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# Effects of Random and Delayed Participation Credit on Participation Levels in Large College Courses

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To the Graduate Council:

I am submitting herewith a dissertation written by Kathleen Briana Aspiranti entitled "Effects of Random and Delayed Participation Credit on Participation Levels in Large College Courses." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in School Psychology.

Robert L. Williams, Major Professor

We have read this dissertation and recommend its acceptance:

R. Steve McCallum, Christopher H. Skinner, David F. Cihak

Accepted for the Council:

Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Carolyn R. Hodges  
Vice Provost and Dean of the Graduate School

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Effects of Random and Delayed Participation Credit on Participation Levels  
in Large College Courses

A Dissertation  
Presented for the  
Doctor of Philosophy  
Degree  
The University of Tennessee, Knoxville

Kathleen Briana Aspiranti  
August 2011

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## Abstract

This study was directed toward improving the balance and consistency of student participation by thinning, randomizing, and delaying credit for student participation. Each of three sections of a large college course ( $n = 55$ ) employed a different contingency for choosing the days in which participation credit was awarded: (1) credit units identified ahead of time, (2) credit units announced at the end of the course, and (3) credit units randomly selected by students at the end of the course. For all contingencies, random selection of 2 out of 4 discussion days in each credit unit occurred at the conclusion of the course. The study compared the effects of the different credit contingencies on the percentage of students participating at selected levels across days and units. Students recorded their individual comments during class discussion. External raters recorded the number of timely and repetitious comments per student, the number of comprehension and factual questions posed by instructors, and the amount of positive and negative feedback provided to each student.

Results showed that when students knew which units would provide participation credit (Section A), the percentage of non-participants and dominant participants decreased, while the percentage of credit-level participants increased. These results are consistent with previous research (e.g., Krohn et al, 2010) reporting balanced participation when students know in advance the specific units when credit is available for participation. Conversely, when students did not know until the end of the semester which units would provide credit (Sections B and C), participation patterns remained relatively similar across units. The percentage of participants at different levels in Sections B and C fell between the percentages for credit and non-credit levels in Section A.



A 50-item survey also was given at the beginning of the course to assess student beliefs concerning class participation. The total survey scores significantly predicted student placement into low- or high-participation groups throughout the course. Logistic regression analyses showed that the primary factor, Personal History and Preference regarding Class Participation, better predicted membership in the low-participant group in non-credit units and membership in the high-participant group in credit units in Section A.

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## Chapter I

### Introduction and Literature Review

Lecturing has been the primary method of instruction in college classes since the 1840s (Garside, 1996). In fact, Wilhelm Wundt, regarded by many as the pioneer researcher in the scientific study of psychology, was known to lecture for a straight hour during his introductory psychology course in the 1880s (Benjamin, 1991; Garside). More recently, introductory psychology classes have often been targeted in research on class participation, perhaps because large classes tend to make lecturing a convenient way to convey information (Weaver & Qi, 2005). Research has shown that, in large classes, less than 5% of the class time involves any kind of student participation (Lewis & Woodward, 1984). Participation in large classes is rarely recorded. Some students prefer the anonymity available in large lecture classes, where the students' principal responsibility is to take notes. Although lecturing usually imparts more information and requires less student preparation than other forms of teaching, the former approach does not provide an opportunity for students actively to apply, evaluate, and expand the ideas addressed by the instructor (Benjamin).

Abundant research demonstrates the importance of active learning in which students participate and interact with the course material and instructor (Bligh, 2000; Boniecki & Moore, 2003; Dancer & Kamvonias, 2005; Weaver & Qi, 2005). Active participation could include group assignments, interactive demonstrations, and class discussions. Participation during class sessions has been found to help students better understand course content, increase retention of course materials, and perceive greater value of the subject (McKeachie, 2002; Reynolds & Nunn,



1997). In addition, participation in course discussions enhances the student's critical thinking and oral communication skills (Garside, 1996; Reynolds & Nunn).

### *Student Barriers Affecting Participation*

Although there are several advantages to participating during course discussions, some students rarely, if ever, participate. Researchers have found inconclusive results as to whether males or females participate more during discussions (Auster & MacRone, 1994; Howard & Henney, 1998; Howard, James, & Taylor, 2002). In addition, upperclassmen or nontraditional students are more likely to comment during discussion than first-year students, and older students are more likely to participate than younger students (Christensen, Curley, Marquez, & Menzel, 1995; Fritschner, 2000; Howard et al., 2002; Weaver & Qi, 2005). Students with higher grade point averages (GPA) also participate more often, as do students who are prepared for a specific day's topic of discussion (Christensen et al.; Fassinger, 1995). Some of the most cited reasons for not participating in class include lack of information or knowledge, incomplete ideas, and shyness or introversion (Connor-Greene, 2005; Howard et al., 2002; Mainkar, 2008; Renne, Kass, & Nay, 1973; Weaver & Qi).

McCleary, Foster, and Williams (2010) have suggested that cognitive variables may account for some differences in participation. Higher scores on a critical thinking test have been correlated with higher amounts of student participation, and some researchers believe that participation could increase critical thinking skills (Garside, 1996). In addition, Howard and Henney (1998) found that student perception of responsibility for discussion is a major contributing factor to class participation. Most class discussions were initiated by unsolicited student questions or comments, indicating that students take responsibility for class discussion.

However, it seems that only a few students may take responsibility for participating in larger classrooms, allowing reticent students simply to observe class discussion. Fassinger (1995) suggested that responsibility, confidence, and interest in class discussion are also important factors contributing to participation and may be influenced by the class atmosphere and teaching strategies.

#### *Course Variables Affecting Student Participation*

There are numerous barriers to creating a classroom culture conducive to discussion, one of them being a large class size. Students are more likely to participate actively in smaller class settings and when sitting close to the instructor (Christensen, Curley, Marquez, & Menzel, 1995; Fassinger, 1995; Montello, 1988). The optimal classroom setup to facilitate class participation is to have students seated in a circular or semi-circular arrangement so students can face each other during discussion (Marx, Fuhrer, & Hartig, 1999; Rosenfeld, Lambert, & Black, 1985). Having students all face the same direction in rows does not foster group participation and provides a less comfortable environment for discussion (Burgess & Kaya, 2007).

Auster and MacRone (1994) report that students are more likely to participate if the instructor addresses them by their first names, encourages them to volunteer comments, gives positive feedback for comments, and asks comprehension questions. A professor-led discussion format is one popular way to create an active learning environment in college courses. Typically, this format consists of the professor's posing questions about previously assigned course readings and then guiding the consequent discussions in order to keep the conversations related to the goals of the course (Steen, Bader, & Kubrin, 1999). However, a balance in discussion across students is difficult to achieve in large classes. One reason for the difficulty in facilitating

discussion in large classes is that many students choose not to participate, knowing that others will mask their silence by participating (Dallimore, Hertenstein, & Platt, 2004). The ideal scenario in a classroom would be to have everyone in the class participating, with no one remaining silent and no one dominating the discussion (Hodge & Nelson, 1991). In fact, having a few students dominate the discussion may discourage others from speaking even to fill awkward silences, knowing that more vocal students will eventually comment.

When attempting to promote discussion, some instructors use the “cold calling” method in which they call on students either systematically or randomly (Dallimore et al., 2002). In this case, students must have read the assignments in order to be prepared when they are called upon to answer a question. Cold calling also ensures that participation is balanced across students and does not allow students to remain disengaged from participation. Although Dallimore and colleagues reported that cold calling increased participation in graduate classes, cold calling does not allow students to volunteer comments when they feel they can best contribute. On the other hand, an open-discussion format allows students to raise their hands or call out comments, thus preventing the instructor from catching them off guard as might occur with cold calling (Bean & Peterson, 1998). The open-discussion format allows students to determine when and if they participate, with less fear of embarrassment about the accuracy or quality of their comments (Weaver & Qi, 2005). Students also may feel more confident about their comments and answers to instructor questions when they volunteer responses than when called on without warning.

Students report that they tend to participate more when asked more analytical than factual questions (Auster & MacRone, 1994). Bloom’s (1956) taxonomy of learning divides critical thinking or cognitive skills into six levels: knowledge, comprehension, application, analysis,

synthesis, and evaluation. Factual questions only tap into the lowest level skill of Bloom's taxonomy and focus on knowledge of places, events, dates, and major ideas. In contrast, only 18% of instructors ask questions that are above Bloom's lowest skill level (Barnes, 1983). Questions that are in the higher skill levels are more likely to foster discussion, but it may take more time for students to formulate answers that reach beyond simple facts.

### *Crediting Student Participation*

One of the ironies of class discussion is that students often think that they participate more than they actually do. For example, when students assess their own participation, they generally rate themselves as participating more frequently than the instructor rates them as participating (Burchfield & Sappington, 1999). In fact, two-thirds of individuals would rank themselves among the top third of participants (Burchfield & Sappington). One suggestion for tempering this misperception is to have students keep track of their comments in class discussions (Dancer & Kamvounias, 2005). This way, students are aware of their level of participation during discussion and can better gauge their participation in relation to other students. In reality, approximately only 12% of students regularly participate in class discussion, with these students typically perceiving participation as their responsibility rather than the instructor's (Howard et al., 2002; Karp & Yoels, 1976).

Although there is no one way to ensure that all students in the course will participate in discussion, some researchers have suggested awarding credit for commenting during discussions as a way to motivate more students to participate in the discussion. In college classes, instructors often have used credit to reward students for reading journal articles, attending class, and serving as research participants (Carkenord, 1994; Padilla-Walker, Zamboanga, Thompson, &

Schmersal, 2005). Many instructors also award credit for participation, but this credit usually is based on subjective recall of a student's overall participation rather than a precise record of the student's actual participation. Some researchers (Carter, 1977; Gilson, 1994; Jacobs & Chase, 1992; Lowman, 1995) warn against grading classroom participation because students who are shy or introverted may feel they are being punished for their lack of participation. Teachers also may assign participation grades retrospectively, subjectively assigning grades without having data to justify the participation grade. This method may penalize a shy non-participant even if he or she did participate once or twice because it is likely that the instructor does not remember those isolated instances.

Others view credit as a motivator to get more students to participate (Bean & Peterson, 1998; Boniecki & Moore, 2003). In addition, awarding credit for participation demonstrates to students that participation is an essential part of the class (Bean & Peterson). However, it is difficult to assign a grade for class participation when considering both quantity and quality of remarks. Some students may comment frequently but their comments may not enrich the class discussion, whereas other students may make only one comment but one that will elucidate a new line or depth of thinking. Trying to award points for both quantity and quality may become complicated for an instructor in a large class; therefore, it is suggested that participation research should focus initially on assessing quantity of participation (Foster et al., 2010). One suggestion is to have students rate themselves at the end of each class or immediately after a comment is made (Howard & Henney, 1998; Krohn et al., 2010). With this method, students are aware of the number of comments they have made and may help instructors objectively grade student participation.

Some students may remain silent during discussion even if they know their silence adversely affects their grade (Mainkar, 2008). Nonetheless, more students are likely to participate voluntarily when they know that participation will improve their grade (Fessinger, 1995). Boniecki and Moore (2003) increased student participation by using a token economy that awarded extra credit. Token economies offer various alternatives for the use of tokens (e.g., dropping a low grade or getting extra points on an exam). In Boniecki and Moore's study, a token was given to the first student to correctly answer each question and the tokens could be exchanged for an extra point on their next exam grade. This token economy increased participation in course discussion and decreased the amount of time until someone raised his or her hand after the instructor asked a question. On average, students took 6 s to respond to an instructor's question during baseline but only 1 s with the token economy. Even though the token system shortened response time, students tended to respond more impulsively, thus possibly giving lower quality comments.

Sommer and Sommer (2007) found that credit for participation given every other day enhanced both quantity and quality of participation on both credit and non-credit days, although participation on credit days did increase more. Students perceived that the credit contingencies increased participation and contributed to greater quality discussion, but they mentioned that some students may make comments with no substance simply to receive credit. The students who were most in favor of receiving credit for participation were those who were invested already in discussion, and the goal of offering credit for participation is to increase comments from low-participating students and decrease participation from the dominating students.

Hodge and Nelson (1991) found that participation by those who are usually silent during discussion increased if the instructor simply put a plus mark on the board by their names when they participated. Similarly, students who usually dominated the discussion talked less when they received pluses by their names for speaking less often. This contingency showed that some formal acknowledgement for talking more or less can alter the amount of class discussion, suggesting that this acknowledgement may serve as reinforcement for talking more or less in class discussion. However, some dominating students were upset that they did not receive marks for participation, even though they participated very often. Given that this was a small class with only 14 students, this simple differential attention may not work with a larger class because marking the board for 50 students or more would likely be labor intensive.

In spite of criticisms regarding crediting participation, many researchers encourage including participation within the formal grading system (Bean & Peterson, 1998; Dallimore, Hertenstein, & Platt, 2004; Janzow & Eison, 1990; Mainkar, 2007). Participation may be viewed as unimportant if it is not graded for credit. Although no studies compare the effects of awarding regular credit versus extra credit for participation, Bonecki and Moore (2003) found that a token economy awarding extra credit can increase participation in a large college class. However, extra credit may not be a large enough incentive for those disinclined to participate or those who already have high grades. Therefore, credit should be included in the regular grading scheme, but it is still unclear what percentage of the overall grade should be set aside for participation. Foster et al. (2009) awarded two points each day for participation in one semester and three points per day the subsequent semester, while Krohn et al. (2010) offered four points each day for participation. In both studies, the amount of credit available for participation was a small

percentage of the total available in the course, and students could still earn an A in the course without any participation credit.

### *Assessing Student Participation*

One of the impediments to research of class participation is finding a manageable, systematic way of assessing participation. In large classes, it is improbable that the instructor would be able to keep track of each student's comments while directing the class discussion, although this has sometimes been applied in smaller classes (Boniecki & Moore, 2003; Hodge & Nelson, 1991). A survey provided to students at the end of the course may seem to be the simplest method to grade participation, but this method may suffer from subjective ratings by instructor or students. Students tend to inflate their own participation levels and rate themselves as more invested in discussion than do their peers or instructors (Burchfield & Sappington, 1999; Howard et al., 2002). Peer rating of participation seems to have adequate validity and inter-rater reliability, but there are limitations associated with peer rating (Love, 1981; Mainkar, 2008; Melvin, 1988). Instead of receiving each peer rating, students may benefit more by receiving the median peer rating for them or their rank in the top 20% of participants. Asking students to rate their peers may cause animosity between classmates or may be too distracting to class discussion.

Another option for assessing student participation is to have independent observers record student comments. However, this arrangement is time consuming for the observers and possibly distracting for the students (Boniecki & Moore, 2003; Foster et al., 2009). Another option is to videotape the class discussion and then rate the tape at a later date, but this process would require synchronization across multiple video cameras. In either case, knowledge of the



students' names would be a must, which is difficult in large classrooms without visible name tags.

Perhaps the least restrictive way to keep track of student comments is to have students record their own comments during class. This way, students are less likely to forget their comments or report more comments than they actually made. In addition, students who record their own participation are more aware of their contribution to the discussion (Dancer & Kamvounias, 2005). A meta-analysis examining the reliability of overall student self-assessment found that students do not consistently overrate or underrate themselves, students in higher-level courses rate themselves more accurately, and poor students tend to overrate themselves while better students underrate themselves (Falchikov & Boud, 1989). Past research (Krohn et al., 2010) has shown that student records of their own comments strongly agree with external records of those comments. Mismatches between student and observer records typically resulted from students recording fewer comments than observers. Follow up research by Krohn and colleagues (2010) showed that student self-recording *per se* did not have a reactive effect on student participation, leading to more or fewer comments when students self-recorded than when they did not.

In order to take full advantage of discussion opportunities in class, students must come to class prepared for the discussion. Inasmuch as failure to read assignments is a strong predictor of not participating in discussions, extensive preparation for the class should contribute to an active and balanced discussion (Burchfield & Sappington, 1999; Fassinger, 1995). Not only should the students prepare by reading assigned texts, they should answer questions regarding what they have read prior to coming to class (Foster et al., 2009). Discussion should focus on subject

matter from the text that is most relevant to the students within the class (Benjamin, 1991).

Although students should be responsible for all reading assignments, discussion of the reading assignments gives students ample opportunity to clarify difficult points or elaborate on the more interesting or debatable issues in what they read.

### *Predicting Student Participation*

Krohn (2010) created a 50-item participation survey to examine student history, perception, and actions regarding participation. Some students do not participate in class discussion, even under ideal classroom settings. Identifying these students at the onset of the course may allow the instructor to encourage them to engage in class discussion in a private setting at the beginning of the course. Krohn examined the predictive potential of the survey on the low and high participant groups. Three factors were extracted by using principal components analyses: History and Confidence regarding Participation, Personal Benefits of Participation, and Expectation for Discussion in College Classes. Total survey scores and the combined factor scores significantly predicted placement in the low- and high-participation groups, as did the History and Confidence factor.

### *Randomization of Credit*

In previous studies on class participation, students were told in which units they could earn credit for participation (Krohn et al., 2010). However, some researchers suggest that randomizing contingency components may promote maintenance of the target behaviors even when the credit contingency is not in effect (Gresham & Gresham, 1982; Skinner & Watson, 1997). A study by Wilder, Flood, and Stromsnes (2001) found that the possibility of an extra-credit quiz increased student attendance. When students knew there would be at least one quiz

sometime during the week, they attended class throughout the entire week rather than only on quiz days.

If the criterion (e.g., behavior, participation, attendance) is randomly selected at the conclusion of a work period, then students cannot be sure while doing the work what criterion will be selected as the basis for the reward (Popkin & Skinner, 2003). Randomly selecting types of reinforcers has been shown to decrease inappropriate and disruptive behaviors in general education classrooms and with students diagnosed as emotionally disturbed (Kershaw-Levering, Sterling-Turner, Henry, & Skinner, 2000; Theodore, Bray, Kehle, & Jenson, 2001). Even if students behaved poorly for part of the day, they still had the opportunity to earn rewards if they behaved well during the randomly selected time.

The Timely Transitions Game (TTG) used an interdependent, group-oriented reward contingency with randomly selected criteria for the reward (Campbell & Skinner, 2004; Yarrough, Skinner, Lee, & Lemmons, 2004). In these studies, the TTG was implemented to decrease room-to-room transition time. At the end of the school day, the teacher randomly selected a transition and a criterion (seconds taken to transition). The students earned a reward if their transition time was less than the randomly selected time. Immediate and consistent decreases in transition time were found when TTG was implemented. Students moved quickly between rooms to earn a reward, even though they did not know the exact criterion for the reward.

Randomized and unknown credit has been applied to writing quizzes in an undergraduate human development course (Hautau et al., 2006; Krohn, Parker, Foster, Aspiranti, McCleary, & Williams, 2009; Turner, Bliss, Hautau, Carroll, Jaspers, & Williams, 2006). In the Krohn et al.

study (2009), students were given daily writing quizzes that covered the previous day's homework. In one section of the course, students were given credit for accuracy on each daily quiz. In the other two sections, students completed the daily quizzes but only received credit for one randomly selected day's quiz per unit. At the conclusion of each unit, a student randomly selected one of four folded cards, each of which represented one of the four quiz days for that unit. Students who received random credit for quizzes performed similarly on quizzes to those who received daily credit for quizzes.

### *Framework for the Current Study*

The current study is an extension of a series of studies on class participation conducted by a research team working with a large undergraduate course (Foster et al., 2009; Krohn et al., 2010). Those studies demonstrated that students can reliably record their own comments in class, that self-recording *per se* does not alter students' level of participation, and that a small amount of course credit for making up to two comments in class increases the percentage of initially low-verbal students who participate in class discussion. Although having students record their own participation requires minimal instructor time, considerable instructor time is required to record the number of comments reported by the students. Thus, the current study is directed toward reducing the amount of instructor recording time, while increasing student consistency in participating across days and units in the course.

The basic strategy for accomplishing the goals of the study was to randomize retroactively the selection of days when credit would be given for participation. The study compared the effects of three levels of randomized selection of days on the dependent variable, which was the percentage of students who participated at the below-contingency level (zero

comments), lower-contingency level (one comment), higher-contingency level (two comments), and beyond-contingency level (more than two comments) across all days and units in comparison to baseline and non-treatment phase. The principal comparisons were the inter-group effects of the three randomized contingencies on student participation and the intra-group comparisons between baseline phase(s) and all phases in which randomized contingencies were applied. The findings also were compared to those reported by Krohn et al. (2010) in which students knew precisely the days on which credit would be available for self-recorded participation. The purpose of this comparison was to determine if retroactive random selection of credit days would retain or dilute the treatment effect of credit on participation as reported by Krohn and colleagues. If the treatment effects are retained through the random selection contingencies, the practical benefits are that an instructor would need to record self-reported participation only on the randomly selected days.

Several research hypotheses were proposed for this study. The researcher hypothesized that students told at the beginning of the experimental portion of the course (Units 2-5) which two units would provide random credit for participation would be more likely to participate in those units than in the two units not targeted for participation credit. On the other hand, students told at the conclusion of the course which two units had been targeted for participation credit would be as likely to participate on non-treatment units and days as those selected for participation credit. Likewise, students who randomly select two units and then two days for participation credit within those two units at the conclusion of the course are likely to have an equivalent percentage of participation as students who participate at pre-defined credit levels across units in the experimental portion of the course. In addition, the researcher hypothesized

that the participation survey administered at the beginning of the course would predict student participation levels within the course. Students with a history of participation and positive attitudes toward participation were expected to participate more during course discussions under both credit and non-credit contingencies. When students have a history of participating in college courses, they are likely to participate regardless of the credit contingency.

## Chapter II

### Method

#### *Participants*

Students ( $N = 165$ ) enrolled in three large sections of an undergraduate human development course participated in this study. There were approximately 55 students enrolled in each section of the course ( $n = 54, 56,$  and  $55$  in Sections A, B, and C, respectively). Approximately 77.2% of the students were women, with most students academically classified as sophomores or juniors. Approximately 13.9% of the students were freshmen, 41.8% sophomores, 21.2% juniors, 7.3% seniors, and 1.8% graduate level. Student course enrollment averaged 15.3 credit units during the spring semester, and self-reported GPA ranged from 1.3 to 3.95 out of a 4.0 scale, with an average of 3.19. This course is a requirement for students entering the teacher education program at a large Southeastern state university.

At the conclusion of the course, as in the Krohn et al. study (2010), students were divided into low-, medium-, and high-participation groups based on their initial participation levels in the baseline phase (Unit 1). There were 44 low participants (0-2 comments per unit), 49 medium participants (3-7 comments per unit), and 63 high participants (8 or more comments per unit). Each day, students were also categorized into four participation levels: non-participants (0 comments per day), students partially meeting credit contingency (1-2 comments per day), students slightly exceeding credit contingency (3-4 comments per day), and students greatly exceeding credit contingency (5 or more comments per day). Daily grouping allowed for day-to-day fluctuation in student participation to compare students both within and between phases.

### *Course Structure*

The course was divided into five developmental units allocated approximately the same amount of time across units. Each unit consisted of seven or eight days, with Units 2, 4, and 5 having an extra day for review before the exam. This distinction in the length of days was based on past course records documenting the greater difficulty level of Units 2, 4, and 5 than Units 1 and 3. The first day the students were shown a video, and the second through fifth days of each unit were devoted to discussing materials presented in the course readings. The final two (or three) days of each unit consisted of a practice exam, feedback on the practice exam, review of assigned journal articles, and then a unit exam. The study focused on days 2-5 in which students recorded participation and discussed material in the Readings booklet for the course. Each student purchased a spiral-bound Readings booklet and a Study Guide booklet prior to the beginning of the course. The Readings booklet contained the instructor notes, which consisted of a 14- to 16-page written outline for each unit presenting concepts and information taken from journal articles, textbooks, and government agencies. Also located in the Readings booklet were five or six full-text journal articles per unit.

Researchers have found that assigned readings and study questions help prepare students for class discussion (Hautau et al., 2006). Prior to attending class, students were expected to read the instructor notes and articles assigned in the course syllabus for that particular day and to be prepared to discuss the assigned material in class. To assist in their understanding of the material, students were required to answer questions over the major topics presented in the instructor notes



and articles. The questions were included in the Study Guide and space was given for student responses in the Study Guide.

Each section of the course was taught by a graduate teaching associate (GTA) who had previously taught the class. The instructors attempted to create a discussion atmosphere by minimizing time devoted to lecturing. Questions posed by the instructors included both factual and comprehension questions. Factual questions were worded so that they could be answered by merely repeating a portion of the instructor notes. A question such as “What do you know about gender differences in exercise?” would be considered factual because all the information needed to answer the question could be found in the instructor notes or articles. Factual questions access knowledge, the lowest skill level of Bloom’s taxonomy (e.g., recall of information, knowledge of dates, events, and places, and knowledge of major ideas). Comprehension questions include questions requiring application, comparison, inferences, or interpretation not directly presented in the instructor notes. For example, “Besides what is listed in the notes, how could you incorporate fitness into your day?” would be a comprehension question, requiring students to think beyond the notes in order to answer the question. These types of questions potentially refer to all of the higher levels in Bloom’s taxonomy (i.e., comprehension, application, analysis, synthesis, and evaluation).

To minimize multiple students answering at once, students were required to raise their hands when they wanted to comment. The instructors first attempted to call on students who had not yet participated, thereby diminishing the likelihood that a few students would dominate the discussion. Because students in the back of the classroom sometimes had trouble hearing comments from soft-spoken classmates in the front, instructors frequently reiterated student

comments before continuing with the discussion. Given the large class size, student names were written on card-stock and displayed during discussion days to make it easier for the instructors to learn names.

### *Procedures*

*Participation assessment.* Students were instructed to record their comments each day on a 3 by 5 inch record card. Students purchased the record cards at the beginning of the course and the cards were used during days 2 through 5 of each unit. Given that class attendance is required to increase participation and create an optimal environment for discussion, students were awarded credit for attending class. In order to increase the likelihood that students would turn in the record cards, other credit-producing information was displayed on the card. Attendance was confirmed for the day by students writing their name, the date, and the unit at the top of the record card. The students then acknowledged whether they had their name card properly displayed, whether they had completed the assigned instructor notes questions, and whether they had completed the article questions for the day. One point was awarded for each of these class preparation activities for a total of 4 points per day (See Figure 1).

Any voluntary comments that the students made were written on the record cards during class. The students were instructed to write a sentence or phrase to indicate the main idea of the comment immediately after making it so they would not forget the comments they made. Spaces were provided on the front of the card for three comments. If students made more than three comments, they were asked to write the additional comments on the back of the card. In addition to reporting each comment, students rated their comment as either timely or repetitious. Timely comments were those that pertained to the topic at hand and did not repeat previously explained

remarks or earlier comments by students. Timely comments included responding to a teacher question, asking a voluntary question, or providing an additional perspective on issues under discussion. Responding in unison with other students did not count as a comment. If a student engaged in a brief interchange with the instructor or another student, they were instructed to count the interchange as only one comment.

In contrast to timely comments, repetitious comments were those already posed by another student. For example, if a student asked a question that was previously asked by someone else, the second student's comment would be rated as repetitious. Instructors cued students when their comments were repetitious by using statements such as "That's the same question John asked," "We have already discussed that point," or "I answered that question a few minutes ago." Students still received credit for making repetitious comments, but they were instructed to mark those comments as repetitious on the record card. The record cards were turned in at the back of the classroom by the door at the end of each class session in which participation was recorded (days 2-5 of each unit).

*Reliability of student recording.* To monitor whether students were accurately reporting their comments, a GTA from another class section observed the discussion during days 2 through 5 of each unit. This observer recorded when a student made a comment and whether it was timely or repetitious. In order to examine the reliability of the observing GTA, an additional GTA from a non-participating section observed during day 4 of each unit. The observers were given the same instructions as the students as to what constituted a timely or a repetitious comment.

Both GTAs sat in the front corner of the room so that all name cards were visible and they could easily hear the discussion. Before the discussion began, the observers made sure they could see all name cards and if a student did not have his or her name card, the instructor gave him or her paper to make a new one. However, the students could not earn a point for having their name card if they had to make a new one. The observers were able to identify each comment quickly and accurately, and names on the record forms were alphabetized by first names to make it easier to record comments. Inasmuch as the observing GTA was present during all discussion days and additional exam days, the students likely became acclimated to the presence of observers in the room.

Inter-rater reliability was calculated by first computing the percentage of agreement between each student's tally and the observers' tally for that student. Then those individual percentages were averaged across students in that section to obtain the composite inter-rater reliability for that section. Data from the observing GTA were compared with the student self-recordings and the records of the observer checking for reliability. (See Appendix C for a copy of the Student Record Form.)

*Instructor consistency.* Given that a different instructor taught each section, it was imperative that all three instructors conduct the discussion in similar ways. In order to prepare the instructors to teach this class, the instructors had previously sat in on the class three times. They also were supplied with comprehension questions they could use, participated in mock class sessions with the course supervisor, and received daily feedback during the first semester they taught the class. Instructors were taught to ask both factual and comprehension questions, to limit time lecturing, and to involve as many students as possible in the discussion. In addition,

the instructors attempted to give each student feedback as to the quality of his or her comment by statements such as “Yes, that’s right,” “That’s not entirely accurate,” or “Good, that is correct.” To verify that the discussion was managed similarly across instructors, an advanced doctoral student first recorded teacher questions and feedback and then gave each instructor daily input regarding needed changes in how he or she asked questions and gave feedback.

Instructor questions and feedback to student comments were recorded on all discussion days. The teacher observer recorded whether each instructor question was a factual or comprehension question. Questions unrelated to course content (such as general housekeeping questions) or that simply opened the floor for discussion (e.g., “Do you have any questions?” or “What else?”) were not recorded by the teacher observer. Instructor feedback for student comments also was recorded. If the instructor restated the student comment, elaborated on the comment, or affirmed the accuracy or value of the comment, then the feedback was considered positive. Negating the accuracy, value, or timeliness of the comment or ignoring the comment was considered negative feedback. Instructor feedback was recorded only when it was immediate and directed at a single student.

