group submissions, from fairly mundane to quite innovative.

For example, some groups did all of the visualization presentation of the material and balance concepts using only words and equations. Other groups used pictures and drawings from other sources, as well as drawings combined with animation, in very effective ways, if not always completely accurate. As one particular example, a group of students developed a character called Mr. H-hat, sweeping into a system and changing colors as energy is transferred as heat, and then exiting out the other side. For one project, each student was asked to post a written critique of all six group submissions. Later, the instructor's critique was posted for all to read. For another project, the student submissions were used as the topic of an online interactive critique. Although the students were not independently tested on their ability to provide visualizations of concepts, these experiences provided some higher-level thinking exercises for them, and it would be easy to imagine that it gave them a better understanding of these concepts, as indicated by higher test scores and positive responses to the course.

Based on three one hour course exams, students in the blended instruction class section scored higher than their counterparts on two of them, although the differences in mean scores on individual exams were never larger than statistically combined uncertainties in these mean

scores. Mean scores on the final exam were (74±2) % for the traditional section and (77±3) % for the blended section, where the uncertainties are the standard errors in the means. Final grades in the class yield the following mean section GPAs: 2.5 ± 0.2 for the traditional section and 2.7 ± 0.2 for the blended section, both well below average college GPAs for these students, but in line with previous ChE201 classes. The previous year, for 55 students completing the course in the two traditionally taught sections, the average GPA was 2.2, the lower value being due to larger numbers of D's and F's, because fewer students withdrew from the course late in the semester than was the case this year.

Student Retention

The instructor was careful to operate the classroom activities for the two sections as close to the same as possible, even though the numbers were smaller in the blended course section, theoretically making it more conducive to interactive methods. In fact, it was just as difficult to illicit classroom responses from the students in the blended section as it was for the traditional section students. There were far more on-task interactions between the students and the instructor for the blended instruction course through online interactive sessions, compared with the traditional classroom situation. In a typical 50-minute online session, there would be on the order of 100 on-task student entries and nearly that many instructor comments (mostly interactive in nature). This compares with an estimate of 10 on-task student comments/questions in a standard 50-minute lecture session of this course, even though small group discussions were used during most of the lecture periods. There were no appreciable differences in interaction rates in the classroom setting for these two sections, in spite of the 2:1 ratio in numbers of students.

The retention rate was significantly higher in the blended section. Of the 18 students that took the first exam, 17 completed the course, with 16 achieving a grade of C- or better (89%). Of the 37 students in the traditional section at the first exam, only 28 completed the course, with 26 receiving grades of C- or better (70%). All but two of the students withdrawing from the traditionally taught section after the first exam did so because they were failing the course. Also, of the original students signing up for the course, the traditional section had 35% bioengineers and the blended section 46%, for an overall average of 40%. Of those completing the course with a C- or better, the corresponding percentages were 27% for the traditional section, 50% for the blended section, and 36% overall. Thus, there was a somewhat better success rate for the bioengineers with the blended instruction section.

Student Satisfaction

Results of the course evaluations were nearly similar for the traditional (4.54 out of 5.0) compared to the blended course (4.49 out of 5.0). However, review of the student written comments regarding suggestions for improving the course and opinion regarding the overall quality of instruction did provide some different insight.

Traditional course students for the most part thought the course was well taught and recommendations were few. As shared by one student, *"I thoroughly enjoyed taking this course. It is definitely a lot of work, but the professor made it fun and I feel like I have learnt the*

material presented. If not for his retirement, I would have no qualms about recommending him to future students. I liked (perhaps not quite enjoyed) that he had homework every class period because it kept me on top of things. I thought the professor was a great help during his office hours." Another student provided this insight following completion of the traditional course, "*Instructor was great. He has a great teaching style. Didn't know it at first, but he helped me think more like an engineer! One, if not the best instructors I've had!*"

Blended instruction course students perceived some loss in the class using the online course materials. For one student, the "*WebCT waste of time; non-productive for me*" and another shared "*Don't try to make it an online course. It was a waste of a class period and I would have preferred to meet in class*." For many of these students they felt there was a real loss in their learning as they didn't meet in the traditional classroom setting. They still felt connected with the instructor because of prior meetings in class and during office hours, but for those students residentially located on the university campus, they do perceive the loss of face-to-face interaction with the faculty member as impacting their learning. This was highlighted by the comments of these three students, "*I thought that online class was difficult. I liked to be able to talk & have the instructor draw out problems & show how to use the chart. I thought reading class discussions was more difficult based on the level of difficulty of the material*"; "*The online was a novel idea but was not effectively incorporated into the course felt more like a wasted day than a class*"; and "*I do not think web-based lecture was successful. It took longer time to communicate w/ classmates and instructor.*"

Conclusions

The purpose of the present study was to compare blended instruction to a traditionally taught sophomore level chemical engineering material and energy balances course (a traditional introductory course in the chemical engineering curriculum). Both quantitative and qualitative measures were used to understand student learning, retention, and satisfaction between the traditional and blended instruction classroom experiences. Generally, results showed that the students in the blended instruction section performed as well as or better than the students in the traditional section and displayed a better retention rate when compared to that of the traditional course.