In order to assess the reliability of the teacher observer’s records of instructor questions and feedback, additional GTAs observed teacher behavior on day 4 of the unit. These GTAs sat in the front corner of the room opposite the GTAs who were recording student comments. From this viewpoint, the observers could see all student name cards and clearly hear the instructor and student discussion. Thus, on all discussion days (days 2 through 5 of each unit), one GTA recorded student comments and another recorded the teacher questions and feedback. On day 4 of each unit, there were four GTAs observing, two recording student comments and two

recording teacher questions and feedback. (See Appendix D for a copy of the Teacher Record Form.)

*Survey of Participation Perspectives.* A 50-question student participation survey adopted from Krohn et al. (2010) was posted on the course website. Students recorded their answers to the survey on a scan form that was turned in on the second day of class. Five points were awarded for completing and returning the scan form. An additional credit opportunity was provided for any student opting not to complete the survey, but all students completed the survey and signed consent for their answers to be used for research purposes.

The survey data were used to predict classroom participation and to examine why some students participated very little in class, irrespective of incentives provided for increased participation. Questions were designed to probe student history of participation, investment in discussion, comfort level in participation, perceived student and teacher roles and responsibility for discussion, and perceived impact of discussion on student understanding. Krohn (2010) completed a series of principal components analyses that resulted in three factors: Personal History and Confidence Regarding Participation, Expectation for Discussion in College Classes, and Personal Benefits of Participation. In the current study, the researcher completed principal components analyses as well to determine if the similar factors could be found with the current sample of students.

#### *Research Design and Credit Contingencies*

The order in which the different credit contingencies would be applied to the different sections of the course was randomly determined before the beginning of the course. Students in all sections were told to record their participation during the baseline unit but that no

participation contingencies would be applied during that unit. At the conclusion of the baseline unit, students were informed that some credit could subsequently be earned for participation in the discussion. At that point, the instructor explained the contingency that would be in effect in that section. In all sections, students were given credit for participation for two out of the four days in two of the five units in each section.

In Section A, students were informed at the beginning of Unit 2 that two days from Units 2 and 4 would count for credit but that those days would be randomly selected by students at the end of the semester. In Section B, students were informed that two days from each of two units announced at the conclusion of the course would be randomly selected for credit at that time. The researcher selected the same two units for credit as had been preannounced for Section A. In Section C, students were informed that two randomly selected days from two randomly selected units would be available for participation credit. Students did both random selections at the end of the course and selected Units 4 and 5. In all three sections, students did not know which days would count for participation credit until the end of the semester. Nonetheless, students in Section A had a more precise frame of reference as to when participation credit would be given than students in the other sections.

Students recorded their participation during each discussion day, including the baseline discussion days. On each selected day, 3 points were awarded for the first comment and 2 points for a second comment. Therefore, on each selected day 5 participation points could be earned, totaling 20 points for the 4 days. In addition, students could earn 5 points if at least 1 comment was made during each of the credited days and 10 points if at least 2 comments were made during each of those days. Thus, a total of 30 points were possible for participation credit.

## Chapter III

### Results

Large group comparisons between units and sections were the main analyses used to examine the treatment effect of credit versus no credit for participation. Additionally, small group and within-subject comparisons were used to evaluate the participation survey's prediction of low- and high-participating students. The results are organized in the following manner: (1) demographic and correlational descriptive data; (2) reliability of student self-recordings and inter-observer agreement on student comments; (3) reliability of inter-observer recording of instructional behaviors; (4) effects of treatment conditions on student participation levels; (5) analysis of low, medium, and high participants using visual representation and proportions tests; (6) effects of the treatment conditions on timeliness of student comments; (7) instructor behaviors and influences on participation levels; and (8) the predictive potential of the Participation Survey scores using factor analysis and logistic regression.

#### *Demographic Data and Correlations*

Correlations were used to determine the strength of the relationship between participation and gender, as well as between participation and academic classification. Mean participation level (average number of comments per day per student) across units was not significantly correlated with gender (.06), academic classification (-.05), or GPA (.01). A significant correlation was obtained between mean participation and mean exam performance ( $r = .23, p < .01$ ), suggesting that students who participate more in class discussions also perform better on exams. However, the magnitude of this correlation was small. Table 2 provides the mean daily participation levels and standard deviations based on student gender and classification. Although



the differences were not statistically significant, graduate students and freshmen participated at slightly higher levels than sophomores and juniors, and females at a somewhat higher level than males.

### *Reliability of Student Recordings*

To examine the accuracy in which students reported their daily participation, the primary GTA observer monitored class discussion every day students recorded participation. Percentage of agreement was used in comparing the number of comments recorded by the students and those observed by the primary observer. Percent agreement results are shown in Table 3. For Section A, the daily range of percent agreement between students and the primary observer was 66.42% (day 1 of Unit 1) to 98.19% (day 2 of Unit 3), with a mean 90.96% agreement. In Section B, percent agreement between students and the primary observer ranged from 66.42% on day 1 of Unit 1 to 99.11% on day 2 of both Units 3 and 5, with a mean of 93.52%. For Section C, the smallest percent agreement was 87.96% on day 1 of Unit 1 and the largest was 100% on day 4 of Unit 3, with a mean of 94.43%. The average agreement across all units and sections between students and the primary observer was 92.97%. In all three sections, the lowest percent agreement between students and the primary rater was on the first day of the first unit. With the percent agreement for day 1 of Unit 1 omitted, the lowest agreement between students and the primary observer was 79.33% for day 1 of Unit 5 in Section A. This pattern may have been due to the students' misunderstanding about the types of comments they were expected to record. An examination of individual student record cards revealed that many students did not accurately report their comments, which led to a lower percentage of agreement. Therefore, on each subsequent day, the instructors reiterated the requirements as to what types of comments were to

be recorded and which vocalizations did not count as comments. Clarifying the instructions for recording comments likely increased the student-observer agreement for the remainder of the semester.

On the second day of each unit, which was the inter-rater check day, a second observer recorded student comments. In some instances in Unit 1, three observers collected student participation data. Table 3 also shows that an increased number of observers in the classroom did not affect student-rater reliability during the inter-rater check day, which suggests that the students became habituated to the observers' presence. Table 4 provides the inter-rater percent agreement between all observer records of daily class participation. This agreement ranged from 94.55% to 99.69% across the three sections with a mean percent agreement of 97.22%. Inter-rater agreement was similar for each section regardless of unit or participation contingency.

#### *Under- and Over-Reporting of Comments*

*Under-reporting of comments.* To obtain a more in-depth view of student reliability, the researcher examined the extent to which students under- and over-reported their number of comments. Tables 5 and 6 show that the average number of comments reported by students was lower than the average number reported by the primary observer for each unit in each section. This difference may have been due in part to the availability of only three spaces for comments on the front of the record card. Even if students made more than three comments, they rarely turned the card over to report additional comments on the back. Therefore, students who made over three comments a day tended to report making only two or three comments. In contrast, the observer recorded all comments students made during each day. In addition, the standard

deviation of student number of comments was less than that reported by the primary observer, suggesting that the observer recorded a wider range of comments.

The amount by which students underreported daily comments was lowest in Section C, where the difference between student and primary observer records ranged from an average of .08 to .18 comments per day across units, with a mean difference of .14 comments.

Comparatively, the mean difference between student and primary observer records of under-reporting in Section B ranged from .18 and .37 comments per day, with a mean difference of .29 comments. The difference between student and primary observer records ranged from an average of .12 and .54 comments per day in Section A, with a mean difference of .29 comments.

Examining the amount of under- and over-reporting in Section A was particularly important, as it was the only section in which students knew the units when credit would be available for participation. Under- and over-reporting of participation was not affected by credit contingencies in Sections B and C, possibly because those students did not know which units received participation credit until the end of the semester.

The extent of each student's under- and over-reporting is presented in Appendix D. Student records were compared and listed as either less than, greater than, or matching the primary observer's records. A statistical procedure that tests two independent proportions was used to examine the significance of instances of under- or over-reporting in treatment versus non-treatment phases (see Ferguson & Takane, 1989, pp. 198-200). In Section A, where students knew beforehand when they would receive credit for participation, between 7% and 26% of students (mean of 17%) under-reported their participation each day, with more students under-reporting in non-treatment than treatment units. There were 93 cases of under-reporting in non-

treatment units (averaging 11.6 cases per day) and 52 cases in non-treatment units (averaging 6.5 cases per day). The proportion of under-reported comments in non-treatment units in Section A was significantly higher than in treatment units ( $p < .01$ ). Out of the 20 students who under-reported during treatment days, 8 students did not receive participation credit for which they had qualified according to observer records. The other 12 students who under-reported during treatment days did so beyond the credit contingency, guaranteeing they would still receive full participation credit.

In Section B, between 9% and 20% of students per day (mean of 13%) under-reported their participation, with 59 cases of under-reporting in treatment units (an average of 7.4 cases per day) and 57 cases in non-treatment units (an average of 7.1 cases per day). A significant difference was not found between cases of under-reporting in treatment and non-treatment units. In fact, under-reporting across units 2-5 in Section B was similar to the under-reporting found in treatment units in Section A. Twelve of the students in Section B who under-reported during treatment days did not receive appropriate credit because of their under-reporting of comments. The remaining 18 students in Section B who under-reported during treatment days did so in excess of the credit contingency, which permitted them to receive full participation credit.

The pattern of under-reporting in Section C was similar to that in Section B. Between 5% and 30% of students (mean of 12%) under-reported their comments each day. The treatment units had 62 cases of under-reporting (averaging 7.8 cases per day) and the non-treatment units had 51 cases of under-reporting (averaging 6.4 cases per day). A significant difference was not obtained between the cases of under-reporting in treatment and non-treatment units. Five cases of under-reporting during treatment days resulted in students' not receiving due credit for

comments actually made in class. The other 35 cases of under-reporting during treatment days occurred when students had already passed the credit contingency (i.e., made more than 2 comments).

Under-reporting comparisons within students across all sections revealed that 67 out of the 165 students under-reported their participation more than twice in the 16 recording days. Of these 60 students, 19 did not receive full participation credit (the number of comments they reported was under the credit contingency) and 4 did not receive full participation credit more than once. Thirteen students under-reported their participation 8 or more days out of the 16 possible recording days; these students were usually the ones who commented well above the contingency but only wrote down 2 or 3 of their comments.

*Over-reporting of comments.* Between 0% and 9% of students (mean of 4%) over-reported participation levels per day in Section A, with more students over-reporting in treatment units. There were 23 cases of over-reporting in treatment units (averaging 2.9 cases per day) and only 10 cases in non-treatment units (averaging 1.3 cases per day). The proportion of over-reported comments was significantly higher in treatment than non-treatment units for Section A ( $p < .05$ ). Four students who over-reported during treatment days received full participation credit when no credit should have been given, while three students received undeserved partial credit. The other three students who over-reported during treatment days did so above the credit level. No significant difference was found in Section A between the proportion of cases when students over-reported above contingency level and those when students over-reported to receive undue credit.

Between 0% and 5% of students (mean of 2%) over-reported participation levels each day in Section B. In treatment units there were 11 cases of over-reporting (an average of 1.4 cases per day) and 8 cases of over-reporting in non-treatment units (an average of 1 case per day). The difference between cases of under-reporting in treatment units and non-treatment units was not significant in Section B. During treatment days, none of the students who over-reported received full participation credit when no credit should have been given, and only 3 students received partial undeserved credit. Four students who over-reported did so in excess of the credit-contingency level.

In Section C, between 0% and 11% of students per day (mean of 4%) over-reported their participation. Seventeen cases of over-reporting occurred both in treatment and non-treatment units, averaging 2.1 cases per day. On treatment days, 1 student received full and 2 students received partial undeserved credit. The remaining 7 students that over-reported during treatment days did so beyond the credit-contingency level.

For the combined sections, within-student comparisons of over-reporting revealed that 36 out of the 165 students over-reported their participation once, 9 students over-reported on two days, 1 over-reported on three days, and 2 over-reported on four days. Of these students, 11 received participation credit when no credit should have been given (5 from Section A, 2 from Section B, and 4 from Section C), which suggests that most students did not over-report their comments deliberately to gain credit. However, only section A knew beforehand the units in which participation credit would be available, probably decreasing the tendency to deliberately over-report in Sections B and C.

### *Timely versus Repetitious Comments*

Agreement between students and observers as to the repetitious nature of students' comments was also assessed. Whenever students recorded a comment, they simultaneously marked whether the comment was repetitious or whether it was timely in nature. Observers also counted the number of repetitious and timely comments made by each student. Repetitious comments were classified as comments that failed to match the topic being discussed, questions or comments that had already been said by another student, or questions about material that had already been sufficiently covered. Clarification questions were not counted as repetitious, as some of the material was difficult for many students to grasp and needed additional explanation. Table 7 displays the percent agreement between student and the primary observer records of timely student comments in each unit. Percent agreement ranged from 79.61% to 98.50%, with the exception of day 1 of Unit 1 for Section A, which was 61.93%. Percent agreement between students and all observers of timely student comments on inter-rater check days, as shown in Table 8, ranged from 85.88% to 99.11%. Percent agreement between the different observers, as displayed in Table 9, ranged from 94.74% to 100%. Percent agreement for the reliability of repetitious comments was not calculated because of the infrequency of those comments. The maximum number of repetitious comments recorded in any unit by either students or observers was 9 comments.

Table 10 displays the percent agreement between student and observer records and the inter-rater agreement of repetitious comments. Students reported far more repetitious comments than the observers: students reported 70 repetitious comments and the observers reported only 19. In fact, the observers recorded only one repetitious comment during the entire course in

Section C. Due to the high consistency between the primary and secondary observers, student records were not compared to the secondary observer, as this would have not provided any additional information. The two observers consistently had 100% agreement, although most of the time they agreed that there were no repetitious comments. The observers disagreed on a repetitious comment in only one case. Unfortunately, the agreement between students and the observer was much lower than agreement between observers. Almost all cases of inconsistency resulted from students rating more comments as repetitious than the observer did. For instance, in Unit 3 of Section C, students rated 8 comments as repetitious, but the observers did not deem any of those comments as repetitious. Even though students were encouraged to ask questions as to the distinction between timely and repetitious comments, few actually did. Misunderstanding the definition of timely comments may have contributed to the students recording more repetitious comments. For instance, students may have recorded incorrect responses or clarifying questions as repetitious, although these were supposed to be categorized as timely comments.

#### *Reliability of Instructional Ratings*

To measure the consistency of teacher behaviors across sections, a GTA observed teacher questions and feedback to the class each day participation was recorded. During the inter-rater check day, an additional observer was present to record teacher behaviors. Inter-rater percent agreement for type of teacher questions is displayed in Table 11. Percentages were calculated for factual and comprehension questions, as well as for the total number of questions asked. Percent agreement ranged from 62.5% to 100% (mean of 88.62%) for factual questions, 60% to 93.75% (mean of 80.48%) for comprehension questions, and from 72.73% to 94.12% (mean of 83.77%)



for total number of questions per unit in the separate sections. Percentage agreement did not differ by type of question, unit, or contingency.

Inter-rater agreement for records of teacher feedback proved to be rather high. Table 12 shows the percent agreement between observers regarding the total number of times feedback was given to students in each unit. All of these percentages were between 89.67% and 100.00% (mean of 95.90%). Teacher feedback also was separated into positive and negative feedback. Given that the number of negative teacher comments was very small, percent agreement for separate types of feedback was combined from all five of the inter-rater days in each section. Average percentage agreement for negative feedback was 75% for Section A, 92% for Section B, and 83% for Section C. These percentages of agreement varied considerably, in part because the lower number of negative teacher comments caused small numbers of disagreements to disproportionately affect percent agreement. More instances of positive feedback in each section produced much higher percent agreement. The two raters obtained 99% agreement for positive feedback across all sections and units.

#### *Effects of Treatment Conditions on Student Participation Levels*

The main analyses centered on the effects of the different treatment conditions on the levels of student participation. The data were first examined through visual analysis of the treatment effects across phases for each section. Then, proportions tests were used to determine if the proportion of students participating at the different levels was significantly different between credit and non-credit units. Multiple analyses allowed participation levels to be examined for significance across phases and sections. In addition, participation levels during baseline were examined to determine if students began the course at comparable levels of

participation.

*Baseline comparisons across sections.* Baseline comparisons of participation ensured that students in all three sections began the course with a similar participation pattern. A one-way analysis of variance (ANOVA) yielded no significant differences between the mean baseline participation levels across the three sections in the first unit,  $F(2, 160) = 1.65, p = .195$ . The mean number of comments per student per day in Unit 1 was 1.88 in Section A, 1.49 in Section B, and 1.98 in Section C.

Previous research (e.g., Foster et al., 2008; Krohn et al., 2008; Krohn et al., 2009) has shown that baseline levels of participation are typically higher than participation in other course units. The difference might relate to the novelty of beginning a new class or the familiarity of the material for many students. The first unit explored health and fitness areas in which students had considerable interest and knowledge. The topics for the other four units examined areas that may not have been as well known to the students enrolled in this class.

In addition, exam performance across sections in Unit 1 was compared to evaluate any differences in psychoeducational knowledge or cognitive abilities between sections. A one-way ANOVA was conducted on Unit 1 exam scores to compare student abilities. There were no significant differences across sections  $F(2, 160) = 1.24, p = .291$ . In fact, exam averages across sections were very similar (Section A = 37.13, Section B = 38.42, Section C = 36.82), which indicates no probable effects from cognitive abilities or previous psychoeducational knowledge. Turner (2007) reported the internal consistency coefficients for the exams to be .796 for Unit 1, .810 for Unit 2, .825 for Unit 3, .693 for Unit 4, and .799 for Unit 5.

*Visual inspection of mean levels of participation.* The percentages of students participating at different levels are displayed in Figures 2 through 5. These graphs show the percentage of students participating at different levels each day: not participating (0 comments), partially meeting the credit contingency (1-2 comments), slightly exceeding the credit contingency (3-4 comments), and greatly exceeding the credit contingency (5 or more comments).

Visual inspection of Figures 2 through 5 reveals that in Section A (the section in which students knew beforehand when the participation contingencies would be applied), more students partially met or slightly exceeded the credit contingency in Units 2 and 4, the units when credit was awarded for participation. Although the mean number of comments per person decreased every unit in Section A, more students participated in the treatment than in the non-treatment units. In Section A, there were more non-participants in Units 3 and 5, the units when students knew no credit was available for participation.

Section A also produced a noticeable increase in the percent of students who made 1 or 2 comments in treatment units. Specifically, the average percentage of students making 1 or 2 comments in treatment units was 52%, while the average percentage in non-treatment units was 29%. The percentage of students slightly exceeding credit contingency (3 or 4 comments) was also higher in treatment units (average of 20%) than in non-treatment units (average of 14%). In contrast, there were fewer participants who greatly exceeded credit contingency in the treatment units than the non-treatment units. The average percentage of students making 5 or more comments in treatment units was 3%, whereas the average percentage in non-treatment units was 8%. By comparison, the average percentage of those making 5 or more comments in baseline

was 6%. The decrease in the percent of students dominating class discussion in treatment phases allowed participation to be more distributed across students, given that fewer students were commenting excessively.

Cross-unit comparisons for Sections B and C showed moderate evidence of treatment effects for the delayed and random-credit arrangement. The intent of this treatment arrangement was to stabilize participation at higher levels across units (fewer non-participants and more credit-level participants) than would have been the case without the credit contingency. As a basis of comparison for Sections B and C percentages, Section A had an average of 48% non-participants across the two non-credit phases and an average of 25% across the known credit phases. The two sections in which selection of credit units and days was made at the end of the semester yielded an average of 37% non-participants across combined credit and non-credit units in Section B and an average of 28% non-participants across these phases in Section C. Thus, Sections B and C both produced a percentage of non-participants between the credit and non-credit percentages of Section A. The Section B percentage was almost precisely mid-way between the credit and non-credit percentages of Section A, whereas the percentage of non-participants in Section C, Units 2 through 5, was very close to the percentage of non-participants in the credit phases of Section A.

As was the case for percentages of non-participants, percentages of credit-level participants in Sections B and C tended to be between the percentages of credit-level participants in non-credit and credit units of Section A. An average of 51% participated at the credit level in the known credit units of Section A, and an average of 29% participated at the credit level in the non-credit units. In Section B, an average of 35% participated at the credit level across Units 2–5

and an average of 44% participated at this level in Section C across Units 2-5. At the upper extreme of participation, the results for dominating participants were mixed. The average percentage of dominating participants was 3.5% in the credit units and 8% in the non-credit units in Section A. Compared to these percentages in Section A, Section B's (credit units announced and random selection of credit days at the end of the semester) percentage of dominating participants was at the non-credit level of Section A (approximately 9%), but Section C's (credit units and days within units selected at the end of semester) was at the credit level manifested in Section A (approximately 4%).

With respect to the stability of participation patterns across Units 2-5 of Sections B and C, the results for Section B showed an increase in the percentage of non-participating students throughout the semester, from 27% in Unit 1 to 47% in Unit 5. However, the percentage of non-participants remained relatively stable across Units 2 through 5 in Section C (see Figure 2). Although the percentage of credit-level participants in Sections B and C was moderately higher in Unit 2 than in Unit 5, the percentages of credit-level participants were similar in three of Units 2-5 in both sections (see Figure 3). The percent of students participating slightly above the credit contingency (3 or 4 comments) showed a declining trend across Units 2-5 in Section B, beginning at 20% in Unit 1 and ending at 9% in Unit 5, but a slight upward trend across these units in Section C (see Figure 4). The percent of dominating students in Section B slightly increased across Units 2-5, whereas the percentages of these students remained relatively stable across Unit 2-5 of Section C (see Figure 5). Overall, the trends and levels across Units 2-5 were more favorable for Section C than B, with Section C having fewer non-participants, more credit-level participants, more students participating slightly above credit level, and fewer dominating

participants. However, neither Sections B nor C showed the distinctions in participation patterns across units as were manifested between credit and non-credit units in Section A.

*Proportions tests.* Proportions tests were then used to determine any significant differences between treatment and non-treatment phases in the percentage of students at different participation levels. The proportions test is a statistical process that compares two independent proportions (see Ferguson & Takane, 1989, pp. 198-200). This procedure was performed on a TI-83 statistical calculator using the STATS function. For all levels of participation (0 comments through 5+ comments), participation in each section was compared between a particular unit and the following unit to determine whether there was a significant difference between treatment and non-treatment phases. In Section A, the proportion of students who did not participate (0 comments) was significantly less in treatment units than in the following non-treatment units. This pattern indicates that Unit 2 (known credit) had significantly fewer non-participants ( $z = 2.33, p < .01$ ) than did Unit 3 (no credit), and Unit 4 (known credit) had significantly fewer non-participants ( $z = 2.60, p < .01$ ) than Unit 5 (no credit). A significant increase resulted in the proportion of students who participated (1 or more comments) in the combined treatment phases than non-treatment phases. In Unit 2 (known credit), an average of 40 students participated each day, whereas that number decreased to an average of 28 per day ( $z = 2.33, p < .01$ ) in Unit 3 (no credit). Similarly, an average of 33 students per day participated in Unit 4 (known credit), while in Unit 5 (no credit) the average was 21 students per day ( $z = 2.18, p < .05$ ).

Treatment phases in Section A also had significantly more students making 1 or 2 comments than did non-treatment phases. Unit 2 (treatment) had an average of 28 students making 1 or 2 comments per day, whereas Unit 3 (non-treatment) had an average of only 16

students ( $z = 2.26, p = .05$ ). In addition, an average of 23 students per day made 1 or 2 comments in Unit 4 (treatment) compared to an average of 11 students per day in Unit 5 (non-treatment) ( $z = 2.51, p < .01$ ). Also, more students made exactly 2 comments per day in treatment than in non-treatment units ( $z = 2.03, p < .05$ ;  $z = 2.37, p < .01$ ). In Unit 2, an average of 16 students made 2 comments per day, while in Unit 3 the average was 7 students per day. Similarly, in Unit 4 an average of 13 students made 2 comments per day, but the average of students in Unit 5 was only 4 per day.

Even though visual inspection of Figure 5 suggests noteworthy differences between treatment and non-treatment phases in the percentage of students greatly exceeding the credit contingency (5 or more comments), proportions tests did not find statistically significant differences for Section A. Neither treatment phase had significantly fewer students at this participation level than the following non-treatment phase, although the difference between Units 4 and 5 neared significance ( $p = .08$ ). None of the other proportions of participation levels (e.g., 1 credit only, 3 or 4 credits) between the treatment and non-treatment phases in Section A yielded significant differences. As expected, no significant differences emerged between treatment and non-treatment phases in Sections B and C. Students in these sections did not know which units counted for credit until the end of the semester, making it impossible for them to judge which units would involve credit for participation. Therefore, participation percentages remained relatively stable across treatment units for these two sections.

#### *Intra-Subject Comparison of Participation across Units*

*Initially low and non-participating students.* Until this point all comparisons have been made between students across treatment and non-treatment phases. Within-subject comparisons

were also made to examine individual changes in participation across units. Students were categorized into low-, medium-, and high-participation groups based on their initial participation levels in the baseline phase (Unit 1). Then the same students were tracked across units to determine if they stayed at the same participation level or if their participation changed across treatment and non-treatment units. Of particular interest were students who began the class by participating infrequently or not at all. It is important to track these students to distinguish those who eventually began to participate at credit levels from those who remained in the low group. In addition, a smaller subgroup of low participants who did not comment at all (non-participants) during Unit 1 was tracked across units. Altogether, there were 44 low-participating students ( $ns = 12, 14, 18$  in Sections A, B, and C, respectively) which includes the non-participant subgroup (14 non-participants:  $ns = 6, 3, 5$  across sections).

The percent of initially low participants who fell into the low, medium, and high levels in subsequent units is visually displayed in Figure 6. This graph shows that the percent of students who stayed in the low category in Unit 2 decreased in all three sections. However, in Sections A and B that number increased again in Unit 3, while in Section C the number of low participants continued to decrease. Section A did not show a decrease in the number of low participants within credit levels, as might have been expected.

Quantitatively, in Section A the percent of initially low participants who stayed in the low category dropped from 12 in Unit 1 to 5 in Unit 2, but then began to steadily increase so that 8 initially low students stayed in the low category in Units 3 and 4. In Unit 5, the last unit and a non-treatment phase, 8 out of 11 students stayed in the low-participation category. The credit contingency did not affect the number of initially low students who remained at the low level for



Section A. However, the number of students who stayed in the low-participation level did decrease from the beginning to the end of the semester, suggesting that some of these students participated more in subsequent units. In Sections B and C, no discernible pattern emerged as to the way initially low participants performed in subsequent units. In Section B, the majority of low participants stayed in the low-participation category. In Section C, with the exception of Unit 3, more low participants stayed in the low-participation category than moved to either the medium or high category. The absence of a pattern suggests that, even though the students knew they would receive credit for some days, delayed and random credit proved too distant and unpredictable to affect participation in Sections B and C, especially in Section B.

Also of interest is the number of students who did not participate at all during the semester. Out of the 44 initially low participants, 14 were initially non-participants and out of these, only 6 did not participate at all during days in which participation was recorded. Four of these students came from Section B, while the other two came from Section C. Surprisingly, none of these students were in Section A, indicating that every student in Section A participated at some point within the semester.

*Initially high and medium participants.* Students initially participating at the high level made an average of 2 or more comments per day in Unit 1, while medium participants made an average of 1 to 2 comments per day. Visually examining the percentage of initially high participants falling into the low, medium, and high categories in each unit showed that the credit contingency seemed to make a modest difference in Section A. In non-treatment phases, less than half of the initially high participants in Section A stayed at the high level. As shown in Table 15, in Unit 3, 11 out of 24 students stayed at the high level, and in Unit 5, 11 out of 23

stayed at the high level. In addition, more initially high participants moved down to the low-participation level in non-treatment phases than in treatment phases. There were no students who switched from the high- to low-participation level in Unit 2, and in Unit 4 only two students switched from the high- to the low-participation group (both treatment units). This pattern suggests that even talkative students may be more lax when they know they will not receive credit.

Sections B and C had many more initially high-participating students, compared to students at other participation levels, stay at the high-participation level throughout the semester. In Section C, the percentage of students who remained in the high level stayed above 68%. It seems that for students initially inclined to participate, using unpredictable and delayed credit contingency did not affect their high-participation level. This finding might be because those students were continuously aware that the days they participate may be chosen to count as credit, or they may simply value participating during class.

Although the differences are most apparent for students in the low- or high-participation levels, students who were initially in the medium-participation category had rather varied levels of participation, often switching to the low or high level across units. In fact, in all sections the percentage of students who stayed in the medium level was often lower than those who switched to other participation levels. If students switched to the high- or low-participation level, they were more likely to comment less than comment more, with the exception of Section C. Table 14 shows that only 1 out of 14 students who were initially medium participants in Section A stayed at that level of participation for the entire semester, and most of the rest moved down to the low category. In treatment phases, students in Section A who were medium participants were more

likely to stay at the medium level or move to the high category than to move to the low category. For example, in Unit 2, 11 out of 14 initially medium participants stayed at the medium level or moved to the high level and in Unit 4, 8 out of the 14 initially medium students were at the medium or high level. In contrast, during Units 3 and 5 (non-treatment) the number of students at the medium or high level was 6 out of 14 and 3 out of 14, respectively.

#### *Timeliness of Student Comments*

During each day that students recorded their comments, they also were instructed to indicate if their comments were timely or repetitious. However, some students had difficulty knowing if their comments could be defined as repetitious. Because of this problem, the primary observer also indicated on her record sheet whether student comments were timely. As shown in Table 16, very few repetitious comments were made in any section. More students recorded that their comments were repetitious than did observers. In addition, no particular unit or credit contingency across sections produced an elevated number of repetitious comments. According to the primary observer, Section A had 10 repetitious comments overall, Section B had 8, while Section C only had 1 repetitive comment. No conclusions about the frequency of repetitious comments can be made because of the small number occurring in each unit and the poor agreement between student and observer ratings. In general, the findings relating to type of student comments showed that most comments were at least somewhat on topic. However, rating the timeliness of student comments did not take into account accuracy or quality of the comment, only if the comment was on the topic being discussed.

### *Instructor Behaviors*

*Instructor questions.* The number and type of questions posed by each instructor was recorded during every discussion day by a GTA. Table 17 gives the number of total questions by instructor per unit as recorded by the primary GTA observer. This table also separates the number of comprehension questions posed from the factual questions. Comprehension questions were particularly important because they gave instructors an opportunity to probe student understanding more deeply rather than allowing students simply to recite an answer from the book. Comprehension questions included questions that required analysis, evaluation, inferences, synthesis, or comparisons to formulate answers. In addition, a large number of total questions is necessary to maximize student chances to respond, especially when there is an opportunity to receive credit for participation. However, as it may take students longer to develop an answer to thought-provoking comprehension questions, an increased number of comprehension questions may decrease the number of total questions posed throughout the class session.

To enhance the consistency between the three instructors, the instructors used the same classroom materials, met with the course supervisor once a week, and practiced creating comprehension questions. The instructors discussed course issues among themselves and shared well thought-out discussion questions. They were encouraged to ask varied questions but to keep the proportion in favor of comprehension questions. For the duration of the course, the primary observer provided regular feedback to the instructors to keep number and type of instructor questions relatively consistent across the three sections.

Figure 7 presents the number of total questions posed by instructor by day and also graphs the mean number of questions per unit. In examining Table 17 and Figure 7, one notices

that the Section B instructor regularly asked more questions (average of 30 questions per day) than either of the other two instructors (average of 24 questions per day in Section A and 27 questions per day in Section B) and that the Section A instructor posed fewer questions than the other instructors. Proportion tests were used to compare the number of total questions across sections and treatment conditions. The Section B instructor asked significantly more questions than the Section A instructor ( $z = 5.58, p < .001$ ) and the Section C instructor ( $z = 3.20, p < .001$ ). In addition, proportions tests revealed that all instructors asked significantly more questions in Units 2 and 4 than in Units 3 and 5 ( $z = 6.87, p < .001$ ): the Section A instructor asked 59 more questions in Units 2 and 4 (treatment units) than in Units 3 and 5 ( $z = 4.26, p < .001$ ); the Section B instructor asked 79 more questions ( $z = 5.03, p < .001$ ) during Units 2 and 4; and the Section C instructor asked 38 more questions during Units 2 and 4 ( $z = 2.57, p < .01$ ).

The daily number of comprehension questions posed by instructors is shown in Figure 8. The Section B instructor asked significantly more questions than the instructors for either Section A ( $z = 6.41, p < .001$ ) or Section C ( $z = 5.45, p < .001$ ). As shown in Table 17, there were more comprehension questions asked than factual questions in every unit of every section except Units 2 and 3 of Section C.

Although few significant differences in the number of instructor questions occurred across sections, there was no indication that treatment phases were paralleled by more or fewer questions. The only noteworthy difference in questions asked was that Instructor B consistently asked more comprehension and total questions than either of the other two instructors. Figure 9 shows the percentage of comprehension questions asked each day compared to the total number of questions. Visual analysis suggests that the average percent of comprehension questions

remained relatively stable across units in each section. The average percent of comprehension questions per unit ranged from 46% in Unit 3 of Section C to 72% in Unit 5 of Section B. Section B saw a gradual increase in the percent of comprehension questions across the units, increasing from 54% of total questions in Unit 1 to 72% in Unit 5. The percentage of comprehension questions remained relatively constant in the other two sections.

The researcher considered the differences in number of questions between treatment and non-treatment phases of Section A to determine if treatment contingencies affected the number of instructor questions or if the number of instructor questions might have affected treatment outcomes. A slight increase in the number of total questions posed by the instructor occurred in the treatment phases. Units 2 and 4 (treatment) had averages of 28 and 27 questions per day, respectively. In contrast, Units 3 and 5 (non-treatment) had averages of 21 and 20 questions per day. A similar trend can be seen in the number of comprehension questions posed during the treatment phases, although the differences between treatment and non-treatment phases were smaller. Units 2 and 4 respectively had 15 and 16 average questions per day, while Units 3 and 5 each had only 11 comprehensive questions per day. However, the percent of comprehensive questions compared to the total amount of questions stayed constant over all units, with a range of only five percentage points (from 52% to 57%).

*Instructor Feedback.* Inasmuch as positive versus negative instructor feedback for student comments can affect rate of commenting, it was important to quantify the amount of positive and negative feedback instructors provided. Table 18 presents the total number of instructor feedback comments given in each section, as well as the amount of positive versus negative feedback given. As is evident in Table 18, much more positive feedback was given than negative feedback

in each unit. The number of positive feedback each unit ranged from 261 (Unit 2 of Section C) to 392 (Unit 1 of Section B), with an average of 297 comments per unit. The number of negative feedback comments ranged from 1 (Unit 3 of Section C) to 22 (Unit 4 of Section B) per unit across sections with an average of 9 negative feedback comments.

The Section A instructor provided significantly more instances of positive feedback during treatment units than non-treatment units ( $z = 5.05, p < .001$ ). A similar amount of negative feedback was provided during treatment and non-treatment units. The combined number of negative feedback comments in treatment phases was 17, while the combined number in non-treatment phases was 15. Thus, the instructor did not give more or less negative feedback under credit than non-credit contingencies. There was no difference between the number of feedback comments in treatment and non-treatment units in Sections B and C.

The means and standard deviations for positive and negative feedback per student each day are given in Table 19. This table also shows the combined mean of teacher feedback for the three sections in each unit. The data trends are visually presented in Figures 10 and 11. Visual inspection of Figure 10 suggests that the average number of positive instructor feedback comments per person per day did not differ considerably across the three sections. The mean number of positive feedback statements per person per day decreased in Section A, stayed largely the same in Section B, and increased in Section C across units. Over all units, the mean positive feedback stayed above 1.2 feedback statements per person per day in all sections. Figure 11 displays the mean number of negative feedback statements per person per day. These averages are much lower than for positive feedback. The only data that stand out are the mean feedback statements for Sections B and C in Unit 4. Negative feedback in this unit was more

prevalent for these two sections than in all other units of all sections. This finding may in part be related to the difficulty of the unit and the propensity for students to guess and give wrong answers to instructor questions. Nonetheless, level of negative feedback was not elevated for this unit in Section A. Positive and negative feedback were consistent across treatment and non-treatment units in Section A, suggesting that treatment conditions did not affect the amount of positive and negative feedback given.

### *Participation Survey Results*

The participation survey was administered to all students at the beginning of the course to examine their individual views on participation. Questions on the survey covered various aspects of participation such as the students' previous levels of participation in college classes, the responsibility of the student to contribute to class discussion, and the impact that credit for participation has on class discussion. Scores on the survey were compared with students' actual participation level in the class to determine how well the survey responses predicted participation levels in class discussion.

The 50 items of the participation survey were subjected to principal components analysis with varimax rotation. Three stages of rotation were used to obtain seven primary factors. During all three rotations, items that did not load .30 or above on at least one factor were dropped from subsequent analysis. Only factors with 3 or more highest loading items were kept for the next round of rotations. This is the same criterion used in the Krohn et al. study (2010). The series of factor analyses ultimately identified 30 items consisting of seven factors representing specific themes in the participation survey. These factors were labeled Personal History and Preference regarding Class Participation (henceforth referred to as History and Preference), Impact of



Discussion on Course Value and Grades (Impact of Discussion), Cognitive and Affective Investment in Class Discussion (Investment in Discussion), Relevance of Discussion (Relevance of Discussion), Possible Impediments to Discussion (Impediments to Discussion), Responsibility for Discussion (Responsibility for Discussion), and High Quality Contributions to Discussion (Quality Contributions). The specific items and their loadings on each factor can be found in Appendix E.

An internal consistency measure, Cronbach's alpha, was computed for all of the survey items (.89), the 30 items in the combined factors (.90), the 8 items in the History and Preference factor (.88), the 6 items in the Impact of Discussion factor (.83), the 4 items in the Investment in Discussion factor (.69), the 3 items in the Relevance of Discussion factor (.59), the 3 items in the Impediments to Discussion factor (.58), the 3 items in the Responsibility for Discussion factor (.46), and the 3 items in the Quality Contributions factor (.49). Only the alphas in the total survey, the combined factors, the History and Preference factor, the Impact of Discussion factor, and the Investment in Discussion factor fall approximately at or above the accepted criterion of .70 (Garson, 2008). These alphas suggest that only these three factors should be considered subscales. The other 4 factors only had 3 or 4 items each, which may have contributed to their low internal consistencies.

The survey data were examined in a variety of ways: a) mean survey scores for low, medium, and high participants based on total course participation; b) comparison of the three participation groups on survey factor scores using ANOVAs; c) individual means on items that produced particularly high or low student endorsement; d) individual item means for the low-,

medium-, and high-participant groups; and e) logistic regression analysis to assess whether the survey results predicted placement in high- and low-participant groups.

*Mean survey scores.* The mean survey scores for low (mean of .5 or fewer comments per day in Unit 1), medium (mean of between .5 and 2 comments per day in Unit 1), and high participants (mean of 2 or more comments per day in Unit 1) were quite different, as shown in Table 20. An ANOVA yielded significant differences between the three groups on total survey scores,  $F(2, 161) = 16.56, p < .001$ . Pairwise comparisons revealed that low participants scored significantly lower on the total survey than medium participants ( $p < .05$ ) or high participants ( $p < .001$ ). However, the total participation scores were not significantly different between medium and high participants. In addition, significant differences were found between the three groups on the combined factors for the participation survey,  $F(2, 160) = 25.52, p < .001$ . Low participants scored significantly lower on the combined factors than did medium participants or high participants ( $p < .001$ ), and medium participants scored significantly lower than high participants ( $p < .05$ ).

Analysis of variance for the seven factors on the participation survey shows significant differences on History and Preference,  $F(2, 169) = 41.91, p < .001$ ; Impact of Discussion,  $F(2, 161) = 15.32, p < .001$ ; Investment in Discussion  $F(2, 161) = 5.77, p < .01$ ; and Impediments to Discussion  $F(2, 161) = 6.14, p < .01$ . All three participation levels yielded significantly different scores on History and Preference and Impact of Discussion ( $p < .001$ ), with the low participants scoring the lowest, the high participants scoring the highest, and the medium group scoring between the low and high participants. With respect to the Investment in Discussion factor, the low-participation group was significantly lower than the medium group ( $p < .05$ ) and the high

group ( $p = .01$ ). However, the medium- and high-participation groups were not significantly different on this factor. For the Impediments to Discussion factor, the low-participation group was significantly lower than the medium group ( $p < .05$ ) and the high group ( $p = .01$ ) but the medium and high groups did not differ significantly. None of the three groups significantly differed from each other on the other factors or the discarded survey items.

*Individual item means.* Appendix C lists all the survey items, means and standard deviations for responses to each item, and the percent of students who chose each item option. Responses to the items were coded from 1 to 5, with higher responses signifying a more positive view of participation. Half of the item means fell in the mid range of responses (between 2.5 and 3.5), 28% of item means fell in the high level (between 3.5 and 4), 20% of items fell in the very high level (between 4 and 4.5), and one item fell in the extremely high level (above 4.5). There were no items that fell in the low level (under 2.5). Thus, overall item responses were skewed toward endorsement of participation.

Three items that fell in the very high level and the one item that fell in the extremely high level were included in the seven factors, specifically Relevance of Discussion and Possible Impediments to Discussion. Items that loaded on Relevance of Discussion included information dealing with the relationship between perceived relevance of course content and participation (item 47, very high level), the effect of student participation on personal standing with teachers (item 48, very high level), and student knowledge of topic before contributing to a discussion (item 28, extremely high level). The ability to judge relevance of comments (item 41, very high level) loaded on the Possible Impediments to Discussion factor.

Results from the remaining items that scored at the very high level suggested that students view their own comments as generally relevant (item 5), students bear most of the responsibility for participating when asked by the instructor to volunteer comments (item 7), students feel positively about commenting during discussion being optional (item 10), students generally prefer volunteering comments rather than being called on (item 17), students expect others who participate frequently in class discussion to perform well in the course (item 27), students view teachers as greatly valuing class discussion (item 37), and students feel that teacher friendliness is an important contributor to student participation (item 49).

Responses to selected items on the participation survey may help account for student interest in participation. Students responded that they would desire to participate more in classes they felt had relevant content. In fact, this item was rated in the very high range and contributed to the Relevance of Discussion factor. Given that this particular class was a prerequisite for the teacher education program and also could be chosen from a list of Arts and Sciences curriculum requirements for a Bachelor of Arts degree, some students who chose the course merely to meet a curriculum requirement may have had little interest in the class and therefore felt minimal inclination to participate. For students less inclined to participate, credit contingencies may increase their tendency to participate to improve their grade in the course. The survey results also indicate that most students feel they are able to determine the relevance of their comments. In fact, this particular item had the highest mean score of all items on the participation survey, indicating that students were very certain about their ability in this area. However, as already revealed by the records of repetitious comments made by students, there was practically zero reliability between student and observer records of repetitious comments. Students consistently

recorded more repetitious comments than did observers, and only once did both the student and observer both rate a comment as repetitious. In this instance, the student wrote on his record card that the first comment he made was repetitious, and the GTA indicated that the first comment that same student made was also repetitious.

Although still considered in the middle range of scores on the participation survey, seven item means fell below 3.0. The responses to these items indicate that students on the average felt that participation should not heavily affect course grades (item 8), keeping records of class participation would detract from concentration (item 13), the optimal class format favors lecture but allows for some discussion (item 14), students were hesitant to answer instructor questions (item 16), they were not very talkative in past college courses (item 33), most college teachers do not believe participation is one of the more important aspects of a course grade (item 34), and quiet students may be discredited because of their lack of participation (item 46). The responses on these items indicate that students may feel more negative toward these participation notions than other participation notions represented in the survey.

Of the seven items that students least endorsed, five of them were included in the participation survey factors. Items that loaded on the factor of Personal History and Preference regarding Class Participation included items 16 (students' responses to instructor questions) and 33 (past teachers' views of student levels of participation), while items that loaded on the Impact of Discussion on Course Value and Grades factor included items 8 (students' attitude about earning course credit for participation) and 14 (discussion versus lecture as the optimal class format). In addition, item 34 (students' perception of whether most college teachers view participation as an important or unimportant aspect of a course grade) was included in the factor

of High Quality Contributions to Discussion. Interestingly, no factors included items that fell in the low and very high to extremely high range of scores. All other items included in the factors fell in the medium to high range of scores on the survey. The mean scores on each item for low, medium, and high participants are shown in Appendix E. For all but four items included in the survey factors, the low participants scored lower than both the medium and high participants.

*Logistic regression.* The total survey scores, the scores on the combined seven factors, and the scores on each of the factors were used as predictors of membership within the different levels of participation through binomial logistic regression. Logistic regression was used to investigate how well the survey could predict placement into low- versus high-participation groups in each unit. Instead of using all three participation groups (low, medium, and high) in the regression analyses, the researcher used only the low and high groups of students. The reason for this distinction was that the analysis of variance results discussed previously found the most significant differences in survey scores between these two groups. The specific students in the low and high groups varied between units, but the criteria for low participants (less than 2 comments during the unit) and high participants (8 or more comments during the unit) were held constant across units.

The classification of low and high participants was the same as that used for low- and high-participating students in Unit 1, when intra-subject comparisons were conducted across units. Given that the low group consisted of students averaging fewer than .5 comments per day and the high group contained students making more than 2 comments per day, a large gap in participation level exists between these two groups. Those students who were in the middle group had the most varied levels of participation and often switched from level to level each unit.

Excluding the middle group removed students whose variability of participation level would likely not be predicted well by scores on the total survey or survey factors. The consistency of the level of participation within the low and high levels was greater, which likely increased predicted membership within these groups.

Binomial logistic regression can evaluate the contribution of each predictor above the contribution of all the other predictors. Total participation survey score was analyzed using logistic regression as a predictor of membership in low- or high-participation groups. Next, the seven factors were analyzed together before examining how well they individually predicted participation. Finally, for the best predictability of participation level, all factors that did not have adequate internal consistency or significant Wald variables were excluded from further analysis.

Table 21 shows that total survey scores significantly predicted student classification into low- or high-participation categories in all five units. Chi-square values were statistically significant ( $p < .001$ ) with  $R^2$  values ranging from .11 to .20. These  $R^2$  values indicate the proportion of the total variability of participation attributable to survey scores. Odds ratios ranged from 1.04 to 1.07, meaning that students were 4-7% more likely to participate (i.e., be included in the high-participant group) with every one unit increase in the total participation survey score. The odds ratios values were lower than expected, partly because of the elevated amount of variance within the scores in the high-participation level. Within the low-participation group, the range of number of comments per unit was only 2 (0 to 2 comments per student), but the range in the high-participation group was 32 (at least 8 comments per unit per student but as many as 40 comments). The odds ratios and  $R^2$  values were relatively consistent across units

with the exception of Unit 5, where the values were slightly lower. This pattern suggests that the survey predicts equally well across the course, except for the last unit.

In addition to determining the overall accuracy of student classification, logistic regression also examines the percent of students correctly classified as low or high participants in a particular unit. Between 58.5% (Unit 5) and 74.6% (Unit 1) of students were correctly classified into high- and low-participation categories when all sections were combined, indicating a better than average degree of accuracy in group placement. Table 22 provides the percent of cases correctly classified for both low- and high-participation groups across sections and units. In general, the total survey scores predicted placement in the high-participation group slightly better than the low group when the sections were combined. In the combined sections, percentages ranged from 57.8% to 64.1%, with an average of 59.9% in the low group, and from 51.9% to 85.5%, with an average of 73.4% in the high group. Total survey scores also better predicted placement in high- than in low-participation groups within sections. In some cases, predictability was very poor, such as for the low participants in Section A in Unit 1 (8.3%) and Unit 2 (12.5%).

As is evident in Table 22, a larger percentage of low-participating students in Section A were correctly classified in non-treatment units (Units 3 and 5) than in treatment units (Units 2 and 4). An average of 77.5% of low-participating students were correctly classified in non-treatment units, while an average of only 28.2% were correctly classified in treatment units. Proportions tests (Ferguson & Takane, 1989) determined that the differences in these proportions were statistically significant ( $p < .001$ ). In contrast, more high-participating students in Section A were correctly classified in treatment units (Units 2 and 4) than in non-treatment units (Units 3



and 5). An average of 83.9% of high-participating students was correctly classified in treatment units as opposed to 57.8% in non-treatment units. This difference in proportions between treatment and non-treatment units was statistically significant for high-participating students ( $p < .001$ ). These patterns suggest that credit for participation may make a greater difference in the participation percentages of high participants under credit conditions than non-credit does in non-treatment conditions. Plus, credit for participation may serve as a greater primer for participation for high participants than for low participants.

Logistic regression also was used to predict placement into groups using only the survey factors as independent variables. In all five units, the combination of survey factors significantly predicted membership in the low- or high-participation groups ( $p < .001$ ,  $R^2$  ranging from .19 to .28), which is shown in Table 23. Similar to the total survey predictions, the combined survey factors predicted equally well across all units except Unit 5, in which the values are slightly lower. Table 24 presents the classification percentages for the combined factors. The average percentage of correct placement in the low-participation group was much higher (78.9%) than was found for the total survey (59.9%). Use of proportions tests showed that the difference between these percentages was statistically significant ( $p < .01$ ). In addition, the average percentage of correct placement in the high-participation group (84.2%) was considerably higher than was obtained for the total survey (73.4%). Proportions tests determined that these differences also were statistically significant ( $p < .05$ ). Thus, it seems that the combined factors predict placement into the two participation groups more accurately than the total survey.

Logistic regression also was used to determine the extent to which each factor separately predicts participation. As shown in Table 25, the History and Preference factor is the only one

that significantly predicted membership in the low- or high-participation group across all units ( $p < .001$ ). The odds ratios for the History and Preference factor ranged between 1.29 (Unit 4) and 1.70 (Unit 1), meaning that students were between 29% and 70% more likely to participate (be included in the high-participation group) for every one unit increase in the History and Preference factor survey score. The Relevance to Discussion factor was significant only in Units 1 ( $p < .01$ ) and 2 ( $p < .05$ ), with odds ratio values of 1.92 and 1.43, respectively. The factors Impact of Discussion, Investment in Discussion, Impediments to Discussion, Responsibility for Discussion, and Quality Contributions were not significant predictors in any unit. The odds ratios for these factors were very close to 1, suggesting that little or no predictive value for these five factors. Also, the Wald statistic for the non-significant factors was close to 0, further indicating that they did not predict membership in the low- or high-participation group.

Finally, logistic regression was performed separately only on those factors that were significant in the previous analysis (i.e., the History and Preference factor for all units and the Relevance of Discussion factors in Units 1 and 2). These results are displayed in Tables 26 and 27. The History and Preference factor significantly predicted membership in low and high participation groups ( $p < .001$ ,  $R^2$  ranging from .27 to .37). The odds ratio values ranged from 1.27 (in Unit 5) to 1.37 (in Unit 1). These odds ratios are higher than those found for the total survey or the combined factors. The Relevance of Discussion factor by itself did not significantly predict membership into low and high groups in Units 1 or 2. Thus, the History and Preference factor is the one factor that best predicts placement into low and high groups.

Table 28 presents the percentage of students correctly classified into participation groups using only the History and Preference factor as a predictor. The History and Preference factor

predicted placement in the low-participation group for combined sections (67.4%) better than the total survey (59.9%) but not as well as the combined factors (78.9%). Similarly, the History and Preference factor predicted placement in the high-participation group (81.1%) better than the total survey (73.4%), but worse than the combined factors (84.2%). Proportions tests show that the combined factors significantly predicted placement in the low-participation group better than both the History and Preference factor and the total survey ( $p < .05$ ). Although the combined factors predicted placement better than the History and Preference factor for the high-participation group, the difference was not statistically significant.

The percentage of students correctly classified into participation groups using only the Relevance of Discussion factor as a predictor is shown in Table 29. The factor poorly predicted placement in the low-participation group, predicting 6.7% of low participants in the combined sections in Unit 1 and only 2.3% in Unit 2. The Relevance of Discussion factor predicted placement in the high-participation group well for the combined sections (94.2% in Unit 1 and 89.8% in Unit 2).

Even though the combined factors predicted placement into high- and low-participation groups better than the History and Preference and Relevance of Discussion factors, the researcher examined the possibility that the History and Preference factor could correctly predict placement within credit and non-credit units, especially in Section A. In Section A, the History and Preference factor predicted placement in both high- and low-participation groups better than the combined factor in both credit and non-credit units. The percentage of low participants correctly classified in Section A using the History and Preference factor as a predictor was 65.10% as opposed to 54.32% using the combined factors. Similarly, the percentage of high

participants correctly classified in Section A using the History and Preference factor (79.06%) was higher than the combined factors (72.66%). Proportions tests showed that the difference between predicted placement using the History and Preference factor and combined factors was statistically significant for the low-participation group ( $p < .05$ ) but not for the high-participation group.

In Section A, the History and Preference factor better predicted placement into the low-participation group during units without credit and better predicted placement into the high-participation group during units with credit. The History and Preference factor correctly classified 50% of low participants in treatment units (Units 2 and 4) and 83.6% of low participants in non-treatment units (Units 3 and 5). In contrast, the percentage of correctly classified high participants using the History and Preference factor was 88.5% in treatment units (Units 2 and 4) and 61.1% in non-treatment units (Units 3 and 5). Proportion tests showed that these differences were statistically significant ( $p < .001$ ).

Because students in Sections B and C did not initially know in which units credit would be rewarded, the researcher hypothesized that the History and Preference factor would predict equally across all units. In Section B, this factor did predict placement into the low-participation and high-participation groups equally across all units and equally across participation groups. In Section C, the factor predicted the high-participation group equally across all units, but the predictive percentages for the low-participation group dropped steadily throughout the semester. In Section C, in particular, it seemed that the high participants were performing as predicted, but the low participants were increasingly more variable in their levels of participation as the course progressed.

## Chapter IV

### Discussion & Conclusions

A primary goal of this study was to examine the effects of awarding random and delayed credit for participation on class-wide participation, particularly among students initially disinclined to comment during class discussion. Students in three large sections (approximately 55 students per section) of an undergraduate course were given credit during certain units for participating at designated levels. The purpose of employing random and delayed credit was to reduce the recordkeeping required when students receive credit for participation every day without compromising the level of participation achieved with regular credit. Although some students regularly participated in class discussion whatever the credit arrangement, others did not participate at all even when given the opportunity to earn credit for participation.

The effects of delayed and random credit for participation were quite varied. A higher percentage of students participated in class discussion when they were informed in advance of the units in which random credit would be available and when the random selection of credit days occurred at the conclusion of the course. No unit credit effect was noted when the random selection was extended to units as well as to days within units and all random selections occurred at the end of the course. Under this combination, the delayed credit contingencies produced participation levels between the credit and non-credited percentages of the section in which students had advance knowledge of the credit units. The results appear to suggest that delayed selection of credit units may be more limiting to participation level than the random selection of days within known units. Perhaps students must experience credit for participation early in a

course for delayed credit to be most effective. Early credit may serve as a primer for the potency of delayed credit.

In addition to assessing the effects of random and delayed credit on participation, the experimenter administered a participation survey created by Krohn and colleagues (2010). The survey was used in this study to predict student placement into low- or high-participation groups. Students' history of participation in previous classes was the strongest predictor of group participation and predicted group placement in high- or low-participation groups in all units irrespective of the credit arrangements used in the various sections of the course.

#### *Effect of Delayed and Randomized Credit on Student Participation*

Students were classified as participants in two ways: by number of comments per day in each unit and by range of participation in each unit as a whole. Student participation each day was classified into four different categories: not participating (0 comments), earning credit for participation (1-2 comments), slightly exceeding the credit contingency (3-4 comments), and greatly exceeding the credit contingency (5 or more comments). Student placement into these categories each day did not take into consideration the number of comments on any other day, as students often daily switched from one category to another. Students were also classified into three levels based on overall participation within the unit: low (0-2 comments in the unit), medium (3-7 comments in the unit), and high (8 or more comments in the unit). These levels permitted intra-subject comparisons that examined individual changes in participation across units and credit contingencies. Participation survey data were also used as a predictor of membership within the low, medium, and high levels of participation.

Within Section A, number of comments varied greatly between credit and non-credit units for non-participants and for students partially meeting the credit contingency (1-2 comments). However, although the number of students partially meeting the credit contingency varied within units (both credit and non-credit), the number of non-participants did not. In contrast, the number of students slightly exceeding the credit contingency (3-4 comments) and greatly exceeding the credit contingency (5 or more comments) did not differ significantly across contingencies. There were negligible differences between credit and non-credit units in Sections B and C for any of the participation categories. Participation at any level in these two sections remained relatively stable or declined across units, and participation percentages fell between the percentages obtained during the credit and non-credit phases of Section A. In all units and sections, students were given the same opportunity to participate as in previous studies pertaining to research in this particular setting (Foster et al., 2009; Krohn et al., 2008; Krohn et al., 2010).

#### *Effect of Delayed and Randomized Credit on Low-Participating Students*

One of the main goals of this study was to increase the percentage of initially low-verbal students who consistently participate in class discussion, while reducing the amount of instructor time it takes to record and grade comments. Previous studies (Foster et al., 2009; Krohn et al., 2008; Krohn et al., 2010) indicated that a small amount of credit given for participation can increase the likelihood of participation for those initially disinclined to participate, but the objective of the current study was to increase the consistency of participation across days and units. Henning (2005) claimed that showing personal interest in students, allowing students time to get to know each other, using a cooperative learning structure, and awarding points for participation may increase the consistency of participation. The current study employed the

strategy of awarding random and delayed credit for participation. Even with an optimally designed course, reticent students may not be inclined to comment during the discussion without the reward of credit. There were 14 students who did not participate at all during the initial unit, but only 6 who did not participate at all during the remaining four units. Of these 6 students, none came from Section A, possibly because the students in this section knew in which units they would receive credit instead of having to wait until the end of the course.

The characterization of some students as consistently reticent is not uncommon in the literature on participation. According to Karp and Yoels (1976), only around 25% of students participate in discussion. Reticence can be defined as non-participation, little or no participation on average, or little or no participation during a single class. The concept of consolidation of responsibility proposes that there is no such thing as an “average” participant. Instead, there are only “talkers” who generate the majority of the class interactions and “nontalkers” who comment only occasionally, if at all (Howard et al., 2002). The consolidation of responsibility classifies students into one of these two groups, because creating a class average would blur the distinctions between the talkers and nontalkers.

In the current study, students were classified at three participation levels (low, medium, and high) based on their participation instead of just two groups (talkers and nontalkers). As explained in Krohn et al. (2010), separating students into only two groups would not allow for the most accurate representation of student participation. Given that students were required to make 2 or more comments to obtain full credit, dividing the students into only two groups would have disproportionately yielded more nontalkers than talkers. Under the criteria that Howard et al. (2002) set forth for talkers, the majority of students would not have qualified as talkers (i.e.,



they did not make two or more comments per day). If the criterion for the talker group was lowered to 1 comment per day, it would not be possible to differentiate students who occasionally commented from those who met or exceeded the credit contingency. For these reasons, it was more beneficial to separate students into those who rarely or never participated (0-2 comments per unit) from those who occasionally participated (3-7 comments per unit), and those who frequently participated (8 or more comments per unit, averaging 2 or more comments per day). In keeping with Howard et al.'s criteria for nontalkers, the researcher classified reticent students in this study as the low-participation group.

Similar to the Krohn et al. study (2010), there were several ways that reticence was defined in the current study. Reticence could refer to students initially disinclined to participate (0-2 comments in the first unit), continual reticence as defined by low participation across units, daily reticence as defined by the percent of non-participants each day, or historical reticence as defined by low scores on the History and Preference factor in the participation survey. The credit contingency in Section A allowed students the opportunity to know which units would be awarded credit and subsequently decreased student reticence in credit units. In fact, all students in Section A participated at least once in the course, although some students only participated once or twice. In Sections B and C, the delayed credit contingency was unsuccessful in increasing participation for the most reticent students.