Learning as measured on the Classroom Community Scale at the end of the course was rated in the traditional section higher than that of the blended instruction students. This finding is different from prior blended instruction research[36], but this research was done with full-time working graduate students, whereas the present study was conducted with residentially situated undergraduate students at a research university. In addition, two other reasons for the difference may also be intervening. First, the completion of the instrument at the end of course survey was requested of students, but was not mandatory. Therefore, students completing the survey may have had a more personal concern or issue they wished to share in completing the instrument. Second, extremes scores could also easily have impacted the overall scores given the small sample size. However, qualitative feedback from the end of course evaluations did reveal that several of these blended instruction course students felt that they did not have a positive learning experience with course. In fact, similar to other findings, many prefer the face-to-face interactions over that of blended instruction when they are possible[34-35]. Future research in

engineering education could benefit from further exploration of the differences of residentially placed undergraduate students at a research university versus those off-campuses and how they potentially differ regarding their sense of learning and connectedness.

Retention in the blended instruction course was better then the traditional course. While a smaller starting class size could have had an effect on this, the present tool collecting information regarding a sense of classroom community did not reveal any differences. The students did report a greater sense of connectedness to their peers or the classroom experience. Results of the course evaluation also did not reveal any differences regarding the students experiencing a greater sense of individualized learning. However, the finding in the present study regarding retention is an interesting one since much of the research regarding distance learning has actually found it in distance learning courses a challenge[33-36]. A factor that may need to be more fully explored could be around the issue of the student's major. For example, in the present study, results indicate that bioengineering majors may have higher success rates in the blended instructional course format in comparison to those in other majors.

Student satisfaction during blended instruction sessions revealed that they were comfortable with the mode of communication in the chat sessions, with many venturing observations they would never have the confidence to make in the classroom. However, there was a significant group of students (around one third) in the blended section that did not like the on-line sessions, believing they were poor substitutes for the classroom experience, and providing this feedback through course evaluations. Faculty reported that more class material was covered during a classroom lecture than during the online sessions, in a ratio of 2:1. For example, two rather involved example problems could be worked through in class, whereas, the same coverage could be given online to only one problem in a 50-minute session. It was found that the use of pre-prepared diagrams on an online white board helped with presentation, and could be used in an interactive way without significantly reducing the time required per topic. Time needs to be taken into consideration in the design of a completely web-based course with other means of presentation and illustration of course concepts, such as pictures, slides and video need to be developed and available to the students during online sessions[30-36].

The present study revealed the pilot study outcomes of the developing Collaborative Learner-constructed Engineering-concept Articulation and Representation (CLEAR) instructional model. What was found is that there are several issues related to support and training in blended environments, including the increased demand on student and faculty time and perceptions of those taking the blended courses when paying for perceived face-to-face courses. There is also a need to provide professional development for faculty who will be teaching blended instruction courses in the development and support in using these online materials. However, it is still essential that we continue to build, develop, and share our models of how to support a blended approach to learning from both the engineering education perspective, as well as from the technological perspective.

Acknowledgements

The National Science Foundation provided the funding for this work through a NSF Planning Grant EEC #0530708. We would also like to acknowledge the contributions of the other

researchers collaborating in the CLEAR project, specifically Denny Davis, Chris Hundhausen, Jerry Maring, Robert Olsen, Dave Pollock, and Richard Zollars for their guidance and contributions to this research.

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APPENDIX

Classroom Community Scale (CCS)*

DIRECTIONS: Below you will see a series of statements concerning a specific course or program you are presently taking or recently completed. Read each statement carefully and place an **X** in the box to the right of the statement that comes closest to indicate how you feel about the course or program. **There are no correct or incorrect responses.** If you neither agree nor disagree with a statement or are uncertain, place an X in the neutral (N) area. Do not spend too much time on any one statement, but give the response that seems to describe how you feel. *Please respond to all items.*

1 = Strongly Agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly Disagree

1. I feel that students in this course care about each other.	1	2	3	4	5
2. I feel that I am encouraged to ask questions.	1	2	3	4	5
3. I feel connected to others in this course.	1	2	3	4	5
4. I feel that it is hard to get help when I have a question.	1	2	3	4	5
5. I do not feel a spirit of community.	1	2	3	4	5
6. I feel that I receive timely feedback.	1	2	3	4	5
7. I feel that this course is like a family.	1	2	3	4	5
8. I feel uneasy exposing gaps in my understanding.	1	2	3	4	5
9. I feel isolated in this course.	1	2	3	4	5
10. I feel reluctant to speak openly.	1	2	3	4	5
11. I trust others in this course.	1	2	3	4	5
12. I feel that this course results in only modest learning.	1	2	3	4	5
13. I feel that I can rely on others in this course.	1	2	3	4	5
14. I feel that other students do not help me learn.	1	2	3	4	5
15. I feel that members of this course depend on me.	1	2	3	4	5
16. I feel that I am given ample opportunities to learn.	1	2	3	4	5
17. I feel uncertain about others in this course.	1	2	3	4	5
18. I feel that my educational needs are not being met.	1	2	3	4	5
19. I feel confident that others will support me.	1	2	3	4	5
20. I feel that this course does not promote a desire to learn.	1	2	3	4	5

* Rovai, A. (2002). Development of an instrument to measure classroom community. *The Internet and Higher Education, 5(3)*, 197-211.