In Section A, there were 31 students who were reticent in at least one unit of the course. This number was significantly higher in noncredit units (21 students in Unit 3, 25 in Unit 5) than in credit units (8 students in Unit 2, 16 in Unit 4). However, the students who were initially reticent ( $n = 12$ ) did not participate at differential levels during credit and non-credit units. Even

though 7 initially-reticent students moved to the medium or high category in Unit 2 (credit), only 4 initially-reticent students participated during Units 3, 4, and 5. This effect is surprising and counter to what was found in the Krohn et al. (2010) study, where half of the initially low-participating students moved to the medium- or high-participation categories during credit units. Ideally, the credit contingency in Section A would have had the largest effect on initially-reticent students. In Sections B and C, the number of low participants each day did not differ significantly between credit and non-credit units because students could not make a prospective distinction between credit and non-credit units. In addition, the number of students who were initially reticent (14 students in Section B, 18 in Section C) did not decrease in credit units, probably because the students did not know which unit would be counted for credit. In Section B, the number of initially-reticent students who eventually participated did not increase across units, in fact only 1 or 2 initially-reticent students participated in subsequent units. Section C saw between 4 and 9 initially-reticent students participate during Units 2 through 5 but without regard to credit contingency.

Section A had only 3 students who did not participate at all during the first unit. Two of these non-participants commented during credit units, and the third student made only one comment during the final unit. Due to the eventual participation of these initially-reticent students, every student in Section A participated at least once during the course. Eleven students across Sections B and C did not comment at all during the first unit. Of these, 6 did not participate at all during the entire course, 4 in Section B and 2 in Section C. It seems that the delayed and random credit contingencies in Sections B and C did not produce enough incentive for more than half of the initial non-participants to comment during the course.

For any one day in Units 2-5 of Sections B and C, the probability of receiving no credit for participation was four times greater than the probability of receiving credit (4 days for credit and 16 days for non-credit). Thus, the matching law (Hernstein, 1961) might predict that students' level of participation would be more aligned with non-credit than credit expectations. Although students could have maximized their credit by participating at the credit-level every day, they knew that most days would not be chosen for credit. Thus, the odds of receiving no credit versus credit for participation on any particular day would be 4 to 1, which ordinarily would tip the scales in favor of non-participation.

Although the credit contingency in Section A reduced the number of reticent participants during credit units, it did not reduce the number of initially-low participants. Additionally, the delayed and random credit contingencies in Sections B and C did not produce a discernible pattern of participation for the initially-low participants in subsequent units. However, logistic analysis showed that the History and Preference factor in the participation survey was able to predict membership in the low- and high-participation levels during each unit of Sections B and C. This suggests that the History and Preference factor may be able to identify students who are initially disinclined to participate, making it easier to identify these students early in the semester. By identifying initially reticent students, the instructor may be able to build rapport early and encourage these particular students to participate, possibly by engaging them in discussions outside of class or offering additional incentives or praise for participating. However, some students may not participate even with additional incentives.

### *Effect of Delayed and Randomized Credit on Medium-Participating Students*

The initially medium-level participants in Section A ( $n = 14$ ) participated at the medium and high levels in credit units and at the low and medium levels in non-credit units. For instance, in Unit 5 (non-credit), only 3 of the initially medium-level participants participated at the medium or high level, but in Unit 2 (credit), 11 students participated at the medium or high level. Even during credit units, there were still some initially medium participants who chose to participate at the low level (3 in Unit 2, 6 in Unit 4). Given that these students began the course as medium participants, it is not clear why they refrained from participating during subsequent units. Inasmuch as some students view offering credit for participation as a distraction from the material or as encouraging unnecessary comments, they may choose not to participate when credit is offered even though they have a history of participating in class (Sommer & Sommer, 2007). This is perhaps a negative effect of offering credit for participation.

In Section B, most medium participants stayed at the medium level throughout the course, and those who changed categories moved more to the low level than to the high level. The opposite effect occurred in Section C, where more students moved from the middle level to the high level instead of to the low level. This disparity may be due to the differences in credit contingencies between Sections B and C; however, this is unlikely because of the similarities of the analyses between these sections in most other areas such as the percentages of students participating at each level throughout the course. Nevertheless, in all sections, even though some of the medium group consistently participated at the medium level, the students in this group were more apt to participate at variable levels. Given that students in the medium group varied their number of comments by unit or even by day, these students became known as the most

difficult group of students to classify and, as such, were not used in some of the later predictive analyses involving the participation survey.

#### *Effect of Delayed and Randomized Credit on High-Participating Students*

During credit units in Section A, almost all of the initially high participants ( $n = 25$ ) stayed at the high level or dropped to the medium level in subsequent units. Only 1 high-participating student in Unit 2 and 2 students in Unit 4 chose to participate at the low level during credit units. There was more variability during non-credit units in Section A, where 5 students in Unit 3 and 6 students in Unit 5 decided to participate at the low level. Participation at the high level was required to earn the maximum amount of participation points; therefore, most students who were inclined initially to participate at the high level continued to do so during credit units. The realization that lower participation would not be penalized during the non-credit units may have led some of the high participants to abstain from commenting during these units. In this case, the students may have been reinforced by the extrinsic reward of class credit rather than the intrinsic satisfaction of learning.

Students in the high-participation group in Sections B and C were more likely to participate continuously during the entire course. Specifically, more than half of the high participants in Section B stayed in the same level across units, and almost all of the high participants in Section C stayed at the high level. High participants in Sections B and C may have been more apt to participate for intrinsic reasons such as gaining satisfaction from correctly answering questions, receiving positive feedback from instructors, or increasing individual productivity. Very few initially high participants chose to participate at the low level in subsequent units.

Although students averaging 2 or more comments per day were placed in the high level, some students made substantially more comments. In Section A, there were slightly fewer students that greatly exceeded the credit contingency (5 or more comments) during credit than non-credit units, but the difference between credit and non-credit units was not enough to be considered significant. These findings are contrary to what was found in the Krohn et al. study (2010), where credit units produced a diminishing number of students who greatly exceeded the credit contingency. In Sections B and C, there was not a noticeable difference across units for students who greatly exceeded the credit contingency. Around 10% of students across units participated at this level in Section B, which was higher than the percentage in non-credit units of Section A. However, around 4% of students participated at this level in Section C, which is closer to the percentage in the credit units of Section A.

#### *Reliability of Student Self-Recording*

Previous research has indicated that students commonly over-report their participation at the end of the class period (Burchfield & Sappington, 2000; Gopinath, 1999). However, Krohn et al. (2010) have shown that students are capable of accurately recording their participation during class sessions and, if anything, tend to under-report their daily number of comments. Those findings were replicated in this study, with agreement between students and observers averaging 92.97%.

Despite high levels of percent agreement between students and observers, students in Section A tended to over-report their number of comments during credit units and under-report number of comments during non-credit units. However, only 6 students received underserved credit during credit days, while 12 students did not receive appropriate credit because of under-

reporting on credit days. Even though some students seemed to misuse the system to gain extra credit, no students gained extra credit on more than one day due to over-reporting, indicating that the over-reporting of comments was relatively infrequent and may have been unintentional.

In Sections B and C, between 5% and 30% of students under-reported their comments each day, similar to what was found during credit units of Section A. There were only 3 students in each Sections B and C who received undeserved credit for participation by over-reporting their comments during days ultimately selected for credit, which suggests that students did not deliberately inflate their number of comments across all days to gain credit. However, it was more difficult for students in Sections B and C to guess when credit would be awarded, as they had a 1 in 5 chance that any day would be chosen for credit since any 4 of the 20 participation days could possibly count for credit.

Although a large number of students tended to under-report their comments, most of these students only under-reported when they had made 3 or more comments. Given that students only needed 2 comments to earn full participation credit, many students stopped recording after 2 comments. In addition, some students only recorded their first three comments because they would have needed to turn the record card over to write more comments. Students rarely recorded more than three comments, especially those who consistently exceeded the credit contingency. Therefore, there was a larger group of students who under-reported than who over-reported their comments, particularly during non-credit units in Section A.

As with the Krohn et al. study (2010), because students tended to under-report their comments, internal validity was not compromised substantially as a result of an inflated credit effect. After considering the option of using student records as the main dependent variable, the

researcher decided that students' tendency to under-report comments would make their records less accurate than observer records. Instructors should be aware that not having observers simultaneously collecting participation data would make it easier for students to over- or under-report their number of comments.

### *Differential Instructor Behavior*

Differences in behaviors across instructors could potentially distort the treatment effect of credit. For instance, one instructor may ask more questions during credit units, thereby allowing students more chances to comment. For this reason, number and type of both instructor questions and feedback to students were recorded. Across sections, the Section B instructor asked significantly more questions than either Section A and C instructors. However, students in Section B did not make more comments overall than the students in the other sections. Across units, all instructors asked significantly more questions during Units 2 and 4 than during Units 3 and 5. However, only students in Section A, who knew that participation credit would be available in Units 2 and 4, actually showed systematic changes in participation levels (fewer non-participants, more credit-level participants, and fewer dominant participants) in those units. The fact that all instructors asked more questions during Units 2 and 4 probably reflected the greater difficulty of material in those units. This finding was contrary to the Krohn et al. study (2010) in which there was no consistent difference in instructor comments during credit and non-credit units.

Instructor feedback to student comments was also recorded by observers, as the amount and type of instructor feedback could potentially alter student participation. Gallien and Oomen-Early (2007) found that students who received personal, immediate feedback indicated greater



course satisfaction and performance than those who only received feedback as a group. Differential positive feedback for participation can also shape students' participation without even introducing external rewards such as credit (Hodge & Nelson, 1991). For this reason, it is necessary to keep the amount and frequency of instructor feedback to student comments consistent across sections and units within sections. Across all sections and units, substantially more positive feedback was given than negative feedback. The only significant difference found between credit and non-credit units was for positive feedback in Section A, indicating that the instructor for Section A provided more positive feedback to students in credit than non-credit units. This pattern may be due to the increased number of comments during the treatment units, causing more positive feedback to be given. In addition, there was more negative feedback during Unit 4 for Sections B and C, which may be related to difficulty of this unit and the tendency for students to guess or answer incorrectly.

#### *Effect of Credit on Repetitious Comments*

As mentioned in previous studies, some students may feel that awarding credit for comments may cause others to “play for points” or cause the quality of discussion to diminish due to an abundance of anecdotal comments (Krohn et al., 2010; Sommer & Sommer, 2007). While the quantity of comments increases during credit units when the credit contingency is known, previous attempts at creating an operational definition for the quality of comments have not produced promising results (e.g., Krohn et al.). Increasing the percentage of students participating during credit units may encourage students to make inane comments simply to earn points. However, extending participation across a larger number of students may increase the probability of quality comments. In the current study, the researcher simplified the definition of a

high-quality comment to include all comments that were timely. Timely comments included anything that pertained to the topic at hand and did not repeat earlier comments or previously explained concepts.

Reliability between student and observer records of quality of participation using the current definitions produced mixed results. Agreement between observers was 98% for timely comments and 90% for repetitious comments. Agreement between students and observers was also high for timely comments (97%), but almost non-existent for repetitious comments (1.4%). Only once out of the 70 repetitious comments did students and the primary observer agree. Students consistently recorded more repetitious comments than observers. In fact, the observers recorded no repetitious comments in Sections B and C and only 6 repetitious comments throughout the entire course in Section A.

There are a few reasons why students and observers did not agree on repetitious comments. Observers had a chance to practice recording comments and discuss with each other what types of comment fit each qualitative category, while the students did not. The students were instructed at the beginning of the semester what constituted timely and repetitious comments, and examples were available for each category in the syllabus. However, it is likely that the students forgot the definition of a repetitious comment and therefore indicated incorrect answers to questions or various anecdotal comments as repetitious. In addition, students were not made aware of the purpose of the research being conducted in class and may not have realized the importance of correctly identifying the quality of comments. Given that points were only awarded for quantity of comments and not quality, students may have not cared about the accuracy of their qualitative reports. To increase consistency across the recording of the quality

of comments, instructors should make sure that students understand the importance of accurately reporting comment quality. Additionally, students must continuously be aware of the definitions of timely and repetitious comments and may benefit from frequent instructor reminders of the differentiation between timely and repetitious comments.

Given that the student-observer reliability for repetitious comments was so low, no predictions can be made regarding the treatment effect of credit on quality of participation. In this study, the definition of a repetitious comment was so narrow that even with students over-reporting their repetitious comments, only 70 comments the entire semester were rated as repetitious. In Section A students reported more repetitious comments in credit units (Units 2 and 4), whereas observers reported more repetitious comments in non-credit units (Units 3 and 5).

The problem with using a dichotomous rating for comments is that students may feel that their comment does not accurately fit into either category. In order to enhance the quality of discussion, perhaps a likert scale for rating comments could be adapted. This format would require students to have more insight into the quality of their comments, but may produce discussions at a higher cognitive level of Bloom's taxonomy instead of simply remembering facts (Barns, 1983; Bloom, 1956). Gioia (1987) recommended that participation must "think though concepts, issues, and practices for the benefit of self or others" (p. 15). Expanding upon this notion, Mainkar (2008) suggested three levels of participation: no-substance (comments that do not add to the understanding of the topic), straightforward (comments that add to the understanding of the topic), and insightful (comments that significantly improve the understanding of the topic). By using a three-tiered definition of participation, the large number of timely comments could be more accurately broken down into either straightforward or

insightful comments. This arrangement may also improve the reliability between students and observers. However, when more categories are added, reliability may decline because of the possibility that a comment (or parts of a comment) may fit into more than one category.

Krohn et al. (2010) suggests using even four or five descriptive categories because that differentiation would allow for more variability in ratings and engage students in a more cognitively-demanding task than simply deciding if their comment is timely or repetitious. The act of becoming cognitively self-aware of one's comments is a task that may need to be practiced and should be considered a valuable learning experience (Falchikov & Boud, 1989). Even if agreement between student and observers' ratings cannot be reached, instructors should be aware that self-evaluation is often an under-developed skill and needs to be taught as an important cognitive skill.

Other factors such as difficulty of instructor questions and consistency of instructor feedback could affect the quality of participation. For example, instructors who ask mainly comprehension questions will probably receive more insightful comments than those who ask mainly factual questions. In addition, neutral or unenthusiastic instructor feedback could indicate to students that their comments were not insightful, even if the comments did significantly increase class understanding on the topic. Instructors must make their feedback explicit to assist students in identifying the quality of their comments.

The results of this study and the Krohn et al. (2010) study indicate that awarding credit for quantity of participation may not increase the quality of participation. As this is contradictory to previous studies (Dallimore, 2004), future research on quality of participation could investigate further the effects of how credit for quantity of comments impacts quality of

participation. In any case, more explicit definitions for quality participation need to be articulated in order for both students and observers to accurately identify the quality of comments.

### *Predictors and Perceptions of Participation*

The current study was developed to create a more effective and efficient way to increase student participation using random and delayed credit contingencies, building on the Krohn et al. (2010) study. In Section A, more students participated in the credit units even though only two of the days counted for credit, creating less work for the instructor and increasing the number of days in which students participated without increasing the number of days that counted for credit. However, some students continuously participated at low rates, even when credit was offered for participation. The participation survey created by Krohn and colleagues (2010) was used in the current study to predict an individual student's participation level.

Results of logistic regression showed that the participation survey was a strong predictor of which students would comment at the low- or high-participation level. Seven factors were derived from the participation survey through principal components analysis: Personal History and Preference Regarding Class Participation (History and Preference), Impact of Discussion on Course Value and Grades (Impact of Discussion), Cognitive and Affective Investment in Class Discussion (Investment in Discussion), Relevance of Discussion (Relevance of Discussion), Possible Impediments to Discussion (Impediments to Discussion), Responsibility for Discussion (Responsibility for Discussion), and High Quality Contributions to Discussion (Quality Contributions). Logistic regression showed that the combination of these seven factors produced  $R^2$  values slightly higher than for the total survey. Of the seven factors, only the History and Preference factor significantly predicted placement in the low- and high-participation groups

across all units. The History and Preference factor actually predicted better than either the total survey or the combined factors. The Relevance of Discussion factor by itself did not significantly predict placement into low- and high-participation groups, but it did add to the predictive potential of the History and Preference factor in Units 1 and 2. The other five factors did not individually add to the predictive potential of the survey. Therefore, results of the History and Preference factor could be used to efficiently predict student placement into participation groups. However, including the questions on the total survey could provide additional information as to why students elect to participate or not participate in class discussion.

The History and Preference factor used in the current study and the History/Confidence factor used in the Krohn et al. study (2010) were very similar. The History and Preference factor included one item regarding expectations for participating in discussion in the current course (item 2) that was not included in the History/Confidence factor in the Krohn et al. study. Similarly, the History/Confidence factor in the Krohn study included one item regarding students' insights on concepts that would benefit peers (item 31) that was not included in the History and Preference factor of the current study. The other seven items in these factors were the same. Item 2 was included in the Expectation for Discussion factor in the Krohn et al. study, while item 31 was included in the Quality of Contributions factor in the current study. Future research using the participation survey should investigate the differences between the factors found, especially regarding the items on the History and Preference scale. Whereas the Krohn et al. study found only three factors in the survey, the current study had seven factors extracted from the participation survey, even though the same procedures were used in identifying factors as Krohn et al. used.

In Section A, the History and Preference factor predicted placement in the low-participation group better during non-credit units and predicted placement in the high-participation group better during credit units. Therefore, if an instructor wanted to find which students would be disinclined to participate during courses that do not offer credit for participation, the History and Preference factor would be useful. The reason for this usefulness may be that many low participants tended to increase their participation during credit units, thus leaving only the students who never or very rarely participated in the low group during credit units. Some students may be able to transcend their reluctance to participate when a small amount of credit is given for participation, whereas others may have more significant reasons why they have a history of not participating (e.g., anxiety, shyness) that would be revealed in responses to the History and Preference items. The History and Preference factor will also successfully predict high participation during units that offer credit for participation. This finding is possibly due to high participants' having a history of participating and enjoying participation in class discussions. High participants also tend to be high achievers and may be motivated by achieving the maximum amount of points possible or the expectation that students should participate during units in which other students are participating (Krohn et al., 2010). In Section A, students knew which units participation did not count for credit, perhaps leading to the notion that participation was no longer required or expected at a high level during these units.

The results of the logistic regression analyses on the participation survey indicate that the best predictor of student participation may be the amount that the student had participated in his previous courses. However, participation history is reported by the student and may not reflect the student's actual participation in previous courses. Karp and Yoels (1976) mention that there

may be a big difference between the way students complete a survey and how they actually act in class. It is possible that a student may falsely indicate higher or lower levels of behavior to create a different impression when completing a survey. For example, students may think the correct answer to a question asking how much they participate in class is very frequently, but in actuality they may participate only rarely during class.

Although it is not possible to observe or change a student's history of participation, an instructor can influence a student's future participation. Therefore, instructors should make participating as comfortable for students as possible in order for reticent students to attempt to comment. Some suggestions on how to create a more inviting environment include being friendly with students, knowing students' names, providing students with the material before class, and using positive feedback for comments (Henning, 2005; Krohn et al., 2010; Mainkar, 2008; Reynolds & Nunn, 1997). Results on the survey showed that high participants scored higher on all factors than low participants, generally indicating a more favorable view of participation and class discussion. Specifically, high participants feel that participation makes classes more enjoyable and increases the student's evaluation of the course, contributing to a preference for a discussion course over a lecture course.

The results of some of the individual survey items provided additional insight into differentiated levels of participation. According to the survey, most students should be able to discriminate between a relevant and non-relevant comment (item 41). In fact, only 0.6% of students indicated that they were not able to tell if their comments were relevant. However, the reliability between students and observers for repetitious comments was virtually nonexistent, suggesting that most students may overestimate their ability to judge the quality of their



comments. Students also indicated that they preferred to participate more in classes they view as highly relevant. However, some students may choose a course only because it fulfills a basic requirement, making it difficult for their instructors to ignite interest in the discussion. In contrast to the findings of the Krohn et al. study (2010), more students reported that quantity of discussion is more likely to contribute to quality than detract from it (36.6%) than reported that quantity of discussion is more likely to detract from quality than contribute to it (29.3%). Twenty two percent of students believed that the two constructs are unrelated. In the Krohn study, more students reported that the quantity of discussion is likely to detract from quality (40.0%) than contribute to it (29.4%). Based on the results of these two studies, the perceived relationship between quantity and quality of discussion appears inconclusive among students. In addition, Sommer and Sommer (2004) found that 71% of students felt that credit for discussion increased the quality of class participation, further confounding the relationship between quantity and quality.

#### *Implications for Instructors*

An immediate or known credit contingency has been shown to increase student participation level during class discussion. The current study provides a framework to use credit effectively and efficiently to increase student participation. Previous research has shown that it is possible to increase participation in large lecture-based classes, as well as in smaller classes, through contingent credit for participation (Boniecki & Moore, 2003). However, there is a difference between simply increasing individual student participation and distributing participation across a larger number of students. To increase participation from the most reticent students, the credit given for commenting must be large enough to persuade these students to

participate but not overpower the credit received in other areas of the course. In this course, 2 comments per day were chosen as the level for the credit contingency. The number of comments required to obtain credit must be large enough to ensure the discussion stays active but small enough so reticent students can obtain at least partial credit. In addition, the credit criterion should not be so large that it encourages some students to dominate the discussion. Partial credit can be given for making occasional comments to encourage reticent students to participate even at a low level.

It is difficult to decrease the number of dominant participants during discussion, especially if the class has a large number of reticent students. Dominant students may feel the need to make up for the reticent students' minimal participation. Plus, dominant students may become irritated when their eagerness to participate is not rewarded with praise (Hodge & Nelson, 1991). Sometimes dominant participants may become frustrated when the instructor attempts to limit their comments or calls on another student. To circumvent this frustration, students should be made aware of the purpose of the credit contingency at the beginning of the course. That is, instructors must explain that distributing participation across all students is a goal of the discussion, and students who have not commented may be called on before those who comment frequently.

Several environmental or instructional changes made it easier in the current study to facilitate successful discussions more than in many large classrooms. Students were given questions to answer in writing on all reading assignments to increase retention and understanding of the material. The students had access to all of the instructor notes from the beginning of the course; during class periods the instructor simply asked questions about the readings and

encouraged discussion of controversial or complex issues. The instructor asked more higher-order than factual questions to facilitate deeper understanding and discussion of the material.

It is also important for the instructor to create a supportive classroom environment where students feel comfortable discussing controversial issues (Fassinger, 1995). The ideal setting for discussion is in small groups and/or circular seating, but this arrangement is not possible in many college classrooms. In the current study, the chairs were arranged in tiered rows in a semi-circle so students could see each other during discussion, even though some students sat behind or in front of others. All students had name cards displayed at all times so the other students and the instructor could easily identify them. The instructors attempted to foster relationships with students by showing interest in students before and after class, encouraging students to stop by for help with course topics during office hours, and using active listening techniques to show interest and respect for student comments.

Class participation encourages students to engage actively in course material, while applying and expanding upon the ideas addressed by the instructor (Benjamin, 1991). Participation in class discussions can enhance students' oral communication skills which is important for students who desire to become teachers. Through participating in discussions, students can practice discussing and evaluating ideas and course material in a safe environment. Participation also has been found to help students better understand material and retain course content, sometimes increasing course grades (McKeachie, 2002; Reynolds & Nunn, 1997). Even if increased participation may not lead to an increased grade on course exams, it does develop a communication skill that will be valuable in the teaching field.

Instructors should be aware that delaying selection of credit units until the end of the

course does not increase percentage of participants across the course units as much as advance notice does in preannounced credit units. In addition, randomizing credit units and days within units does not increase or sustain a high level of participation if students have to wait until the end of the course to choose credit days. To illustrate this point, Section B's average percentage of credit-level participants was somewhat closer to the average percentage of credit-level participation in the non-credit than the credit units of Section A, whereas Section C's average percentage of credit-level participants was closer to that of the credit than the non-credit phases in Section A. These cross-sectional comparisons indicate that the delayed and random selection of credit units and days was not as potent as known credit units but appeared to be more effective than a non-credit arrangement for participation. The chance for credit during any given day is too minimal and the reward too distant for students to maintain focus on the effects of participating every day.

In order to increase participation for reticent students and decrease participation for high participants, a more immediate credit contingency must be adopted. Revealing the credit units beforehand but randomly selecting the days to credit at the conclusion of the units encourages students to participate for all four days within the unit while only receiving credit for two of those days. Students should be reminded frequently about the possibility of gaining credit for participation during randomized or delayed credit contingencies so they do not lose focus on the contingency. However, delaying student knowledge of the credit contingency does not encourage the same level of class participation as when students have previous knowledge of the credit contingency, even though it does produce a higher level of participation than a non-credit contingency.

### *Limitations*

The design of this study used the percent of participants as the primary dependent variable rather than the frequency of participation, which limited the types of analysis that could be performed. Visual inspection of graphs/tables and proportions tests were the principal analyses used in comparing credit and non-credit units. Additionally, the research design for all sections began with a baseline of a known non-credit unit. Students in Section A knew that they would receive some credit for participation in Unit 2, and students in Sections B and C knew that they might receive some participation credit in Unit 2. Therefore, all sections were aware that participation credit was potentially available (if not certain) in Unit 2. Varying the treatment conditions may produce different views on participation from the beginning of the course. For instance, if participation is required in Unit 1, students may become used to the format of the class from the beginning and continue to participate throughout the course. Plus, early credit for participation may enhance the motivation for earning later credit for participation.

The best way to control for instructor behavior is to have only one instructor teach all three sections. As this was not possible, the researcher tried to limit instructional differences across sections and units within sections by monitoring instructors' behavior and giving them continuing feedback as to how their behaviors might be varying across units or from instructors in other sections. However, analyses showed that the instructor behaviors still differed somewhat, with one instructor asking more questions than the others. Some instructor behaviors were not accounted for, such as interactions with students before and after class, the level of formality of instructor questions, or the interactions between the instructors and specific groups

of students (e.g., females, non-traditional students, high participants). Even with these possible confounding variables, variations in instructor behavior did not appear to interact with treatment conditions in a way that would inflate or undermine treatment effects.

Other issues that may confound conclusions from this study were the presence of observers, the time limit of the class, and the number of students. There were always two observers who sat at the front corners of the classroom and, on the third recording day of each unit, four observers were in the classroom. Students were not informed as to the reason for the observers' presence, but they could obviously see the observers taking notes whenever someone commented during class. Given that students may have known that their participation in the class discussion was being tallied, they may have been more aware of their comments. However, the observers attempted to be as unobtrusive as possible. Plus, their presence and observation was equivalent across sections and units within sections.

Another possible limitation to this study was the time limit of each course session. Each session was only 50 minutes long, which definitely limited the number of comments each student could make. After observing and teaching the course, the researcher determined that a criterion of two comments was appropriate and attainable during each class. Nevertheless, some students who wished to make comments were not called on the few times they had their hands raised, which may have discouraged them from further attempts to participate. It may be preferable to record the number of hands raised or "intended comments" instead of actual comments due to some students' reticence to even raise their hands because of fear of being called on.

It would have been beneficial to interview low and high participants regarding their perceptions of the role of participation in the course. Often, feedback at the end of a course can

help an instructor understand why treatment conditions worked with some students and were ineffective with other students (Dallimore et al., 2004). Non-participants especially could provide insight as to why credit for participation may not be valued or why some students chose not to participate when given an extrinsic reward for participation. Some students may participate only because of the credit contingency, but others may feel insulted by the addition of external rewards and may lose their initial internal motivation to participate (Bean & Peterson, 1998; Deci, Koestner, & Ryan, 1999). Perhaps extra credit would reinforce those who need an external motivator to participate, while those intrinsically motivated to participate could earn extra credit in other ways.

#### *Future Research and Conclusions*

The current study is a continuation of the Krohn et al. (2010) study that examined the effect of credit on classroom participation. By using random credit contingencies, it is possible to increase the amount of days in which students participate at high levels and yet minimize the number of days that count for credit. In Section A, high participation was recorded throughout the credit units, even though only four days out of the eight total days were counted for credit. Nonetheless, more students participated in credit units than non-credit units. In Sections B and C, although there was relative consistency in participation across units, the percentage of students participating at credit level fell somewhere between the percentage of credit-level participants in the credit and non-credit phases in the section in which students knew the credit units in advance. Thus, some loss in the percentage of students participating at credit level did occur when the random selection of credit units was delayed until the end of the semester. Again, one has to weigh this decrement in credit-level participation against more consistency in participation

achieved under a random and delayed credit arrangement. Research should continue as to what level of delayed and randomized credit could maximize consistent and balanced participation among students.

Students' level of self-reported participation in previous courses was the best predictor of high or low participation in the current course. Given that some students are extremely reticent and do not participate even when credit is offered, follow-up interviews at the conclusion of the course may provide insight as to why these students are unwilling to participate. Several strategies can be used by instructors to increase the likelihood that students will participate: creating a welcoming environment, asking mainly comprehension questions, giving appropriate feedback for comments, encouraging students to ask questions or discuss complex topics, and insisting that students arrive to class prepared to discuss the materials. The goal is to balance quantity of participation across all students.

Future research concerning participation and course credit may search for answers to the following questions: Why do some students choose not to participate? Would a higher or lower level of credit encourage reticent students to participate more? Who is ultimately responsible for the quality and quantity of course discussion, the student or instructor? Would awarding credit for participating in small group activities increase reticent students' tendency to participate in the class as a whole? Do some students actually learn better by just listening than by participating? Would the instructor's presenting a tone before asking a question alert students to listen closely to the impending question? Does cold calling or voluntary commenting create a better discussion environment? How would the effects of cold calling work if no one volunteered comments? Would an interdependent group reward encourage more reticent students to participate? Could



students be taught to correctly identify the quality of their comments using a 3- 4- or 5-tiered scale? Do students who make more insightful comments perform better in the course?

Finally, is there a way to use delayed and/or random credit to increase class participation across the semester? One possibility is to use known credit at the beginning of the course as a primer for delayed or randomized credit contingencies in later units. Inasmuch as delayed and random credit produced minimal treatment effects in this study, further research on the usage of delayed and random credit to achieve the maximum amount of participation should be pursued. The answers to these questions will determine how instructors can obtain the highest and most consistent levels of participation, particularly in reticent students, while investing the least amount of time in record keeping.

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## Appendixes

## Appendix A: Tables

Table 1

*Flowchart of Treatment Combinations and Sequences for Each Section*

	Unit				
	1	2	3	4	5
Section A	BL-KNC	KC	KNC	KC	KNC
Section B	BL-KNC	UC <sup>c</sup>	UC <sup>nc</sup>	UC <sup>c</sup>	UC <sup>nc</sup>
Section C	BL-KNC	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>

*Note.* BL = baseline unit, KC = known credit unit, KNC = known non-credit unit, UC = unknown credit unit, RC = random credit unit, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.

Table 2

*Mean Daily Participation Level and Standard Deviation Based on Student Gender and Academic Classification*

	Daily Participation Mean					
	Overall	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
<b>Gender</b>						
Male	1.45 (1.29)	1.65 (1.53)	1.46 (1.26)	1.30 (1.25)	1.34 (1.22)	1.39 (1.61)
Female	1.66 (1.40)	1.83 (1.49)	1.65 (1.39)	1.68 (1.54)	1.68 (1.61)	1.45 (1.65)
<b>Academic Classification</b>						
Freshman	1.86 (1.30)	2.23 (1.45)	1.85 (1.14)	1.81 (1.73)	1.71 (1.19)	1.28 (1.64)
Sophomore	1.65 (1.53)	1.69 (1.56)	1.64 (1.46)	1.61 (1.57)	1.78 (1.88)	1.63 (1.84)
Junior	1.36 (1.17)	1.61 (1.69)	1.31 (1.12)	1.35 (1.20)	1.49 (1.24)	1.06 (1.17)
Senior	1.70 (1.15)	2.01 (1.06)	1.90 (1.43)	1.65 (1.33)	1.23 (0.90)	1.31 (1.43)
Graduate	1.94 (1.64)	2.19 (1.38)	1.83 (2.31)	1.83 (1.93)	1.96 (1.57)	1.83 (1.43)

Table 3

*Percent Agreement between Student and Observer Records of Class Participation*

		Units				
		1	2	3	4	5
Section A	Average	87.78	92.94	91.95	95.42	86.70
	Day 1	66.42	93.11	90.56	93.09	79.33
	Day 2	93.11	94.66	98.19	96.61	89.81
	Day 3	95.75	87.45	90.23	94.76	82.59
	Day 4	87.78	92.94	91.95	95.42	86.70
Section B	Average	85.78	93.18	97.10	94.93	96.61
	Day 1	66.42	93.22	98.52	95.84	93.88
	Day 2	93.11	94.66	99.11	98.21	99.11
	Day 3	95.75	88.40	96.73	94.64	95.84
	Day 4	98.85	96.55	94.05	91.02	97.63
Section C	Average	92.37	92.13	96.35	95.30	96.00
	Day 1	87.96	94.87	93.58	91.84	96.36
	Day 2	95.07	95.16	94.56	95.76	96.09
	Day 3	94.76	88.18	97.27	96.62	95.75
	Day 4	91.69	90.31	100.00	96.98	95.76

Table 4

*Percent Agreement between Observer Records of Class Participation*

		Units				
		1	2	3	4	5
Section A	Average	97.53	97.02	98.75	92.30	98.15
	Day 1	97.79	NA	NA	NA	NA
	Day 2	93.89	97.02	98.75	92.30	98.15
	Day 3	99.69	NA	NA	NA	NA
	Day 4	98.53	NA	NA	NA	NA
Section B	Average	96.79	94.66	99.11	98.21	99.11
	Day 1	94.55	NA	NA	NA	NA
	Day 2	96.71	94.66	99.11	98.21	99.11
	Day 3	NA	NA	NA	NA	NA
	Day 4	99.11	NA	NA	NA	NA
Section C	Average	99.26	97.95	98.61	92.80	98.09
	Day 1	NA	NA	NA	NA	NA
	Day 2	99.63	98.95	98.61	98.80	98.09
	Day 3	99.54	NA	NA	NA	NA
	Day 4	98.61	NA	NA	NA	NA



Table 5

*Means and Standard Deviations of Student and Primary Observer Record of Participation*

Section	Units									
	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Section A	BL-KNC		KC		KNC		KC		KNC	
Student	1.70	(1.14)	1.67	(1.08)	1.12	(1.23)	1.41	(1.16)	0.76	(1.22)
Observer 1	1.95	(1.60)	1.79	(1.36)	1.54	(1.88)	1.53	(1.40)	1.30	(2.02)
Difference	0.25	(0.46)	0.13	(0.28)	0.42	(0.65)	0.12	(0.24)	0.54	(0.80)
Section B	BL-KNC		UC <sup>c</sup>		UC <sup>nc</sup>		UC <sup>c</sup>		UC <sup>nc</sup>	
Student	1.64	(1.43)	1.51	(1.50)	1.45	(1.52)	1.41	(1.51)	1.16	(1.53)
Observer 1	2.01	(2.02)	1.70	(1.83)	1.63	(1.84)	1.78	(2.19)	1.49	(2.04)
Difference	0.37	(0.59)	0.19	(0.33)	0.18	(0.32)	0.37	(0.68)	0.33	(0.51)
Section C	BL-KNC		RC <sup>nc</sup>		RC <sup>nc</sup>		RC <sup>c</sup>		RC <sup>c</sup>	
Student	1.34	(1.34)	1.32	(1.30)	1.57	(1.23)	1.53	(1.25)	1.54	(1.34)
Observer 1	1.47	(1.53)	1.49	(1.55)	1.65	(1.35)	1.71	(1.50)	1.68	(1.59)
Difference	0.13	(0.19)	0.17	(0.25)	0.08	(0.12)	0.18	(0.25)	0.14	(0.25)

*Note.* BL = baseline unit, KC = known credit unit, KNC = known non-credit unit, UC = unknown credit unit,

RC = random credit unit, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.

Table 6

*Means and Standard Deviations of Recording of Number of Daily Comments*

Section	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Section A	BL-KNC		KC		KNC		KC		KNC	
Average	1.95	(1.60)	1.79	(1.36)	1.54	(1.88)	1.53	(1.40)	1.30	(2.02)
Day 1	2.06	(1.59)	1.72	(1.35)	1.18	(1.44)	1.48	(1.55)	1.40	(1.88)
Day 2	2.11	(1.69)	2.10	(1.67)	1.33	(1.66)	1.56	(1.41)	1.45	(2.44)
Day 3	1.94	(1.62)	1.69	(1.22)	1.85	(2.30)	1.55	(1.18)	1.36	(1.98)
Day 4	1.70	(1.50)	1.64	(1.19)	1.79	(2.10)	1.54	(1.47)	0.98	(1.79)
Section B	BL-KNC		UC <sup>c</sup>		UC <sup>nc</sup>		UC <sup>c</sup>		UC <sup>nc</sup>	
Mean	2.01	(2.02)	1.70	(1.83)	1.63	(1.84)	1.78	(2.19)	1.49	(2.04)
Day 1	1.75	(1.91)	1.85	(1.90)	1.57	(1.90)	1.49	(1.89)	1.22	(1.75)
Day 2	2.16	(2.04)	1.83	(1.90)	1.74	(1.83)	1.88	(2.23)	1.65	(1.99)
Day 3	2.37	(2.09)	1.60	(1.64)	1.69	(1.84)	2.41	(2.74)	1.63	(2.02)
Day 4	1.75	(2.03)	1.50	(1.87)	1.53	(1.79)	1.33	(1.88)	1.46	(2.42)
Section C	BL-KNC		RC <sup>nc</sup>		RC <sup>nc</sup>		RC <sup>c</sup>		RC <sup>c</sup>	
Average	1.47	(1.53)	1.49	(1.55)	1.65	(1.35)	1.71	(1.50)	1.68	(1.59)
Day 1	1.47	(1.47)	1.47	(1.63)	1.80	(1.36)	1.85	(1.49)	2.08	(1.84)
Day 2	1.60	(1.48)	1.43	(1.27)	1.67	(1.30)	1.80	(1.53)	1.74	(1.56)
Day 3	1.10	(1.29)	1.26	(1.36)	1.22	(1.10)	1.73	(1.64)	1.43	(1.43)
Day 4	1.71	(1.89)	1.78	(1.94)	1.90	(1.62)	1.45	(1.33)	1.47	(1.52)

Table 7

*Percent Agreement between Student and Primary Observer Records of Timely Student Participation during Each Unit*

Unit	1	2	3	4	5
Section A	BL-KNC	KC	KNC	KC	KNC
Day 1	61.93	92.52	89.17	92.83	79.61
Day 2	92.81	95.33	90.39	87.89	86.69
Day 3	96.57	87.89	91.93	95.04	83.89
Day 4	96.87	96.57	98.11	94.74	95.04
Section B	BL-KNC	UC <sup>c</sup>	UC <sup>nc</sup>	UC <sup>c</sup>	UC <sup>nc</sup>
Day 1	88.09	98.18	98.50	95.82	93.71
Day 2	97.61	95.50	98.21	95.80	97.61
Day 3	95.82	93.43	97.29	94.91	94.61
Day 4	97.61	98.50	92.25	91.07	97.61
Section C	BL-KNC	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>
Day 1	88.16	94.18	92.69	92.05	96.35
Day 2	94.80	91.49	93.60	93.31	94.18
Day 3	93.89	86.35	95.45	96.62	94.84
Day 4	91.16	89.02	96.36	96.64	93.93

*Note.* BL = baseline unit, RC = random credit, KC = known credit unit, KNC = known non-credit unit,

UC = unknown credit unit, NR = not recorded, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.

Table 8

*Percent Agreement between Student and Observer Records of Timely Student Participation on Inter-rater Check Days*

Pairs within sections	1	2	3	4	5
Section A	BL-KNC	KC	KNC	KC	KNC
Students and observer 1	87.05	93.08	92.40	92.63	86.31
Students and observer 2	86.19	92.85	88.54	89.44	89.17
Section B	BL-KNC	UC <sup>c</sup>	UC <sup>nc</sup>	UC <sup>c</sup>	UC <sup>nc</sup>
Students and observer 1	94.78	96.40	96.56	94.40	85.88
Students and observer 2	95.92	94.02	99.11	97.59	96.71
Students and observer 3	95.82	NR	NR	NR	NR
Section C	BL-KNC	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>
Students and observer 1	92.00	90.26	94.53	94.65	94.82
Students and observer 2	93.59	91.49	92.07	94.22	93.27
Students and observer 3	94.80	NR	NR	NR	NR
All sections					
Students and observer 1	91.28	93.25	94.50	93.89	92.34
Students and observer 2	91.90	92.79	93.24	93.75	93.05
Students and observer 3	95.31	NR	NR	NR	NR

*Note.* BL = baseline unit, RC = random credit, KC = known credit unit, KNC = known non-credit unit,

UC = unknown credit unit, NR = not recorded, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.

Table 9

*Percent Agreement between Observer Records of Timely Student Participation on Inter-rater Check Days*

Pairs within sections	Units				
	1	2	3	4	5
Section A	BL	KC	KNC	KC	KNC
Observer 1 and observer 2	97.98	97.52	98.15	94.74	97.52
Section B	BL	UC <sup>c</sup>	UC <sup>nc</sup>	UC <sup>c</sup>	UC <sup>nc</sup>
Observer 1 and observer 2	97.92	96.43	98.21	98.21	99.11
Observer 1 and observer 3	00.11	NR	NR	NR	NR
Observer 2 and observer 3	98.66	NR	NR	NR	NR
Section C	BL	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>
Observer 1 and observer 2	99.70	99.38	98.47	96.36	99.09
Observer 1 and observer 3	100.00	NR	NR	NR	NR
Observer 2 and observer 3	100.00	NR	NR	NR	NR
All sections					
Observer 1 and observer 2	98.53	97.78	98.29	96.44	98.57
Observer 1 and observer 3	99.11	NR	NR	NR	NR
Observer 2 and observer 3	98.66	NR	NR	NR	NR

*Note.* BL = baseline unit, RC = random credit, KC = known credit unit, KNC = known non-credit unit, UC = unknown credit unit, NR = not recorded, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.

Table 10

*Percent Agreement between Student and Observer Records of Repetitious Student Commenting on Baseline (b), Credit (c), and Non-Credit (nc) Units*

	Units				
	1	2	3	4	5
Section A	b	c	nc	c	nc
Students and observer 1*	0% (0/5)	25% (1/4)	0% (0/3)	0% (0/4)	0% (0/1)
Observers 1 and 2**	100% (0/0)	100% (1/1)	100% (2/2)	0% (0/1)	50% (1/2)
Section B	b	c	nc	c	nc
Students and observer 1	0% (0/5)	0% (0/4)	0% (0/3)	0% (0/2)	0% (0/4)
Observers 1 and 2	100% (0/0)	100% (0/0)	100% (0/0)	100% (0/0)	100% (0/0)
Section C	b	nc	nc	c	c
Students and observer 1	0% (0/7)	0% (0/6)	0% (0/8)	0% (0/9)	0% (0/5)
Observers 1 and 2	100% (0/0)	100% (0/0)	100% (0/0)	100% (0/0)	100% (0/0)

*Note.* <sup>b</sup> = baseline unit, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit

\*Based on the number of cases in the entire four-day unit

\*\* Based on the number of cases on only the inter-rater day in each unit

Table 11

*Percent Agreement between Observer Records of Teacher Questions*

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Section A	b	c	nc	c	nc
Factual	87.50	96.15	82.35	80.00	100.00
Comprehension	73.91	88.24	62.50	71.43	60.00
Total	89.19	93.02	72.73	83.33	80.65
Section B	b	c	nc	c	nc
Factual	94.44	93.33	90.91	90.91	62.50
Comprehension	93.75	79.17	71.43	82.05	81.82
Total	94.12	84.62	78.13	85.25	94.12
Section C	b	c	c	nc	nc
Factual	100.00	95.00	80.00	94.44	81.82
Comprehension	87.50	91.67	92.31	79.17	92.31
Total	92.86	100.00	84.85	90.24	87.50

*Note.* <sup>b</sup> = baseline unit, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.

Table 12

*Percent Agreement between Observer Records of Total Teacher Feedback*

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Section A	b	c	nc	c	nc
Positive feedback	97.20	92.78	91.21	98.73	100.00
Negative feedback	0.00	100.00	0.00	100.00	100.00
Total	98.11	94.06	94.44	89.67	95.37
Section B	b	c	nc	c	nc
Positive feedback	97.96	96.04	90.00	93.00	96.83
Negative feedback	50.00	66.67	33.33	50.00	100.00
Total	95.14	97.04	95.84	96.43	100.00
Section C	b	nc	nc	c	c
Positive feedback	97.18	98.55	100.00	98.60	96.51
Negative feedback	33.33	66.67	100.00	81.82	100.00
Total	98.00	92.61	99.40	94.20	98.18
All sections					
Positive feedback	97.45	95.79	93.73	96.78	97.78
Negative feedback	27.78	77.78	44.44	77.27	100.00
Total	97.08	94.57	96.56	93.43	97.85

*Note.* <sup>b</sup> = baseline unit, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.



Table 13

*Number of Initially Low-Participating Students Falling into Low, Medium, and High Categories in Each Unit (Intra-subject Comparisons across Units)*

		Units				
		1	2	3	4	5
Section A	n =	12	12	12	12	11
Low		12	5	8	8	8
Medium		0	6	3	4	3
High		0	1	1	0	0
Section B	n =	14	14	14	14	14
Low		14	11	13	12	13
Medium		0	3	1	1	0
High		0	0	0	1	1
Section C	n =	18	18	17	15	15
Low		18	13	8	9	11
Medium		0	5	8	6	4
High		0	0	1	0	0

Low = mean participation less than 2 comments per unit

Medium = mean participation between 2 and 8 comments per unit

High = mean participation greater than 8 comments per unit

Table 14

*Percent of Initially Medium-Participating Students Falling into Low, Medium, and High Categories in Each Unit (Intra-subject Comparisons across Units)*

		Units				
		1	2	3	4	5
Section A	n =	14	14	14	14	14
Low		0	3	8	6	11
Medium		14	8	5	5	1
High		0	3	1	3	2
Section B	n =	18	18	17	18	17
Low		0	6	7	6	7
Medium		18	11	7	10	9
High		0	1	3	2	1
Section C	n =	17	17	17	17	17
Low		0	4	1	1	3
Medium		17	6	7	10	7
High		0	7	9	6	7

Low = mean participation less than 2 comments per unit

Medium = mean participation between 2 and 8 comments per unit

High = mean participation greater than 8 comments per unit

Table 15

*Percent of Initially High-Participating Students Falling into Low, Medium, and High Categories in Each Unit (Intra-subject Comparisons across Units)*

		Units				
		1	2	3	4	5
Section A	n =	24	24	24	23	23
Low		0	0	5	2	6
Medium		0	9	8	5	6
High		24	15	11	16	11
Section B	n =	23	23	22	22	22
Low		0	1	2	0	2
Medium		0	7	6	5	7
High		23	15	14	17	13
Section C	n =	16	16	16	15	16
Low		0	0	1	2	2
Medium		0	5	2	2	0
High		16	11	13	11	14

Low = mean participation is 0-2 comments per unit

Medium = mean participation between 2 and 8 comments per unit

High = mean participation 8 or more comments per unit

Table 16

*Number of Timely and Repetitive Comments per Unit Recorded by Students and the Primary**Observer*

	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5	
	T	R	T	R	T	R	T	R	T	R
Section A	b		c		nc		c		nc	
Student	325,	5	333,	4	211,	3	264,	4	139,	1
Observer	392,	2	357,	3	290,	2	288,	1	238,	2
Section B	b		c		nc		c		nc	
Student	342,	5	300,	4	285,	3	263,	2	225,	4
Observer	420,	0	337,	2	322,	4	330,	0	290,	2
Section C	b		nc		nc		c		c	
Student	261,	7	245,	6	290,	8	269,	9	265,	5
Observer	289,	0	278,	0	306,	0	298,	1	289,	0

Note. R = repetitive comments, T = timely comments; <sup>b</sup> = baseline unit, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.

Table 17

*Number of Questions (Factual, Comprehension, Total) Posed by Instructors by Unit within Each*

*Section*

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total
Section A	b	c	nc	c	nc	
Factual	47	54	40	46	35	222
Comprehension	56	59	43	62	44	264
Total	103	113	83	108	79	486
Section B	b	c	nc	c	nc	
Factual	58	55	39	57	29	238
Comprehension	66	73	65	101	74	379
Total	124	128	104	158	103	617
Section C	b	nc	nc	c	c	
Factual	46	62	53	55	44	260
Comprehension	58	54	47	66	55	280
Total	104	116	100	121	99	540

*Note.* <sup>b</sup> = baseline unit, <sup>c</sup> = credit unit, <sup>nc</sup> = non-credit unit.

Table 18

*Number of Feedback (Positive, Negative) Given to Students by Instructors by Unit within Each*

*Section*

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Section A	BL	KC	NC	KC	NC
Positive	357	343	268	272	228
Negative	8	9	13	8	2
Total	365	352	281	280	230
Section B	BL	UC <sup>c</sup>	UC <sup>nc</sup>	UC <sup>c</sup>	UC <sup>nc</sup>
Positive	392	317	311	288	311
Negative	4	9	6	22	6
Total	396	326	317	310	317
Section C	BL	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>
Positive	270	261	300	266	277
Negative	3	13	1	21	7
Total	276	274	301	287	284

*Note.* BL = Baseline unit; KC = known credit unit; NC = known non-credit unit; UC = unknown credit unit; RC = random credit unit; <sup>c</sup> = credit unit; <sup>nc</sup> = non-credit unit.

Table 19

*Means and Standard Deviations for Positive and Negative Instructor Feedback following*

*Student Participation per Day in Each Unit*

Section	Units									
	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Section A	BL		KC		NC		KC		NC	
Positive	1.75	(0.19)	1.72	(0.23)	1.40	(0.26)	1.45	(0.19)	1.24	(0.17)
Negative	0.04	(0.05)	0.05	(0.01)	0.07	(0.04)	0.04	(0.04)	0.01	(0.02)
Section B	BL		UC <sup>c</sup>		UC <sup>nc</sup>		UC <sup>c</sup>		UC <sup>nc</sup>	
Positive	1.85	(0.20)	1.59	(0.26)	1.59	(0.11)	1.53	(0.12)	1.59	(0.11)
Negative	0.02	(0.03)	0.05	(0.03)	0.03	(0.02)	0.12	(0.10)	0.03	(0.02)
Section C	BL		RC <sup>nc</sup>		RC <sup>nc</sup>		RC <sup>c</sup>		RC <sup>c</sup>	
Positive	1.38	(0.28)	1.38	(0.12)	1.60	(0.29)	1.51	(0.18)	1.45	(0.33)
Negative	0.03	(0.01)	0.07	(0.04)	0.01	(0.01)	0.12	(0.07)	0.07	(0.02)
Combined										
Positive	1.67	(0.22)	1.56	(0.21)	1.53	(0.22)	1.50	(0.16)	1.48	(0.20)
Negative	0.03	(0.03)	0.05	(0.03)	0.03	(0.02)	0.09	(0.07)	0.03	(0.02)

*Note.* BL = Baseline unit; KC = known credit unit; NC = known non-credit unit; UC = unknown credit unit; RC = random credit unit; <sup>c</sup> = credit unit; <sup>nc</sup> = non-credit unit.

Table 20

*Mean Scores and Standard Deviations on the Participation Survey for Initially Low-, Medium-, and High-Responding Participants*

	Participant Groups		
	Low	Medium	High
Total Survey <sup>a</sup>	166.27 (16.09)	178.20 (16.82)	184.75 (14.11)
Combined Factors <sup>b</sup>	96.85 (12.19)	107.54 (12.22)	113.65 (10.08)
Factor 1: History and Preference <sup>c</sup>	21.05 (5.41)	26.11 (4.70)	29.77 (4.00)
Factor 2: Impact of Discussion <sup>d</sup>	17.78 (3.91)	20.35 (3.49)	21.75 (3.24)
Factor 3: Investment in Discussion <sup>e</sup>	13.71 (2.71)	15.23 (2.59)	15.37 (2.53)
Factor 4: Relevance of Discussion <sup>f</sup>	12.85 (1.39)	13.15 (1.43)	13.32 (1.58)
Factor 5: Impediments to Discussion <sup>f</sup>	9.93 (2.27)	11.12 (2.21)	11.44 (2.08)
Factor 6: Responsibility for Discussion <sup>f</sup>	9.56 (1.60)	9.50 (1.48)	9.72 (1.79)
Factor 7: Quality Contributions <sup>f</sup>	10.34 (1.81)	10.45 (1.72)	10.60 (1.55)
Discarded Survey Items <sup>g</sup>	71.05 (6.02)	72.32 (6.06)	72.73 (5.20)

*Note.* <sup>a</sup>Possible score range was 50 - 250. <sup>b</sup>Possible score range was 30 - 150. <sup>c</sup>Possible score range was 8 - 40.

<sup>d</sup>Possible score range was 6 - 30. <sup>e</sup>Possible score range was 4 - 20. <sup>f</sup>Possible score range was 3 - 15. <sup>g</sup>Possible score range was 20 - 100.



Table 21

*Logistic Regression Results using the Total Participation Survey Items to Predict Placement in Low- and High-Participation Groups each Unit*

Unit	<i>B</i>	SE	Wald statistic	Odds Ratio	95% CI for		$R^{2\dagger}$
					Lower	Upper	
1 <sup>a</sup>	0.06	0.01	18.00***	1.06	1.03	1.09	0.18
2 <sup>b</sup>	0.06	0.02	15.93***	1.06	1.03	1.09	0.18
3 <sup>c</sup>	0.06	0.01	16.66***	1.06	1.03	1.09	0.17
4 <sup>d</sup>	0.07	0.02	17.81***	1.07	1.04	1.10	0.20
5 <sup>e</sup>	0.04	0.01	11.20***	1.04	1.02	1.07	0.11

\*\*\*  $p < .001$

† Cox & Snell R-squared

<sup>a</sup>Significance for the full model,  $X^2(1) = 23.14$ ,  $p < .001$ .

<sup>b</sup>Significance for the full model,  $X^2(1) = 20.62$ ,  $p < .001$ .

<sup>c</sup>Significance for the full model,  $X^2(1) = 21.01$ ,  $p < .001$ .

<sup>d</sup>Significance for the full model,  $X^2(1) = 24.37$ ,  $p < .001$ .

<sup>e</sup>Significance for the full model,  $X^2(1) = 13.15$ ,  $p < .001$ .

Table 22

*Percent of Cases Correctly Classified into Low and High Groups each Unit by Section with the with the Total Participation Survey Score for Each Student as the Predictor Variable*

Unit	1	2	3	4	5
Section A	BL	KC	NC	KC	NC
Low Participants	8.3%	12.5%	81.8%	43.8%	73.1%
High Participants	96.3%	90.5%	68.8%	77.3%	46.7%
Overall	69.2%	69.0%	76.3%	63.2%	63.4%
Section B	BL	UC <sup>c</sup>	UC <sup>nc</sup>	UC <sup>c</sup>	UC <sup>nc</sup>
Low Participants	66.7%	72.2%	72.7%	76.5%	72.7%
High Participants	82.6%	76.5%	64.7%	85.0%	35.7%
Overall	76.3%	74.3%	69.2%	81.1%	58.3%
Section C	BL	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>
Low Participants	66.7%	55.6%	18.2%	38.5%	23.5%
High Participants	78.9%	71.4%	100.0%	90.0%	87.5%
Overall	73.0%	64.1%	75.7%	69.7%	61.0%
All Sections Combined					
Low Participants	57.8%	56.8%	60.0%	60.9%	64.1%
High Participants	85.5%	79.7%	71.2%	79.0%	51.9%
Overall	74.6%	69.9%	65.8%	71.3%	58.5%

*Note.* BL = baseline units; KC =known credit; NC = known no credit; UC = unknown credit; RC = random credit;

<sup>c</sup> = credit unit; <sup>nc</sup> = non-credit unit

Table 23

*Logistic Regression Analysis of Combined Participation Survey Factor Scores across Units*

Unit	<i>B</i>	SE	Wald statistic	Odds Ratio	95% CI for		$R^{2\dagger}$
					Lower	Upper	
1 <sup>a</sup>	0.10	0.02	22.38***	1.10	1.06	1.15	0.25
2 <sup>b</sup>	0.09	0.02	19.93***	1.10	1.05	1.14	0.24
3 <sup>c</sup>	0.10	0.02	21.77***	1.10	1.06	1.14	0.24
4 <sup>d</sup>	0.11	0.02	22.86***	1.12	1.07	1.17	0.28
5 <sup>e</sup>	0.08	0.02	17.96***	1.09	1.05	1.13	0.19

\*\*\*  $p < .001$ 

† Cox &amp; Snell R-squared

<sup>a</sup>Significance for the full model,  $X^2(1) = 32.68$ ,  $p < .001$ .<sup>b</sup>Significance for the full model,  $X^2(1) = 28.41$ ,  $p < .001$ .<sup>c</sup>Significance for the full model,  $X^2(1) = 31.06$ ,  $p < .001$ .<sup>d</sup>Significance for the full model,  $X^2(1) = 35.54$ ,  $p < .001$ .<sup>e</sup>Significance for the full model,  $X^2(1) = 24.13$ ,  $p < .001$ .

Table 24

*Percent of Cases Correctly Classified into Low and High Groups each Unit by Section with the Seven Survey Factors together as a Model for Predicting Participation*

Unit	1	2	3	4	5
Section A	BL	KC	NC	KC	NC
Low Participants	16.7%	37.5%	81.8%	62.5%	73.1%
High Participants	96.3%	90.5%	62.5%	77.3%	46.7%
Overall	71.8%	75.9%	73.7%	71.1%	63.4%
Section B	BL	UC <sup>c</sup>	UC <sup>nc</sup>	UC <sup>c</sup>	UC <sup>nc</sup>
Low Participants	73.3%	77.8%	77.3%	82.4%	76.2%
High Participants	82.6%	76.5%	76.5%	90.0%	80.0%
Overall	78.9%	77.1%	76.9%	86.5%	77.8%
Section C	BL	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>
Low Participants	66.7%	50.0%	36.4%	33.3%	31.3%
High Participants	83.3%	80.0%	96.9%	85.0%	79.2%
Overall	75.0%	65.8%	77.8%	65.6%	60.0%
All Sections Combined					
Low Participants	84.4%	77.3%	74.2%	82.2%	76.2%
High Participants	89.7%	87.9%	84.5%	88.7%	70.4%
Overall	87.6%	83.3%	79.6%	86.0%	73.5%

*Note.* BL = baseline units; KC =known credit; NC = known no credit; UC = unknown credit; RC = random credit;

<sup>c</sup> = credit unit; <sup>nc</sup> = non-credit unit

Table 25

*Logistic Regression Analysis of All Participation Survey Factor Scores as Predictors*

Factor	<i>B</i>	SE	Wald statistic	Odds Ratio	95% CI for		<i>R</i> <sup>2†</sup>
					Lower	Upper	
Unit 1 <sup>a</sup>							
History and Preference	0.53	0.11	23.71***	1.70	1.37	2.10	0.45
Impact of Discussion	-0.05	0.11	0.19	0.95	0.76	1.19	0.45
Investment in Discussion	-0.20	0.14	1.94	0.82	0.62	1.08	0.45
Relevance of Discussion	0.65	0.21	9.32**	1.92	1.26	2.93	0.45
Impediments to Discussion	-0.11	0.15	0.55	0.90	0.67	1.20	0.45
Responsibility for Discuss.	-0.12	0.19	0.41	0.89	0.62	1.28	0.45
Quality Contributions	-0.28	0.18	2.34	0.76	0.53	1.08	0.45
Unit 2 <sup>b</sup>							
History and Preference	0.33	0.08	15.73***	1.39	1.18	1.64	0.37
Impact of Discussion	-0.05	0.11	0.23	1.05	0.86	1.29	0.37
Investment in Discussion	-0.09	0.13	0.51	0.91	0.71	1.17	0.37
Relevance of Discussion	0.36	0.18	4.00*	1.43	1.01	2.03	0.37
Impediments to Discussion	-0.03	0.15	0.05	0.97	0.72	1.30	0.37
Responsibility for Discuss.	-0.25	0.17	2.15	0.78	0.56	1.09	0.37
Quality Contributions	-0.26	0.19	2.03	0.77	0.53	1.11	0.37

Table 25 Continued

Factor	<i>B</i>	SE	Wald statistic	Odds Ratio	95% CI for		$R^{2\ddagger}$
					Lower	Upper	
Unit 3 <sup>c</sup>							
History and Preference	0.26	0.07	13.74***	1.29	1.13	1.48	0.35
Impact of Discussion	0.13	0.10	1.74	1.14	0.94	1.39	0.35
Investment in Discussion	-0.20	0.12	2.87	0.82	0.65	1.03	0.35
Relevance of Discussion	0.11	0.17	0.41	1.11	0.80	1.55	0.35
Impediments to Discussion	0.80	0.13	0.40	1.08	0.85	1.39	0.35
Responsibility for Discuss.	-0.21	0.16	1.70	0.81	0.59	1.11	0.35
Quality Contributions	0.05	0.17	0.10	1.06	0.76	1.46	0.35
Unit 4 <sup>d</sup>							
History and Preference	0.32	0.08	16.70***	1.29	1.18	1.61	0.41
Impact of Discussion	0.13	0.10	1.65	1.14	0.93	1.40	0.41
Investment in Discussion	-0.28	0.15	3.59	0.82	0.57	1.01	0.41
Relevance of Discussion	0.40	0.21	3.60	1.11	0.99	2.25	0.41
Impediments to Discussion	0.14	0.15	0.84	1.08	0.86	1.53	0.41
Responsibility for Discuss.	-0.27	0.18	2.35	0.81	0.54	1.08	0.41
Quality Contributions	-0.08	0.19	0.18	1.06	0.64	1.33	0.41

Table 25 Continued

Factor	<i>B</i>	SE	Wald statistic	Odds Ratio	95% CI for		$R^{2\dagger}$
					Lower	Upper	
Unit 5 <sup>e</sup>							
History and Preference	0.29	0.07	16.07***	1.34	1.14	1.55	0.32
Impact of Discussion	0.12	0.09	1.94	1.13	0.95	1.35	0.32
Investment in Discussion	-0.14	0.11	1.44	0.87	0.70	1.09	0.32
Relevance of Discussion	0.24	0.17	2.02	1.28	0.91	1.78	0.32
Impediments to Discussion	-0.06	0.12	0.21	0.95	0.74	1.20	0.32
Responsibility for Discuss.	-0.21	0.15	2.06	0.81	0.60	1.08	0.32
Quality Contributions	-0.31	0.17	3.29	0.73	0.53	1.03	0.32

\* $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

† Cox & Snell R-squared

<sup>a</sup>Significance for the full model,  $X^2(7) = 68.65$ ,  $p < .001$ ,  $R^2 = .46$ .

<sup>b</sup>Significance for the full model,  $X^2(7) = 46.91$ ,  $p < .001$ ,  $R^2 = .37$ .

<sup>c</sup>Significance for the full model,  $X^2(7) = 48.27$ ,  $p < .001$ ,  $R^2 = .35$ .

<sup>d</sup>Significance for the full model,  $X^2(7) = 56.71$ ,  $p < .001$ ,  $R^2 = .41$ .

<sup>e</sup>Significance for the full model,  $X^2(7) = 45.59$ ,  $p < .001$ ,  $R^2 = .32$ .

Table 26

*Logistic Regression Analysis of the History and Preference Factor in Units Significant in the Combined Factor Score*

Factor	<i>B</i>	SE	Wald statistic	Odds Ratio	95% CI for	
					Lower	Upper
Unit 1 <sup>a</sup>						
History and Preference	0.31	0.58	29.61***	1.37	1.22	1.53
Unit 2 <sup>b</sup>						
History and Preference	0.25	0.05	24.48***	1.28	1.16	1.41
Unit 3 <sup>c</sup>						
History and Preference	0.27	0.05	27.09***	1.31	1.18	1.45
Unit 4 <sup>d</sup>						
History and Preference	0.28	0.05	27.75***	1.32	1.19	1.47
Unit 5 <sup>e</sup>						
History and Preference	0.24	0.05	24.37***	1.27	1.15	1.39

\*  $p < .05$ ; \*\*\*  $p < .001$

<sup>a</sup>Significance for the full model,  $X^2(1) = 52.75$ ,  $p < .001$ ,  $R^2 = .37$ .

<sup>b</sup>Significance for the full model,  $X^2(1) = 38.26$ ,  $p < .001$ ,  $R^2 = .31$ .

<sup>c</sup>Significance for the full model,  $X^2(1) = 42.74$ ,  $p < .001$ ,  $R^2 = .32$ .

<sup>d</sup>Significance for the full model,  $X^2(1) = 45.73$ ,  $p < .001$ ,  $R^2 = .35$ .

<sup>e</sup>Significance for the full model,  $X^2(1) = 36.00$ ,  $p < .001$ ,  $R^2 = .27$ .



Table 27

*Logistic Regression Analysis of the Relevance of Discussion Factor in Units Significant in the Combined Factor Score*

Factor	<i>B</i>	SE	Wald statistic	Odds Ratio	95% CI for	
					Lower	Upper
Unit 1 <sup>a</sup>						
Relevance of Discussion	0.15	0.13	1.26	1.16	.90	1.51
Unit 2 <sup>b</sup>						
Relevance of Discussion	0.13	0.13	.92	1.13	.88	1.46

<sup>a</sup>Significance for the full model,  $X^2(1) = 1.27, p = .26, R^2 = .01$ .

<sup>b</sup>Significance for the full model,  $X^2(1) = .92, p = .34, R^2 = .01$ .

Table 28

*Percent of Cases Correctly Classified into Low and High Groups each Unit by Section with only the History and Preference Factor as a Model for Predicting Participation*

Unit	1	2	3	4	5
Section A	BL	KC	NC	KC	NC
Low Participants	58.3%	37.5%	86.4%	62.5%	80.8%
High Participants	96.3%	90.5%	68.8%	86.4%	53.3%
Overall	84.6%	75.9%	78.9%	76.3%	70.7%
Section B	BL	UC <sup>c</sup>	UC <sup>nc</sup>	UC <sup>c</sup>	UC <sup>nc</sup>
Low Participants	80.0%	77.8%	77.3%	88.2%	76.2%
High Participants	82.6%	82.4%	76.5%	90.0%	73.3%
Overall	81.6%	80.0%	76.9%	89.2%	75.0%
Section C	BL	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>
Low Participants	72.2%	55.6%	45.5%	41.7%	50.0%
High Participants	88.9%	80.0%	92.0%	85.0%	87.5%
Overall	80.6%	68.4%	77.8%	68.8%	72.5%
All Sections Combined					
Low Participants	66.7%	65.9%	65.5%	68.9%	69.8%
High Participants	88.2%	84.5%	81.0%	87.1%	64.8%
Overall	79.6%	76.5%	73.5%	79.4%	67.5%

*Note.* BL = baseline units; KC = known credit unit; NC = known non-credit unit; UC = unknown credit unit; RC = random credit unit; <sup>c</sup> = credit unit; <sup>nc</sup> = non-credit unit.

Table 29

*Percent of Cases Correctly Classified into Low and High Groups each Unit by Section with only the Relevance of Discussion as a Model for Predicting Participation*

Unit	1	2
Section A	BL	KC
Low Participants	0.00%	0.00%
High Participants	100.00%	100.00%
Overall	69.2%	72.4%
Section B	BL	UC <sup>c</sup>
Low Participants	26.7%	55.6%
High Participants	91.3%	64.7%
Overall	65.8%	60.0%
Section C	BL	RC <sup>nc</sup>
Low Participants	27.8%	27.8%
High Participants	84.2%	81.0%
Overall	56.8%	56.4%
All Sections Combined		
Low Participants	6.7%	2.3%
High Participants	94.2%	89.8%
Overall	59.6%	52.4%

*Note.* BL = baseline units; KC = known credit unit; NC = known non-credit unit; UC = unknown credit unit; RC = random credit unit; <sup>c</sup> = credit unit; <sup>nc</sup> = non-credit unit.

## Appendix B: Figures

### Student Record Card

Name: \_\_\_\_\_ N Card: (  ) Yes  or No

Unit: \_\_\_\_\_ Date: \_\_\_\_\_ IN HW: (  ) Yes  or No

AQ HW: (  ) Yes  or No

Voluntary Comments: Check each comment as Timely (T) or Repetitious (R).

1. T ( ) or R ( ) --

2. T ( ) or R ( ) --

3. T ( ) or R ( ) --

Over: (  ) Yes  or No

*Figure 1.* Record card for recording participation and daily credit activities.

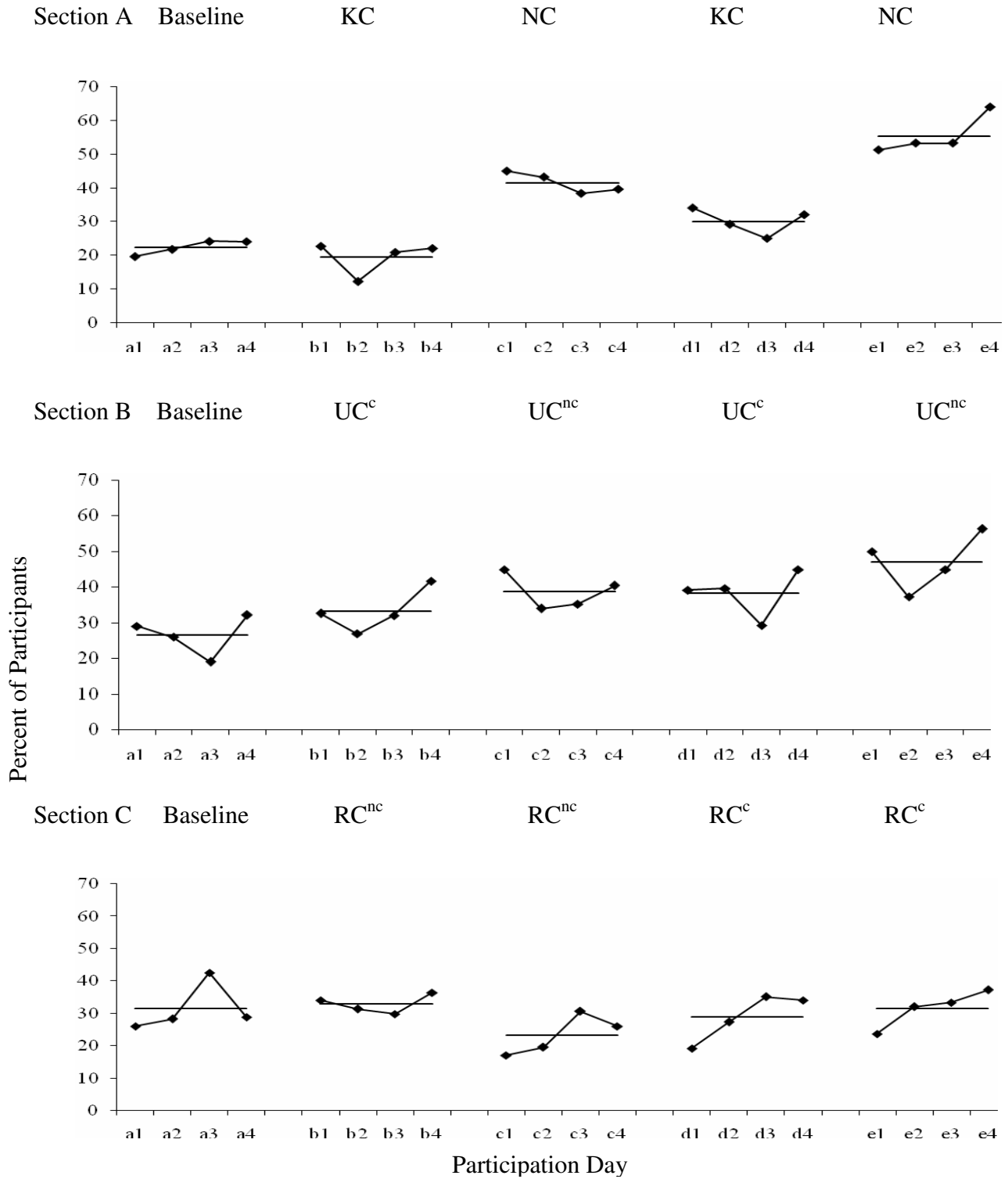


Figure 2. Percent of non-participants each day (0 comments).

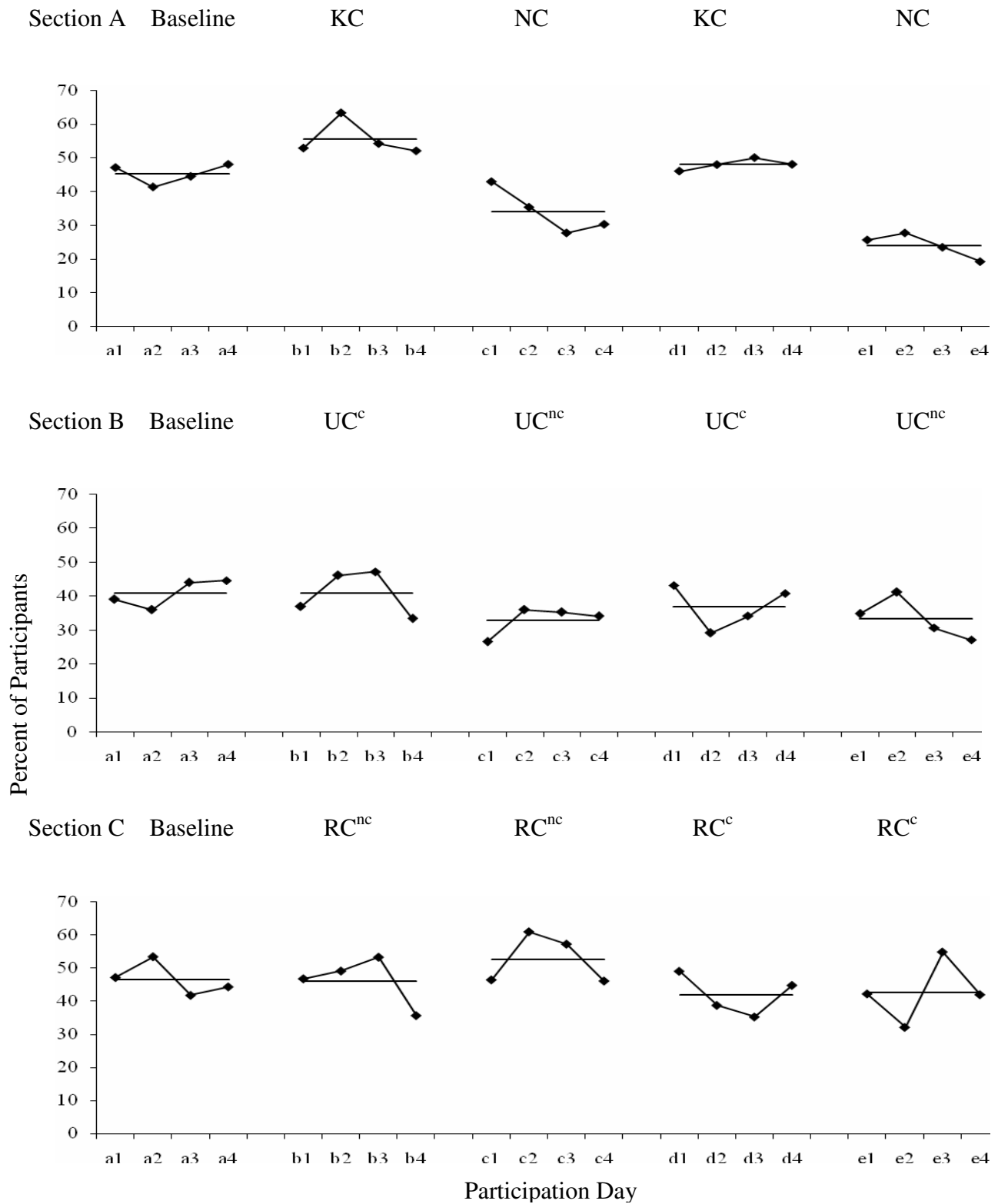


Figure 3. Percent of students partially meeting credit contingency each day (1-2 comments).

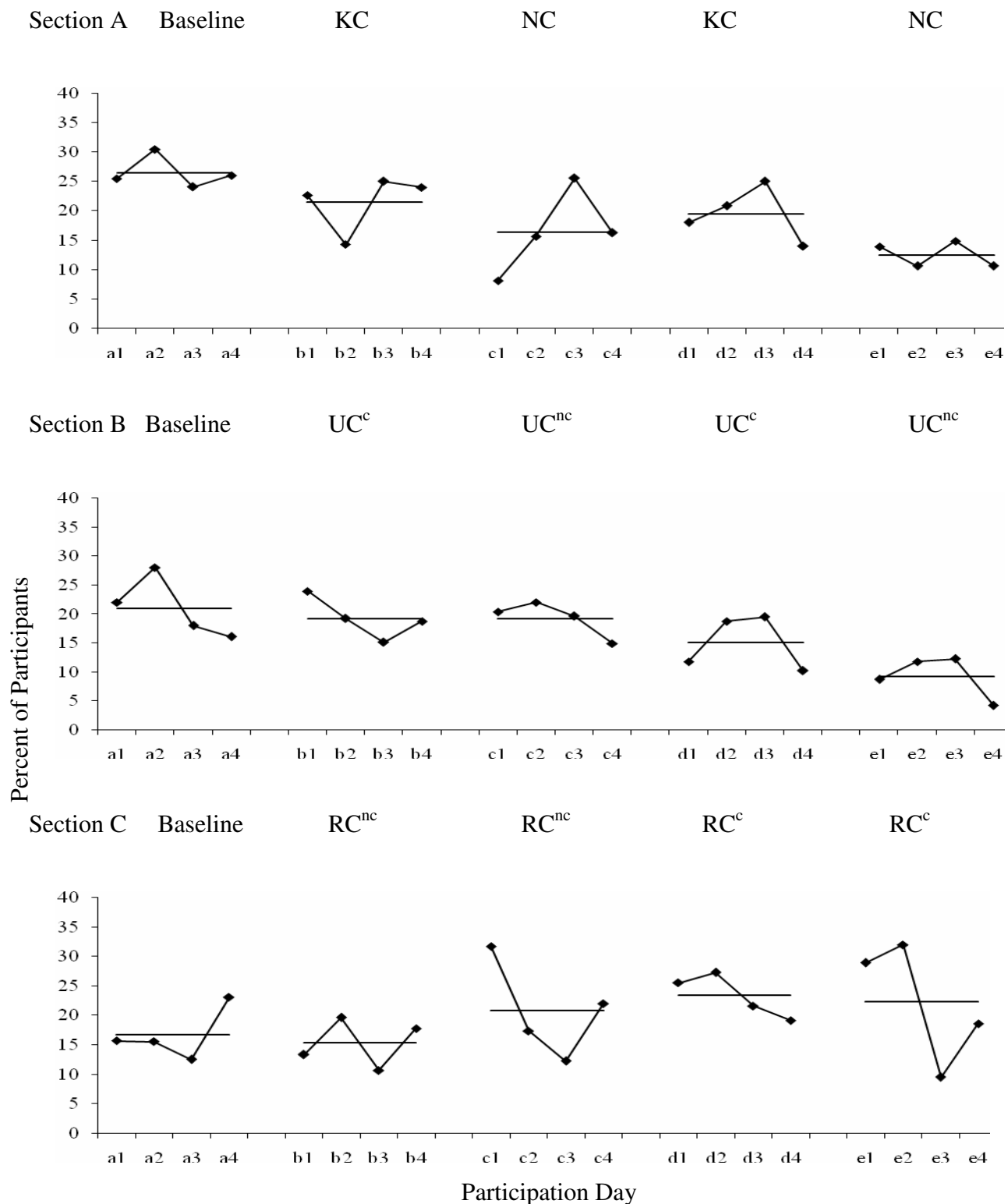


Figure 4. Percent of students slightly exceeding credit contingency each day (3-4 comments).



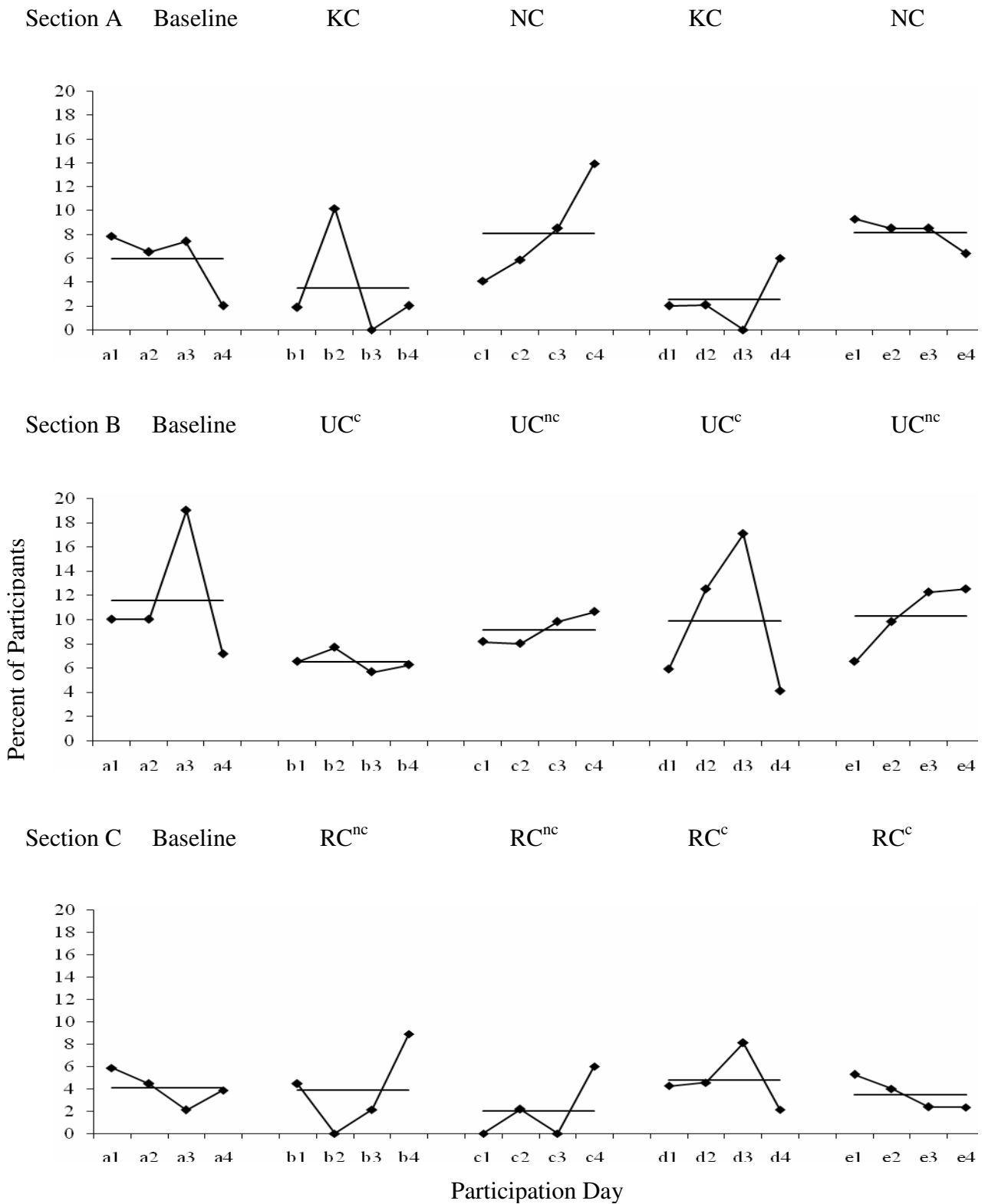


Figure 5. Percent of students greatly exceeding credit contingency per day (5+ comments).

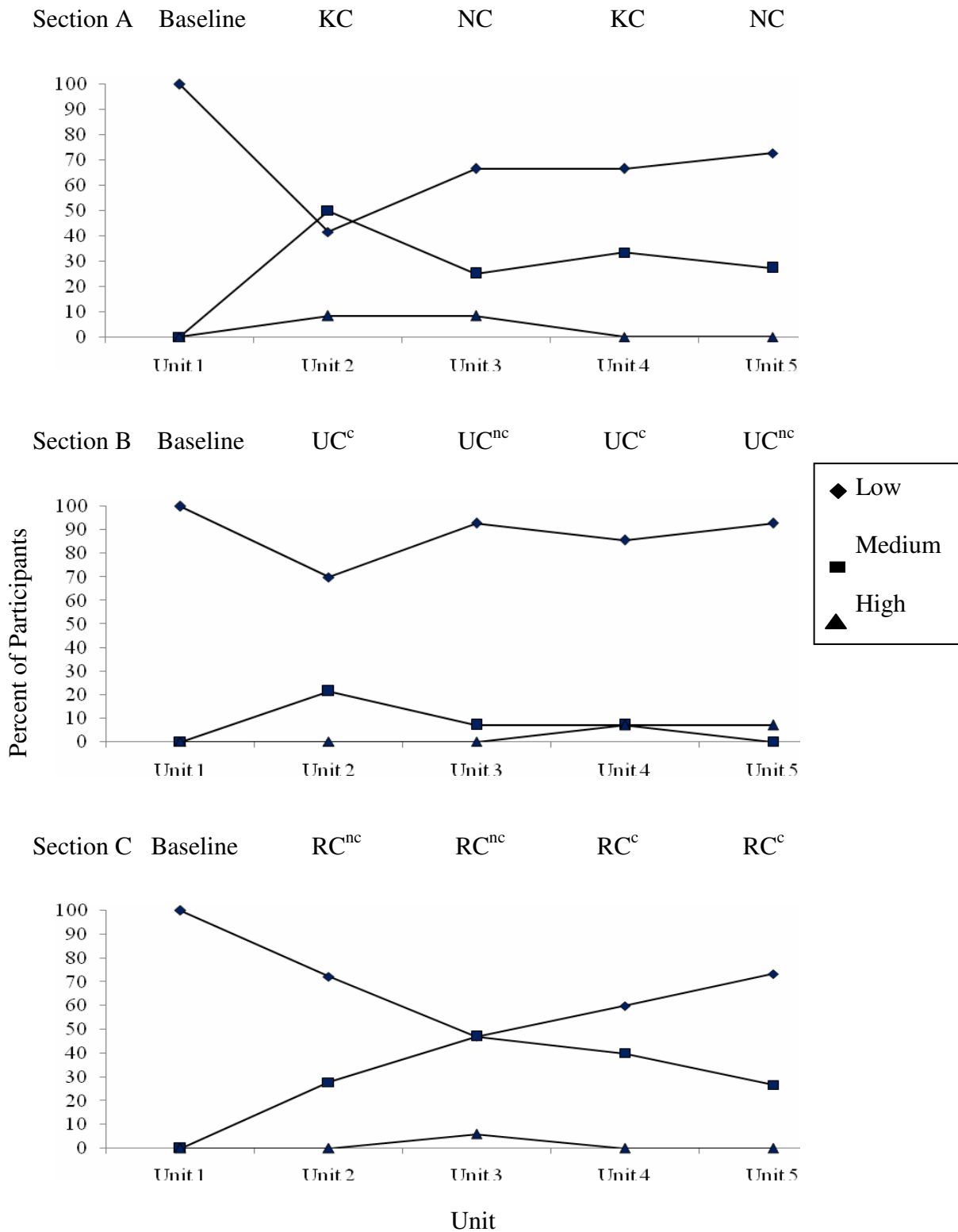


Figure 6. Intra-subject percentage of low participants in Unit 1 participating at low, medium, and high levels across subsequent units.

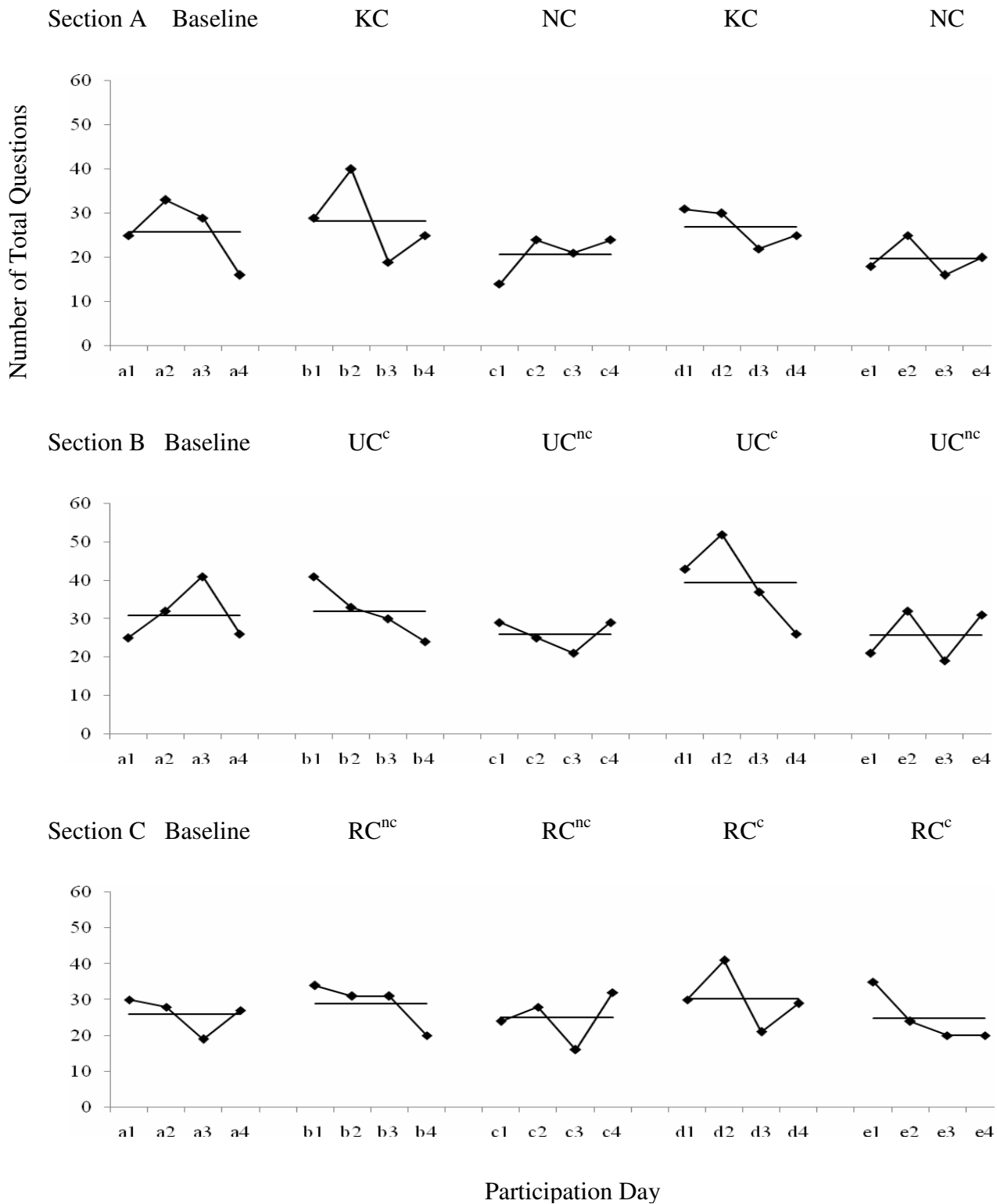


Figure 7. Number of total questions posed by instructor each day.

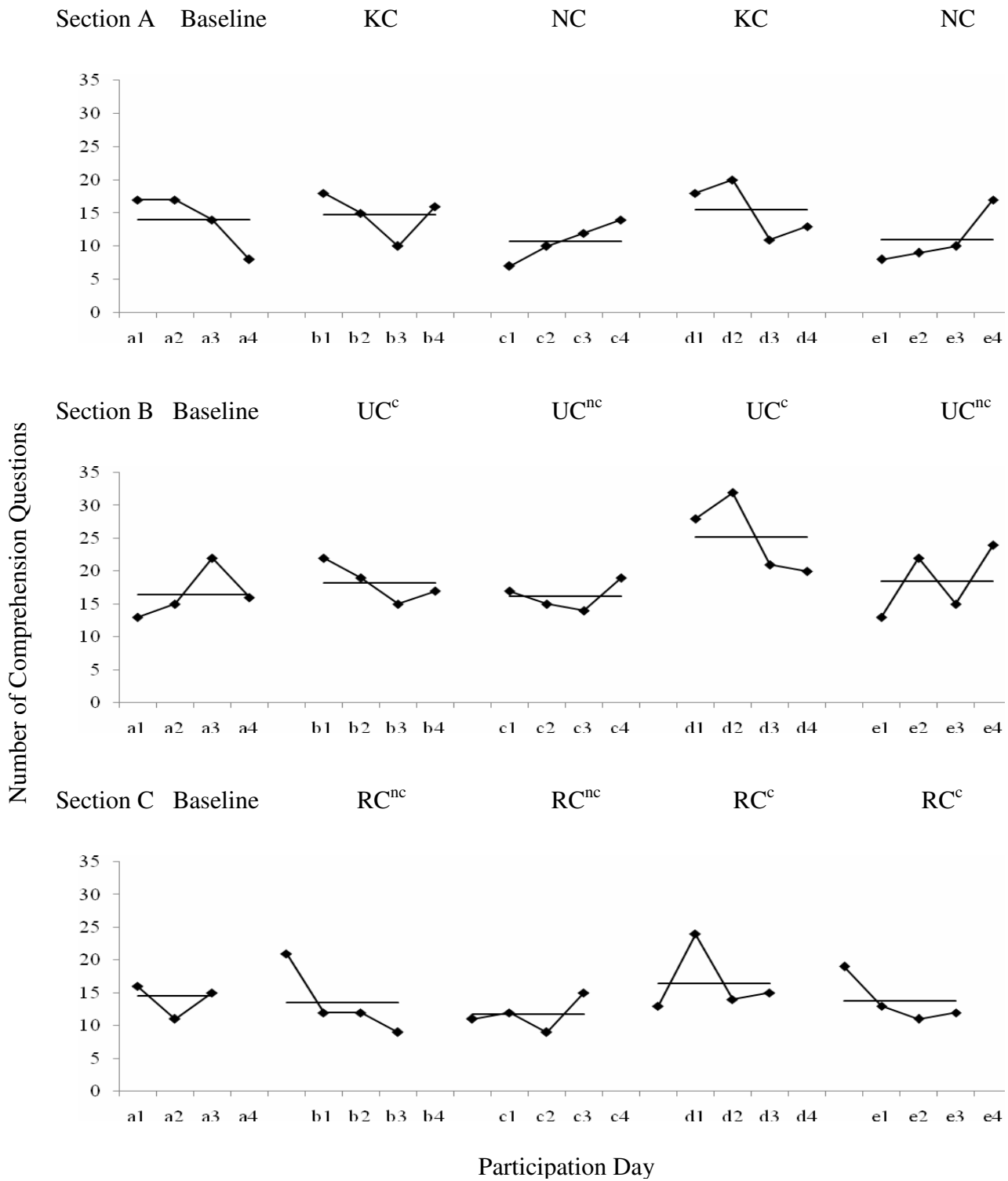


Figure 8. Number of comprehension questions posed by instructor each day.



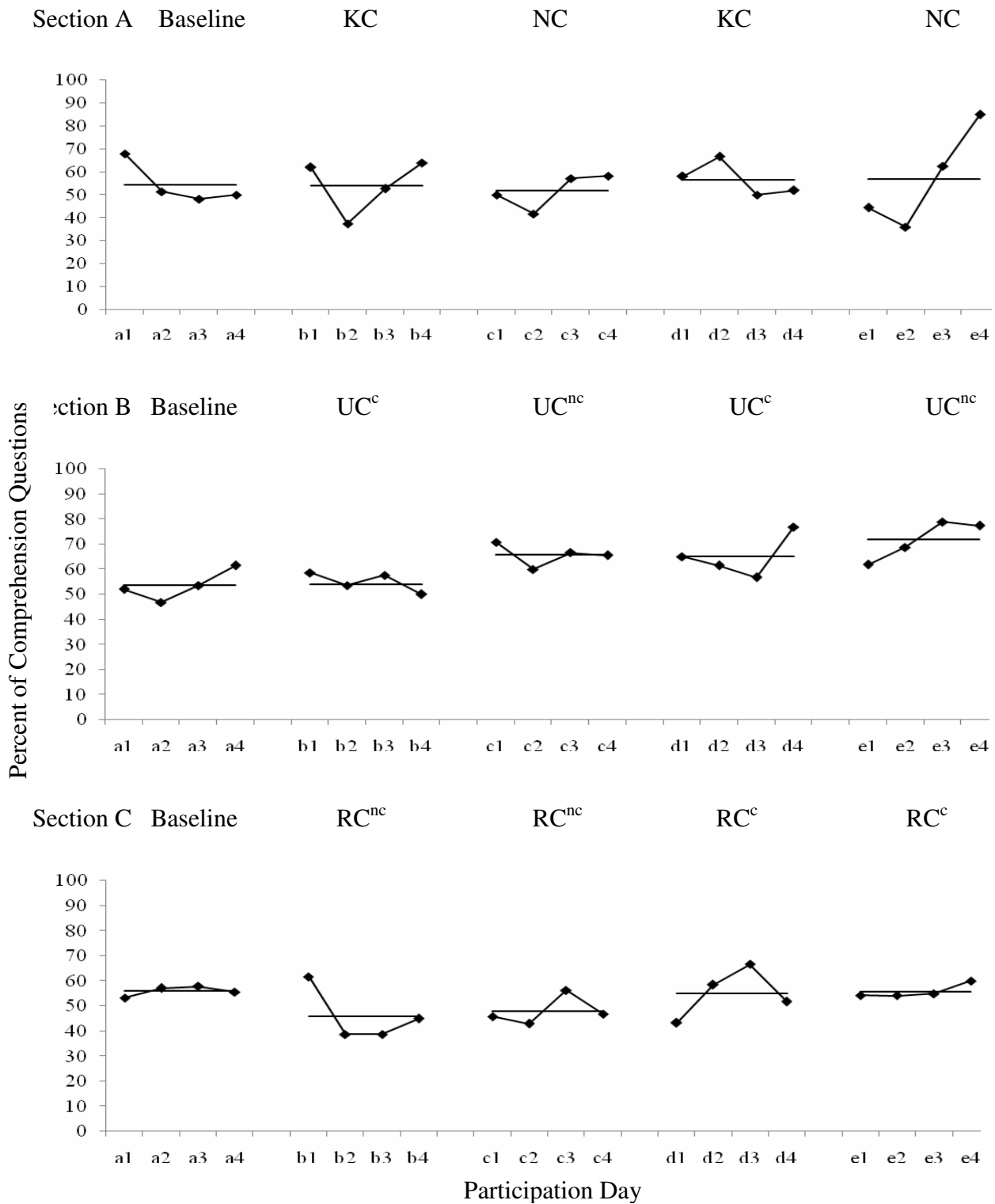


Figure 9. Percent of comprehension questions posed by instructor each day.

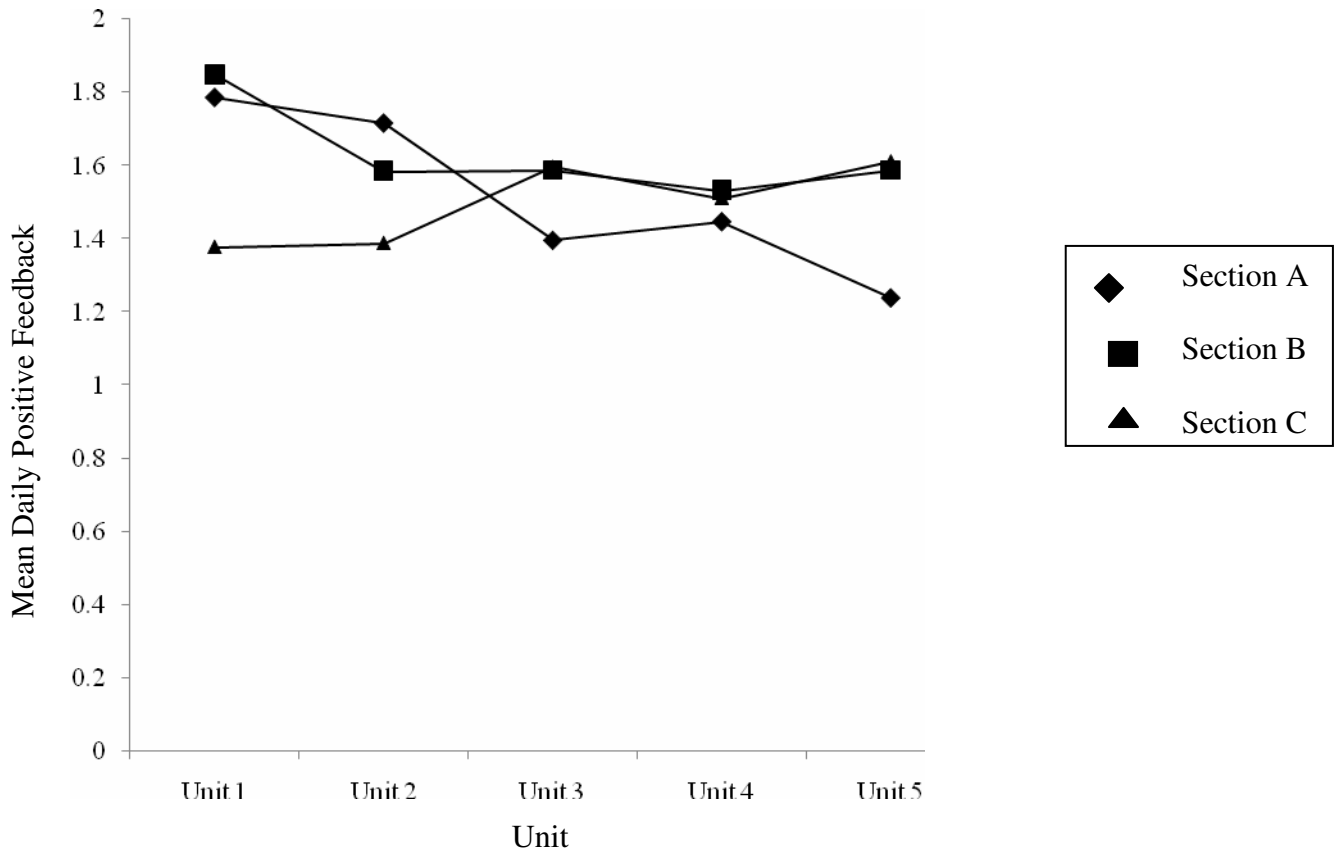


Figure 10. Mean quantity of positive teacher feedback provided daily to individual students in each unit.

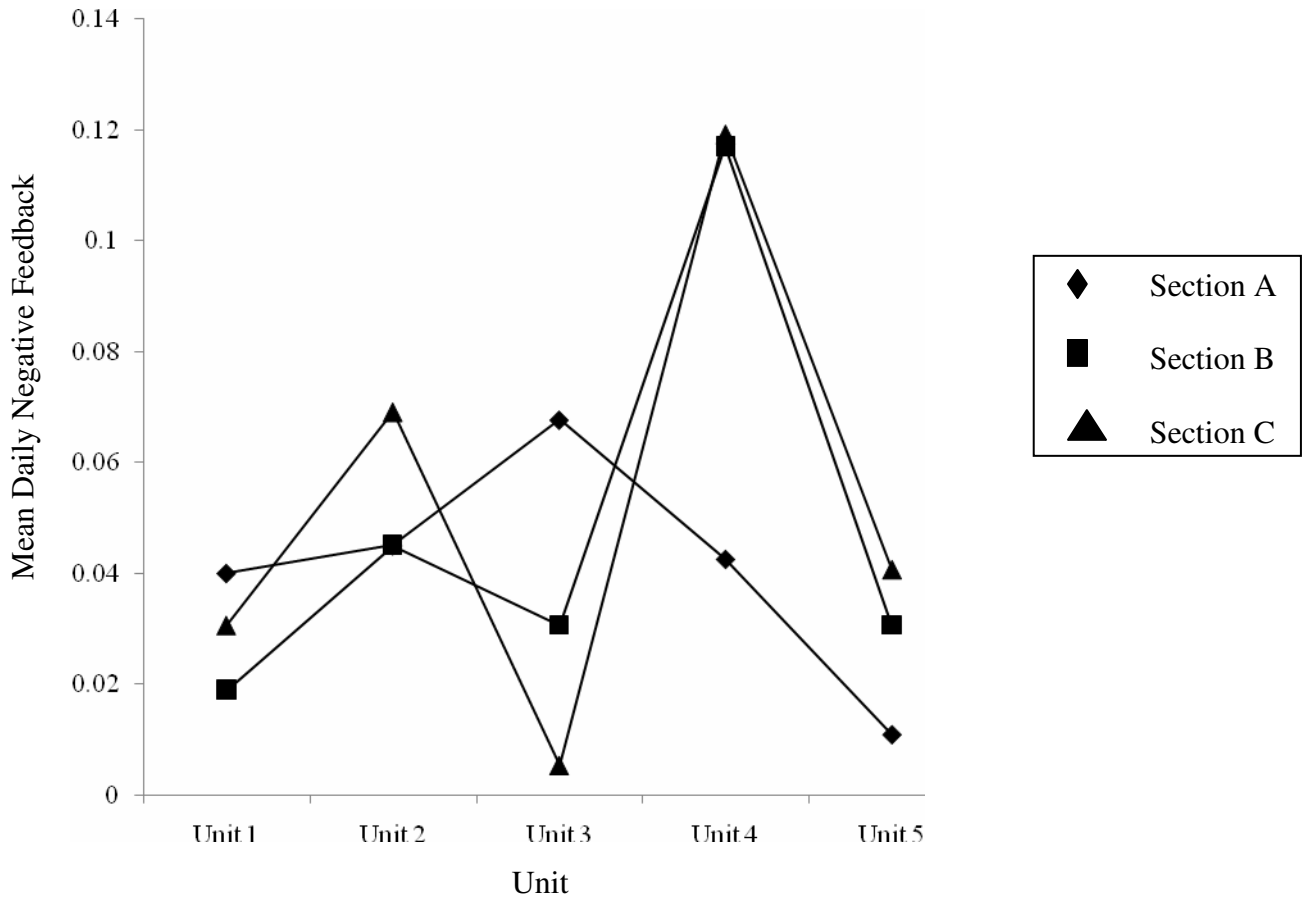


Figure 11. Mean quantity of negative teacher feedback provided daily to individual students in each unit.







## Appendix E: Participation Survey

Following each item stem is the mean and standard deviation for the total sample. The possible range for each item is 1 (option e) to 5 (option a). Note that option a for each item generally indicates a more favorable nature of participation (e.g., greater comfort participating, higher previous or anticipated levels of participation). The percent of students that selected each item option is also provided in parenthesis.

1. Which of the following best describes your previous pattern of class participation in college courses? (mean = 3.28, SD = 0.96)
  - a. participating several times a day in most class discussions (11.0%)
  - b. participating once or twice a day in most class discussions (29.3%)
  - c. participating once or twice a day in about 50% of the class discussions (37.8%)
  - d. participating infrequently in class discussions (20.7%)
  - e. never participating in class discussions (1.2%)
  
2. Which of the following best describes your expectations for participating in discussions in the 210 course? (mean = 3.73, SD = 0.79)
  - a. participating several times a day in most discussions (15.3%)
  - b. participating once or twice a day in most discussions (47.9%)
  - c. participating once or twice a day in about 50% of the discussions (31.9%)
  - d. participating infrequently in discussions (4.3%)
  - e. never participating in discussions (0.6%)
  
3. Which of the following best describes your feelings about participating in discussions in classes as large as the 210 course? (mean = 3.25, SD = 1.05)
  - a. consistently feel comfortable when participating (8.5%)
  - b. generally feel comfortable when participating (39.0 %)
  - c. feel comfortable about half the time when participating (26.8%)
  - d. generally feel uncomfortable when participating (20.1%)
  - e. consistently feel uncomfortable when participating (5.5%)
  
4. Which of the following best describes how you feel when called on to participate in class discussion? (mean = 3.02, SD = 1.03)
  - a. extremely confident (4.9%)
  - b. somewhat confident (32.9 %)
  - c. neutral (28.7%)
  - d. somewhat uncomfortable (26.8%)
  - e. extremely uncomfortable (6.7%)

5. Which of the following best describes your perspective of the relevance of your comments in class discussion? (mean = 4.28, SD = 0.64)
  - a. Your comments are almost always relevant. (37.2%)
  - b. Your comments are generally relevant. (54.9%)
  - c. Your comments are relevant about half the time. (6.7%)
  - d. Your comments are seldom relevant. (1.2%)
  - e. Your comments are almost never relevant. (0.0%)
  
6. Which of the following most accurately describes your typical level of preparation for class discussion in past courses? (mean = 3.74, SD = 0.56)
  - a. completed all of the homework related to the topic to be discussed plus done some additional investigation of the topic (4.9%)
  - b. completed all of the homework related to the topic to be discussed (65.2%)
  - c. completed most of the homework related to the topic to be discussed (28.7%)
  - d. completed little of the homework related to the topic to be discussed (1.2%)
  - e. completed none of the homework related to the topic to be discussed (0.0%)
  
7. What is your attitude about student responsibility for participating in class discussion when the instructor asks students to volunteer responses to instructor questions? (mean = 4.05, SD = 0.74)
  - a. Students are totally responsible for volunteering comments under those circumstances. (27.4%)
  - b. Students bear most of the responsibility for volunteering comments under those circumstances. (53.0%)
  - c. Students have marginal responsibility for volunteering comments under those circumstances. (17.1%)
  - d. Students have little responsibility for volunteering comments under those circumstances. (2.4%)
  - e. Students have no responsibility for volunteering comments under those circumstances. (0.0%)
  
8. What is your attitude about earning course credit for participating in class discussion? (mean = 2.82, SD = 0.90)
  - a. Participation should be the most heavily weighted contributor to your grade. (4.3%)
  - b. Participation should be substantially weighted in the computation of your grade. (11.6%)
  - c. Participation should be moderately weighted in the computation of your grade. (53.0%)
  - d. Participation should be minimally weighted in the computation of your grade. (24.4%)
  - e. Participation should not be considered in the computation of your grade. (6.7%)

9. How do you feel when an instructor indicates at the beginning of a course that students will be expected to participate in class discussion? (mean = 3.14, SD = 1.00)
- extremely positive (11.0%)
  - generally positive (21.3%)
  - neutral (41.5%)
  - generally negative (23.2%)
  - extremely negative (3.0%)
10. How do you feel when an instructor indicates at the beginning of a course that class discussion is welcomed but optional? (mean = 4.05, SD = 0.83)
- extremely positive (34.1%)
  - generally positive (39.0%)
  - neutral (24.4%)
  - generally negative (2.4%)
  - extremely negative (0.0%)
11. What would be the relative likelihood of your asking a question versus answering a question in class discussion? (mean = 3.30, SD = 1.18)
- much more likely to ask a question (20.1%)
  - somewhat more likely to ask a question (20.1%)
  - about equally likely to ask or answer a question (37.8%)
  - somewhat more likely to answer a question (13.4%)
  - much more likely to answer a question (8.5%)
12. How would you describe the general effect of your participating in discussion on your learning in a course? (mean = 3.40, SD = 0.87)
- learn best when participating heavily in discussion (9.1%)
  - learn best when participating regularly in discussion (36.6%)
  - learn best when participating periodically (40.2%)
  - learn best when participating infrequently in discussion (12.8%)
  - learn best when never participating in discussion (1.2%)
13. How do you think that your keeping a record of your participation in class discussion would affect your concentration on the discussion? (mean = 2.89, SD = 1.20)
- would greatly increase your concentration on the discussion (11.6%)
  - would generally contribute to your concentration on the discussion (20.1%)
  - would have an uncertain effect on your concentration on the discussion (25.6%)
  - would generally detract from your concentration on the discussion (31.1%)
  - would greatly detract from your concentration on the discussion (11.6%)

14. Which of the following class formats (discussion versus lecture) do you prefer in courses you take? (mean = 2.88, SD = 0.87)
- all discussion (3.0%)
  - mainly discussion but some lecture (18.9%)
  - a balance between discussion and lecture (45.1%)
  - mainly lecture but some discussion (28.7%)
  - all lecture (4.3%)
15. What do you see as the relationship between the quantity and quality of class discussion? (mean = 3.17, SD = 1.06)
- Quantity consistently contributes to quality. (8.5%)
  - Quantity is more likely to contribute to quality than detract from it. (36.6%)
  - Quantity and quality are unrelated. (22.0%)
  - Quantity is more likely to detract from quality than contribute to it. (29.3%)
  - Quantity consistently detracts from quality. (3.7%)
16. How do you typically respond when an instructor poses a question for class discussion? (mean = 2.86, SD = 1.06)
- quickly speak up (2.4%)
  - speak up after a short delay (28.7%)
  - speak up but with considerable hesitancy (34.8%)
  - speak up only if no one else speaks up (20.7%)
  - not speak up even if no one else speaks up (13.4%)
17. How do you feel about a discussion format in which students volunteer comments rather than being called on by the instructor? (mean = 4.03, SD = 1.10)
- greatly prefer volunteering comments rather than being called on (46.3%)
  - somewhat prefer volunteering comments rather than being called on (23.8%)
  - equally comfortable with volunteering and being called on (18.3%)
  - somewhat prefer being called on rather than volunteering (9.8%)
  - greatly prefer being called on rather than volunteering (1.8%)
18. Who is responsible for a *high level of student participation* in class discussion? (mean = 3.45, SD = 0.65)
- exclusively the students (3.7%)
  - primarily the students (42.7%)
  - shared equally between the students and the instructor (48.8%)
  - primarily the instructor (4.9%)
  - exclusively the instructor (0.0%)

19. Who is responsible for *very limited student participation* in class discussion? (mean = 3.26, SD = 0.83)
- exclusively the students (4.3%)
  - primarily the students (36.0%)
  - shared equally between the students and the instructor (43.3%)
  - primarily the instructor (14.6%)
  - exclusively the instructor (1.8%)
20. How would a class with frequent discussion affect your evaluation of the course? (mean = 3.51, SD = 0.86)
- greatly increase your evaluation of the course (13.4%)
  - generally increase your evaluation of the course (34.1%)
  - have little effect on your evaluation of the course (42.7%)
  - generally decrease your evaluation of the course (9.1%)
  - greatly decrease your evaluation of the course (0.6%)
21. What effect does frequent discussion by other students have on your concentration in class? (mean = 3.48, SD = 0.98)
- greatly increases your concentration (15.2%)
  - moderately increases your concentration (34.8%)
  - minimally affects your concentration (36.0%)
  - moderately decreases your concentration (11.0%)
  - greatly decreases your concentration (3.0%)
22. What effect does your personal participation in class discussion have on your concentration in class? (mean = 3.81, SD = 0.93)
- greatly increases your concentration (24.4%)
  - moderately increases your concentration (42.7%)
  - minimally affects your concentration (23.2%)
  - moderately decreases your concentration (9.1%)
  - greatly decreases your concentration (0.6%)
23. What effect does the option of volunteering comments whenever you wish have on your concentration in class? (mean = 3.59, SD = 0.91)
- greatly increases your concentration (18.3%)
  - moderately increases your concentration (32.3%)
  - minimally affects your concentration (40.2%)
  - moderately decreases your concentration (8.5%)
  - greatly decreases your concentration (0.6%)

24. How does the possibility that you might be called on to respond to an instructor question affect your concentration in class? (mean = 3.75, SD = 1.12)
- greatly increases your concentration (28.0%)
  - moderately increases your concentration (39.6%)
  - minimally affects your concentration (15.2%)
  - moderately decreases your concentration (13.4%)
  - greatly decreases your concentration (3.7%)
25. How does frequent discussion in the class as a whole affect your enjoyment of a class? (mean = 3.81, SD = 1.00)
- makes the class much more enjoyable (27.4%)
  - makes the class somewhat more enjoyable (39.0%)
  - doesn't affect your enjoyment one way or the other (22.6%)
  - makes the class somewhat less enjoyable (9.1%)
  - makes the class much less enjoyable (1.8%)
26. How do you feel toward students who frequently comment in class discussion? (mean = 3.14, SD = 1.05)
- You greatly appreciate their frequent participation. (8.5%)
  - You generally appreciate their frequent participation. (32.9%)
  - You feel neutral toward their frequent participation. (26.8%)
  - You are generally annoyed by their frequent participation. (32.9%)
  - You are greatly annoyed by their frequent participation. (8.5%)
27. What are your academic expectations of students who frequently participate in class? (mean = 4.20, SD = 0.69)
- You expect them to do well in the course. (36.0%)
  - You expect them to do somewhat better than average in the course. (48.2%)
  - You expect their frequent contributions to be unrelated to their performance in the course. (15.9%)
  - You expect them to do somewhat worse than average in the course. (0.0%)
  - You expect them to do poorly in the course. (0.0%)
28. Some students like to be knowledgeable about a course topic before contributing to class discussion on that topic. How do you feel about this issue? (mean = 4.59, SD = 0.64)
- You have the strongest inclination to comment on topics about which you have the most knowledge. (66.5%)
  - You are moderately inclined to comment on topics about which you have the most knowledge. (26.8%)
  - Your knowledge about topics has little effect on your tendency to comment on those topics. (6.1%)
  - You feel somewhat less need to comment on topics about which you have the most knowledge. (0.6%)



- e. You feel the least need to comment on topics about which you have the most knowledge. (0.0%)
29. To what degree does student sharing of personal experiences in class discussion contribute to the quality of the discussion? (mean = 3.75, SD = 0.88)
- a. greatly heightens the quality of class discussion (17.1%)
  - b. moderately heightens the quality of class discussion (51.2%)
  - c. has a neutral impact on the quality of class discussion (23.2%)
  - d. moderately diminishes the quality of class discussion (6.7%)
  - e. greatly diminishes the quality of class discussion (1.8%)
30. How do you typically respond when no one else is responding to a teacher question? (mean = 3.60, SD = 1.16)
- a. Attempt to answer the question when no one else is responding. (28.0%)
  - b. Wait until the silence has become somewhat uncomfortable to you before attempting to answer the question. (29.9%)
  - c. Wait until the silence has become extremely uncomfortable to you before attempting to answer the question. (17.7%)
  - d. Respond only if the instructor calls on you to answer the question. (23.2%)
  - e. Decline to respond to the question even if the instructor calls on you. (1.2%)
31. Do you believe you have insights about course concepts that would benefit your peers if you shared them in class? (mean = 3.43, SD = 0.67)
- a. definitely “yes” (4.3%)
  - b. generally “yes” (40.2%)
  - c. uncertain (49.4%)
  - d. generally “no” (6.1%)
  - e. definitely “no” (0.0%)
32. What effect do long pauses between teacher questions and student responses have on your desire to participate in class discussion? (mean = 3.02, SD = 1.08)
- a. greatly increases your desire to participate (6.7%)
  - b. moderately increases your desire to participate (29.3%)
  - c. minimally affects your desire to participate (32.9%)
  - d. moderately decreases your desire to participate (21.3%)
  - e. greatly decreases your desire to participate (9.8%)
33. How would teachers in your past college courses most likely characterize your level of participation in class discussion? (mean = 2.99, SD = 0.88)
- a. the most talkative student in class (3.7%)
  - b. among the more talkative students in class (25.0%)
  - c. talkative to an average level (39.6%)
  - d. among the less talkative students in class (29.9%)
  - e. the least talkative student in class (1.8%)

34. How would you characterize teacher views regarding the inclusion of class discussion in student grades in your past college courses? (mean = 2.88, SD = 0.84)
- Participation is the most important part of a student's grade. (3.0%)
  - Participation is among the more important contributors to a student's grade. (17.2%)
  - Participation is on par with several other contributors to a student's grade. (47.6%)
  - Participation is among the less important contributors to a student's grade. (29.3%)
  - Participation is not included in a student's grade. (3.0%)
35. In comparison to other classes you are taking this semester, what expectation do you have for your participation in 210 class discussion? (mean = 3.71, SD = 0.89)
- more participation in 210 discussion than in any other class (19.5%)
  - more participation in 210 discussion than in most other classes (39.6%)
  - about the same level of participation in 210 discussion as in other classes (34.1%)
  - less participation in 210 discussion than in most other courses (5.5%)
  - less participation in 210 discussion than in any other course (1.2%)
36. Which of the following best expresses your view of the long-term value of learning to express one's views in public? (mean = 3.96, SD = 0.77)
- Learning to express one's views in public is among the most important skills one can develop in school. (23.8%)
  - Learning to express one's views in public is among the more important skills one can develop in school. (51.8%)
  - Learning to express one's views in public is an important skill but certainly not among the more important skills one can develop in school. (22.0%)
  - Learning to express one's views in public is among the lesser skills one can develop in school. (1.8%)
  - Learning to express one's view in public is among the least important skills one can develop in school. (0.6%)
37. Your interpretation of how teachers feel about class discussion is best reflected in which of the following claims? (mean = 4.20, SD = 0.75)
- Most teachers strongly value class discussion. (37.2%)
  - Most teachers moderately value class discussion. (47.6%)
  - Most teachers are neutral toward class discussion. (12.8%)
  - Most teachers moderately devalue class discussion. (2.4%)
  - Most teachers strongly devalue class discussion. (0.0%)

38. How would most of your high school teachers likely describe your participation in class? (mean = 3.85, SD = 0.93)
- extremely verbal in class (25.6%)
  - generally verbal in class (43.9%)
  - occasionally verbal in class (22.0%)
  - generally quiet in class (7.3%)
  - extremely quiet in class (1.2%)
39. Many teachers try to stimulate class discussion by asking questions. Which of the following best expresses your view of most teacher questions? (mean = 3.64, SD = 0.60)
- Most are highly challenging. (4.9%)
  - Most are moderately challenging. (55.5%)
  - Most are routine in nature. (38.4%)
  - Most provide little challenge. (1.2%)
  - Few provide any challenge at all. (0.0%)
40. At the completion of a class session in which you participated frequently, how would you most likely feel about possible classmate reaction to your comments? (mean = 3.44, SD = 0.76)
- You would feel your classmates strongly valued your comments. (8.5%)
  - You would feel your classmates moderately valued your comments. (33.5%)
  - You would feel that your classmates were neutral toward your comments. (52.4%)
  - You would feel that your classmates moderately devalued your comments. (4.3%)
  - You would feel that your classmates strongly devalued your comments. (1.2%)
41. Which of the following best represents your ability to judge the relevance of your comments in class discussion? (mean = 4.31, SD = 0.76)
- You can determine whether a comment will be relevant even before you make the comment. (47.0%)
  - You have your first sense of whether a comment is relevant as you are making the comment. (38.4%)
  - You can tell whether a comment is relevant only by the instructor's reaction to the comment. (14.0%)
  - You can only judge the relevance of your comment when you have time to reflect on it after class. (0.0%)
  - You never really have a sense of whether your comment was relevant. (0.6%)
42. How would frequent participation in college classes likely affect your grades in those courses? (mean = 3.79, SD = 0.70)
- Consistently raise your grades. (12.2%)
  - Generally raise your grades. (57.9%)
  - Have little effect on your grades. (26.2%)
  - Generally lower your grades. (3.7%)

- e. Consistently lower your grades. (0.0%)
43. How do you typically feel when you have volunteered a comment in class discussion? (mean = 3.37, SD = 0.86)
- a. You feel very important in the class. (3.7%)
  - b. You feel as if you have gained some positive recognition. (51.2%)
  - c. You feel neutral about your comment. (23.8%)
  - d. You fear that you might have said the wrong thing. (21.3%)
  - e. You believe your comment has been poorly received. (0.0%)
44. How much of a personal priority is improving the amount and/or quality of your participation in class discussion? (mean = 3.30, SD = 0.82)
- a. It is your top priority. (5.5%)
  - b. It is among your highest priorities. (32.3%)
  - c. You are neutral about the prospect of improving your class participation. (52.4%)
  - d. It is among your lowest priorities. (6.1%)
  - e. It is a non-priority for you. (3.7%)
45. What is your opinion of the social status of students who participate frequently in class discussion? (mean = 3.16, SD = 0.78)
- a. They tend to be the most popular students in class. (1.2%)
  - b. They are among the more popular students in class. (32.2%)
  - c. Frequent participation has little effect on one's standing with peers. (50.6%)
  - d. They are among the less popular students in class. (12.8%)
  - e. They tend to be the least popular students in class. (3.0%)
46. What is your opinion of the social status of students who participate little, if at all, in class discussion? (mean = 2.87, SD = 0.65)
- a. They are greatly admired for their quietness. (1.2%)
  - b. They are generally admired for their quietness. (9.1%)
  - c. Their minimal participation has little effect on how peers regard them. (67.7%)
  - d. They are generally discredited for their quietness. (19.5%)
  - e. They are greatly discredited for their quietness. (2.4%)
47. What is your view of the relationship between the perceived relevance of course content and student inclination to participate in class discussion? (mean = 4.36, SD = 0.75)
- a. Students feel the greatest desire to participate in courses they view as highly relevant. (50.6%)
  - b. Students feel a moderate desire to participate in courses they view as relevant. (36.6%)
  - c. Student inclination to participate is not affected by the perceived relevance of the course content. (11.0%)
  - d. Students feel somewhat less need to participate in courses they view as relevant. (1.8%)

- e. Students feel the least need to participate in courses they view as highly relevant. (0.0%)
48. Which of the following best represents how students' participation in class discussion will affect their personal standing with teachers? (mean = 4.18, SD = 0.60)
- a. Students who participate frequently usually are the most liked by their teachers. (28.7%)
  - b. Students who participate frequently increase their chances of being liked by their teachers. (61.0%)
  - c. Frequent participation has little effect on how much teachers like a student. (10.4%)
  - d. Frequent participation decreases students' chances of being liked by their teachers. (0.0%)
  - e. Students who participate frequently are the least liked by their teachers. (0.0%)
49. Which of the following best represents the effect of a teacher's friendliness on student participation in class discussion? (mean = 4.10, SD = 0.58)
- a. Teacher friendliness is the number one contributor to student participation in class discussion. (21.3%)
  - b. Teacher friendliness is among the more important contributors to student participation in class discussion. (68.9%)
  - c. Teacher friendliness has little to do with student participation in class discussion. (8.5%)
  - d. Teacher friendliness is among the less important contributors to student participation in class discussion. (1.2%)
  - e. Teacher friendliness is the least important contributor to student participation in class discussion. (0.0%)
50. Compare the effects of teacher friendliness and teacher knowledge of the subject matter in the course on student participation in class discussion. (mean = 3.12, SD = 1.00)
- a. Teacher knowledge is a far greater contributor than teacher friendliness to class discussion. (9.2%)
  - b. Teacher knowledge is a somewhat stronger contributor than teacher friendliness to class discussion. (23.3%)
  - c. Teacher knowledge and teacher friendliness have an equal impact on class discussion. (42.3%)
  - d. Teacher friendliness is a somewhat stronger contributor than teacher knowledge to class discussion. (20.2%)
  - e. Teacher friendliness is a far greater contributor than teacher knowledge to class discussion. (4.9%)

Appendix F: Student's Under- and Over-Reporting Class Participation during Non-Credit versus Credit Units

Student #	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
(section B)	UC <sup>c</sup>				UC <sup>n</sup>				UC <sup>c</sup>				UC <sup>nc</sup>			
1	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
2	=	=	=	=	=	=	>	>	=	<	<	=	=	=	=	=
3	=	=	<n	=	=	=	=	=	=	=	=	=	=	=	=	=
4	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
5	=	=	=	=	=	=	=	=	=	=	<	=	=	=	<	=
6	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
7	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
8	=	=	=	=	=	<	=	=	=	=	=	>p	=	=	=	=
9	=	=	>	=	=	=	=	=	=	=	<	<n	=	=	=	=
10	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
11	=	=	<n	=	=	=	=	=	=	=	=	=	=	=	=	=
12	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
13	=	=	=	=	<	<	=	<	=	=	=	<n	<	<	=	=
14	=	=	=	=	<	=	=	=	=	=	=	=	=	=	=	=
15	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
16	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
17	=	<	<	=	=	=	<	=	=	=	=	=	=	=	=	<

Student #	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
(section B)	UC <sup>c</sup>				UC <sup>n</sup>				UC <sup>c</sup>				UC <sup>nc</sup>			
18	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
19	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=
20	=	=	=	=	=	=	=	=	<n	=	=	<n	=	=	=	=
21	=	=	=	=	=	>	=	=	>p	=	=	=	=	=	=	=
22	<	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
23	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
24	=	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=
25	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
26	=	<	=	<	=	=	=	=	<	<	<	<	<	<	=	<
27	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=
28	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
29	=	=	=	=	=	=	=	<	=	=	=	=	=	<	=	=
30	=	=	=	=	<	=	=	=	>p	=	<	=	<	=	<	=
31	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
32	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
33	<	=	<n	<	=	=	=	=	=	=	<	=	=	=	=	=
34	<	=	<	<	<	<	<	<	<	<	<	=	=	<	<	<

35 = = = = = = < = = < = = = < =

	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Student #	UC <sup>c</sup>				UC <sup>n</sup>				UC <sup>c</sup>				UC <sup>nc</sup>			
(section B)	UC <sup>c</sup>				UC <sup>n</sup>				UC <sup>c</sup>				UC <sup>nc</sup>			
36	=	>	<n	=	=	=	=	=	=	=	=	=	=	=	=	=
37	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
38	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
39	=	=	=	=	=	=	>	=	=	=	>	=	=	=	=	=
40	<	>	=	<	<	<	<	<	=	<	<	<n	<	<	<	<
41	=	=	>p	=	=	=	=	=	=	=	=	=	=	=	=	=
42	=	=	=	=	=	<	=	<	=	=	<	<n	<	=	=	=
43	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
44	=	<	=	=	=	=	=	=	=	=	<	=	=	=	=	=
45	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
46	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
47	<	<	<	=	<	<	<	<	<	<	<	<	<	<	<	<
48	=	<	<	<	=	=	<	<	<	<	=	=	=	=	<	=
49	<	=	<	<	=	=	>	=	=	=	=	<	=	<	<	<
50	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=
51	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	>
52	=	=	<	<	=	=	=	=	=	=	=	<n	=	=	=	=



53            < = = <            = < = =            = > = =            = < = =

	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Student #																
(section B)	UC <sup>c</sup>				UC <sup>n</sup>				UC <sup>c</sup>				UC <sup>nc</sup>			
54	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
55	=	=	<	=	<	=	=	=	=	=	=	<	<	=	=	=
56	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
B >	0	2	3	0	0	1	2	4	3	1	1	1	0	0	0	1
B > p	0	na	1	na	na	na	na	na	1	na	na	1	na	na	na	na
B > f	0	na	0	na	na	na	na	na	0	na	na	0	na	na	na	na
B <	6	5	9	6	8	7	6	7	5	7	11	10	7	8	8	6
B < n	0	na	4	na	na	na	na	na	2	na	na	6	na	na	na	na
(section A)	KC				KNC				KC				KNC			
57	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
58	=	=	=	=	=	>	=	=	>	=	=	=	>	=	=	=
59	<	<	<	<	<	=	=	<	=	=	=	=	=	<	=	=
60	>	=	<	=	=	=	<	=	<	=	<	=	=	<	<	=
61	=	>	=	=	=	=	=	=	=	=	=	=	=	=	=	=
62	=	=	=	=	=	=	=	=	=	=	=	=	<	=	=	=
63	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
64	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=

65	= > = =	< < < =	= < <n =	< = < =
66	< = = =	< = = =	= < = =	= = = =

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	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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Student #	Unit 2				Unit 3				Unit 4				Unit 5			
(section A)	KC				KNC				KC				KNC			
67	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
68	=	=	=	=	=	=	=	=	=	=	=	=	=	=	>	=
69	=	=	>	=	>	=	=	=	>	=	=	=	=	<	=	>
70	<	<	=	=	=	<	<	=	<	=	>f	>	>	<	<	=
71	=	=	=	=	=	=	=	>	<	=	=	=	<	=	=	=
72	=	=	=	=	=	=	=	=	=	=	=	>p	<	=	=	<
73	=	=	>f	=	<	<	<	=	=	>	=	=	<	<	=	=
74	=	<	<	<n	<	<	<	<	<	<	=	<n	<	<	<	<
75	=	<	=	=	<	=	<	=	=	=	=	=	=	=	=	=
76	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
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81	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
82	=	=	=	=	=	=	=	=	=	=	=	=	=	=	<	=

83	= = = =	= < < =	= = = <	= < = <
84	= = = =	= = = =	= = = =	= = = =

	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

Student #	KC				KNC				KC				KNC			
(section A)	KC				KNC				KC				KNC			
85	<	<	<	=	<	=	<	=	=	=	=	=	=	=	=	<
86	=	>	=	=	=	=	=	=	=	=	=	=	=	=	=	=
87	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
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89	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
90	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
91	<	<	=	>	=	=	=	=	=	=	=	=	=	=	=	=
92	<	<	<	=	=	<	=	<	=	<	=	<	<	<	<	=
93	=	=	=	=	=	=	=	<	=	=	=	=	>	<	<	=
94	=	=	>	=	=	=	=	=	=	=	=	=	=	=	=	=
95	=	=	<	=	=	=	<	<	<	<	<	=	<	<	<	=
96	=	=	>p	=	=	<	<	=	=	=	=	=	<	=	<	=
97	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
98	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
99	=	=	<n	=	=	=	=	<	=	=	=	=	=	=	=	=

100	= = = =	< < = =	= < <n =	= = = =
101	= = = =	= < = =	> < = =	< = = =
102	< = = =	= < < =	= < = =	= = = =
	<hr/>			
	Unit 2                      Unit 3                      Unit 4                      Unit 5			
	1 2 3 4                      1 2 3 4                      1 2 3 4                      1 2 3 4			
	<hr/>			
Student #				
(section A)	KC	KNC	KC	KNC
103	= = = =	= = = =	= = = =	= < < =
104	= = = =	= = = <	= = = =	= = = <
105	< > = =	= < > <	> < = >f	< = < =
106	> < = =	< < < <	< < = =	< < = =
107	> = = =	= = < =	= = = =	= = < =
108	= = = =	= = = =	= = = =	= = = =
109	= = >f =	= = = =	= = = <n	= = = =
110	> = = =	= = = =	= = = =	= = = =
	<hr/>			
A >	4 4 5 1	2 1 1 1	4 1 1 3	3 0 1 1
A > p	na na 1 1	na na na na	na na 0 1	na na na na
A > f	na na 2 0	na na na na	na na 1 1	na na na na
A <	8 7 9 3	11 13 14 9	6 11 4 4	13 14 13 6
A < n	na na 3 1	na na na na	na na 2 2	na na na na
	<hr/>			
(section C)	RC <sup>nc</sup>	RC <sup>nc</sup>	RC <sup>c</sup>	RC <sup>c</sup>
111	= = = =	= = = =	= = = =	= = = =

112	= < = <	= = = =	< < < =	< = < <
113	= = = =	= = = >	= = = =	= = = =
114	= = > =	= < = =	= = = =	= = = =
115	< = = <	= = = =	< = < =	>f = = =

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	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

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Student #	RC <sup>nc</sup>				RC <sup>nc</sup>				RC <sup>c</sup>				RC <sup>c</sup>			
(section C)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
116	=	=	=	=	=	=	<	=	=	=	=	=	=	=	=	=
117	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
118	=	=	=	=	=	=	=	=	<n	=	=	=	=	=	=	=
119	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
120	<	=	=	<	<	=	=	=	<	<	=	=	=	<	>	=
121	=	=	=	=	=	=	=	=	=	=	=	>	=	=	=	=
122	=	=	=	=	=	=	=	=	=	=	=	=	=	>	=	=
123	=	=	=	<	=	=	=	=	<	=	=	=	=	=	=	=
124	=	<	=	=	=	=	=	=	=	=	=	>	<	>	=	=
125	<	=	>	<	=	=	=	=	=	=	=	=	=	=	=	=
126	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
127	=	<	=	<	=	=	=	=	=	<	=	=	=	<	=	<
128	<	=	=	<	=	<	<	=	=	=	=	=	=	<	=	=
129	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=

130	= = > =	= = = =	= = = =	= = = =
131	= < = =	= < = =	= = = =	= = = =
132	= = = <	= = = =	= = = =	= = = =
133	= = = <	< = = <	<n = < <	<n <n = =

Student #	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
(section C)	RC <sup>nc</sup>				RC <sup>nc</sup>				RC <sup>c</sup>				RC <sup>c</sup>			
134	=	<	<	=	=	=	=	=	=	=	=	=	=	=	=	=
135	=	=	=	=	=	=	=	=	<	=	=	=	=	=	<	=
136	=	=	<	=	=	=	=	=	=	=	=	=	=	=	=	=
137	=	=	=	=	=	<	=	=	=	=	=	=	=	=	=	=
138	=	<	=	=	=	=	=	=	=	=	=	=	=	=	=	=
139	=	=	=	<	=	=	=	<	<	<	<	<	<	=	<	=
140	=	=	=	=	<	=	=	=	=	=	=	=	=	=	=	=
141	>	<	=	=	=	<	=	<	=	<	=	<	=	=	=	=
142	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
143	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
144	=	<	=	=	=	=	=	=	=	=	=	=	=	=	=	=
145	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
146	<	=	=	<	>	=	=	=	=	=	=	=	=	<	=	=
147	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=

148	>	>	=	=	=	=	<	=	<	=	=	=	=	=	<	=
149	=	=	=	=	>	=	=	=	=	=	=	=	=	=	=	=
150	=	=	=	=	>	=	=	=	=	=	=	=	=	=	=	=
151	=	=	=	=	=	=	=	=	=	=	=	=	=	=	<	=

Student #	Unit 2				Unit 3				Unit 4				Unit 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
(section C)	RC <sup>nc</sup>				RC <sup>nc</sup>				RC <sup>c</sup>				RC <sup>c</sup>			
152	=	=	=	<	=	=	=	=	=	=	=	=	=	=	=	=
153	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
154	=	=	=	=	=	=	=	=	>	=	=	<	=	=	=	>
155	=	=	=	=	=	=	>	=	=	=	=	=	=	=	=	=
156	=	<	>	=	=	<	=	=	=	=	=	=	=	=	=	=
157	>	=	=	=	>	=	=	=	<	=	=	=	=	=	=	=
158	=	=	=	=	=	=	=	<	=	=	=	=	=	=	=	=
159	=	=	=	=	=	=	<	=	=	<n	=	=	=	=	=	=
160	=	=	=	=	=	<	=	<	=	>p	>	>	=	>	=	=
161	=	=	=	<	=	=	=	=	>p	=	<	=	=	=	<	<
162	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	>
163	=	=	=	=	=	=	=	=	=	=	=	=	<	=	=	=
164	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
165	=	=	<	=	=	=	=	=	=	=	=	=	=	=	=	=

C >	3	1	4	1	6	0	2	0	3	1	1	3	2	3	1	3
C > p	na	na	na	na	na	na	na	na	1	1	na	na	0	0	na	na
C > f	na	na	na	na	na	na	na	na	0	0	na	na	1	0	na	na
C <	5	8	3	15	3	7	3	7	11	17	6	6	8	4	6	4
C < n	na	na	na	na	na	na	na	na	2	1	na	na	1	1	na	na
<hr/>																
Total >	7	7	7	2	8	2	5	5	10	3	3	7	5	3	2	5
Total > p	0	na	1	1	na	na	na	na	2	2	0	3	0	0	na	na
Total > f	0	na	2	0	na	na	na	na	0	0	1	1	1	0	na	na
Total <	19	20	21	24	22	27	23	23	22	25	21	20	28	26	27	16
Total < n	0	na	7	1	na	na	na	na	4	1	2	8	1	1	na	na

*Note:* > indicates student over-reporting; < indicates student under-reporting; = indicates agreement between student and observer; A = section A; B = section B; C = section C; p = student over-reporting resulted in partial credit being unjustly awarded; f = student over-reporting resulted in full credit being unjustly awarded; n = student under-reporting resulted in students not receiving due credit; BL = baseline unit; RC = random credit; KC = known credit unit; KNC = known non-credit unit; UC = unknown credit unit; na = not applicable; <sup>c</sup> = credit unit; <sup>nc</sup> = non-credit unit.



## Appendix G: Questionnaire Items Comprising Factors and Factor Loadings

### **Factor 1 – Personal History and Preference regarding Class Participation**

1. Which of the following best describes your previous pattern of participation in college courses? (.827)
2. Which of the following best describes your expectations for participating in discussions in the 210 course? (.757)
3. Which of the following best describes your feelings about participating in discussion in the classes as large as the 210 course? (.705)
4. Which of the following best describes how you feel when called on to participate in class discussion? (.463)
9. How do you feel when an instructor indicates at the beginning of a course that students will be expected to participate in class discussion? (.564)
16. How do you typically respond when an instructor poses a question for class discussion? (.633)
33. How would teachers in your past college courses most likely characterize your level of participation in class discussion? (.740)
38. How would most of your high school teachers likely describe your participation in class? (.547)

### **Factor 2 – Impact of Discussion on Course Value and Grades**

8. What is your attitude about earning course credit for participating in class discussion? (.552)
12. How would you describe the general effect of your participating in discussion on your learning in a course? (.548)
14. Which of the following class formats (discussion versus lecture) do you find most acceptable in courses you take? (.626)
20. How would a class with a lot of class discussion affect your evaluation of the course? (.755)
25. How does a lot of discussion in class affect your enjoyment of a class? (.725)

42. Think of the classes in which you participated the most thus far in college. How would you judge the effect of your participation in class discussion on the grades you received in those classes? (.574)

### **Factor 3 – Cognitive and Affective Investment in Class Discussion**

22. What effect does your personal participation in class discussion have on your concentration in class? (.679)
24. How does the possibility that you might be called on to respond to an instructor question affect your concentration in class? (.598)
36. Which of the following best expresses your view of the long-term value of learning to express one's views in public? (.426)
43. How do you feel when you have volunteered a comment in class discussion? (.701)

### **Factor 4 – Relevance of Discussion**

28. Some students like to be knowledgeable about a course topic before contributing to class discussion on that topic. How do you feel about this issue? (.725)
47. What is your view of the relationship between the perceived relevance of course content and level of student participation in class discussion? (.616)
48. Which of the following best represents how student's participation in class discussion will affect their personal standing with teachers? (.637)

### **Factor 5 – Possible Impediments to Discussion**

30. How do you typically respond to teacher questions with seemingly obvious answers? (.504)
32. What effect do long pauses between teacher questions and student responses have on your desire to participate in class discussion? (.622)
41. Which of the following best represents your ability to judge the relevance of your comments in class discussion? (.611)

### **Factor 6 – Responsibility for Discussion**

18. Who is responsible for a high level of student participation in class discussion? (.731)

19. Who is responsible for very limited student participation in class discussion? (.777)
34. How would you characterize teacher views regarding the inclusion of class discussion in student grades in past college courses you have taken? (.370)

**Factor 7 – High Quality Contributions to Discussion**

29. To what degree does student sharing of personal experiences in class discussion contribute to the quality of the discussion? (.780)
31. Do you believe you have insights about course concepts that would benefit your peers if you shared them in class? (.541)
44. How much of a personal priority is improving the amount and/or quality of your participation in class discussion? (.529)

Appendix H: Means for Low, Medium, and High-Responding Participants on each Item on the  
Participation Survey

**Items on Factor 1-**

<b>Personal History and Confidence Regarding Participation:</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>
1. Which of the following best describes your previous pattern of class participation in college courses?	2.68	3.24	3.75
2. Which of the following best describes your expectations for participating in discussions in the 210 course?	3.20	3.72	4.12
3. Which of the following best describes your feelings about participating in discussion in classes as large as the 210 course?	2.59	3.29	3.68
4. Which of the following best describes how you feel when called on to participate in class discussion?	2.41	3.06	3.42
9. How do you feel when an instructor indicates at the beginning of a course that students will be expected to participate in class discussion?	2.61	3.05	3.63
16. How do you typically respond when an instructor poses a question for class discussion?	2.00	2.92	3.40
33. How would teachers in your past college courses most likely characterize your level of participation in class discussion?	2.32	2.94	3.53
38. How would most of your high school teachers likely describe your participation in class?	3.24	3.91	4.23
<b>Factor 1 Total</b>	<b>21.05</b>	<b>26.13</b>	<b>29.76</b>

<b>Items on Factor 2-</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>
<b>Impact of Discussion on Course Value and Grades:</b>			
8. What is your attitude about earning course credit for participating in class discussion?	2.49	2.86	3.00
12. How would you describe the general effect of your participating in discussion on your learning in a course?	2.93	3.47	3.65
14. Which of the following class formats (discussion versus lecture) do you prefer in courses you take?	3.56	2.82	3.18
20. How would a class with frequent discussion affect your evaluation of the course?	3.10	3.45	3.86
25. How does frequent discussion in the class as a whole affect your enjoyment of a class?	3.24	3.85	4.18
42. How would frequent participation in college classes likely affect your grades in those courses?	3.46	3.89	3.89
Factor 2 Total	18.78	20.34	21.76

<b>Items on Factor 3-</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>
<b>Cognitive and Affective Investment in Class Discussion:</b>			
22. What effect does your personal participation in class discussion have on your concentration in class?	3.34	3.98	3.95
24. How does the possibility that you might be called on to respond	3.41	3.83	3.89

to an instructor question affect your concentration in class?			
36. Which of the following best express your view of the long-term value of learning to express one's views in public?	3.71	3.98	4.12
43. How do you typically feel when you have volunteered a comment in class discussion?	3.24	3.42	3.40
Factor 3 Total	13.70	15.21	15.36

<b>Items on Factor 4-</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>
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**Relevance of Discussion**

28. Some students like to be knowledgeable about a course topic before contributing to class discussion on that topic. How do you feel about this issue?	4.44	4.62	4.67
47. What is your view of the relationship between the perceived relevance of course content and level of student participation in class discussion?	4.29	4.32	4.46
48. Which of the following best represents how students' participation in class discussion will affect their personal standing with teachers?	4.12	4.21	4.19
Factor 4 Total	12.85	13.15	13.32

<b>Items on Factor 5-</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>
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**Possible Impediments to Discussion**

30. How do you typically respond when no one else is responding to a teacher question?	2.83	3.71	4.04
32. What effect do long pauses between teacher questions and student responses have on your desire to participate in class discussion?	2.88	3.08	3.05
41. Which of the following best represents your ability to judge the relevance of your comments in class discussion?	4.22	4.33	4.35
Factor 5 Total	9.93	11.12	11.44

**Items on Factor 6-  
Responsibility for Discussion**

	<b>Low</b>	<b>Medium</b>	<b>High</b>
18. Who is responsible for a high level of student participation in class discussion?	3.46	3.45	3.44
19. Who is responsible for very limited student participation in class discussion?	3.29	3.21	3.30
34. How would you characterize teacher views regarding the inclusion of class discussion in student grades in your past college courses?	2.80	2.83	2.98
Factor 6 Total	9.55	9.49	9.72

**Items on Factor 7-  
High Quality Contributions to Discussion**

29. To what degree does student sharing of personal experiences in class discussion contribute to the quality of the discussion?	3.73	3.83	3.67
31. Do you believe you have insights about course concepts that would benefit your peers if you shared them in class?	3.34	3.30	3.63
44. How much of a personal priority is improving the amount and/or quality of your participation in class discussion?	3.27	3.32	3.30
Factor 7 Total	10.34	10.45	10.60
<b>All other items:</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>
5. Which of the following best describes your perspective of the relevance of your comments in class discussion?	4.20	4.23	4.40
6. Which of the following most accurately describes your typical level of preparation for class discussion in past courses?	3.76	3.79	3.67
7. What is your attitude about student responsibility for participating in class discussion when the instructor asks students to volunteer responses to instructor questions?	3.98	4.03	4.14
10. How do you feel when an instructor indicates at the beginning of a course that class participation is welcomed but optional?	4.02	4.03	4.09
11. What would be the relative likelihood of your asking a question versus answering a question in class discussion?	3.46	3.15	3.35
13. How do you think that your keeping a record of your participation in class discussion would affect your concentration on	2.88	3.00	2.77



the discussion?

15. What do you see as the relationship between the quantity and quality of class discussion?	3.10	3.26	3.12
17. How do you feel about a discussion format in which students volunteer comments rather than being called on by the instructor?	4.34	3.98	3.86
21. What effect does frequent discussion by other students have on your concentration in class?	3.34	3.45	3.61
23. What effect does the option of volunteering comments whenever you wish have on your concentration in class?	3.41	3.64	3.67
26. How do you feel toward students who frequently comment in class discussion?	3.12	3.15	3.14
27. What are your academic expectations of students who frequently participate in class?	4.02	4.21	4.32
35. In comparison to other classes you are taking this semester, what expectation do you have for your participation in 210 class discussion?	3.32	3.86	3.81
37. Your interpretation of how teachers feel about class discussion is best reflected in which of the following claims?	4.15	4.20	4.23
39. Many teachers try to stimulate class discussion by asking questions. Which of the following best expresses your view of most teacher questions?	3.44	3.71	3.70
40. At the completion of a class session in which you participated	3.44	3.36	3.53

frequently, how would you most likely feel about possible  
classmate reaction to your comments?

45. What is your opinion of the social status of students who  
participate frequently in class discussion? 3.17 3.18 3.12

46. What is your opinion of the social status of students who  
participate little, if at all, in class discussion? 2.90 2.83 2.89

49. Which of the following best represents the effect of a teacher's  
friendliness on student participation in class discussion? 4.10 4.08 4.14

50. Compare the effects of teacher friendliness and teacher  
knowledge of the subject matter in the course on student  
participation in class discussion. 2.90 3.17 3.21

All Discarded Items Total 71.05 72.31 72.77

## Vita

Kathleen Briana Aspiranti was raised in Columbus, Ohio and graduated from Worthington Kilbourne High School. She received a B.A. in Psychology and a B.F.A. in Dance from Wright State University in Dayton, Ohio in 2004. She enrolled at the University of Tennessee, Knoxville to pursue her Ph.D. in School Psychology. In December 2009 she received a M.S. in Educational Psychology. Kathleen completed requirements for her Ph.D. in August 2011 after a year-long internship at the Tennessee Internship Consortium, which is accredited by the American Psychological Association.