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Adult Students' Learning Behaviors in the College Mathematics Classroom

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Abstract

Adult students 25 and older are a growing population at U.S. colleges and universities. Mathematics courses present a particular challenge for these students who may have less academic preparation than younger students and have experienced a significant time-lapse since their last formal mathematics instruction. This exploratory, qualitative study focuses on the experiences of two adult students in a mixed-age college mathematics course with particular emphasis on participation in classroom discussion and activities. Adult student participation in classroom discussions was enhanced by a strong motivation to be successful in the course, wanting to help classmates, and a disregard for the perceptions of classmates. Participation was hindered by not being familiar with the material, fear of appearing ignorant, and discomfort in the classroom.

Key words: adult undergraduates, college mathematics, classroom participation.

Introduction

Joe walked into the mathematics classroom, took a seat near the back of the room, removed a notebook from his backpack, and started looking over his notes. He was a clean cut man in his late twenties whose walk and bearing betrayed his past military training. A few minutes later, Mary, a young lady in her early thirties, entered the classroom, sat next to Joe, and prepared for class. As the small classroom filled with students, Joe and Mary sat quietly, looking over their notes, occasionally making quiet comments to each other. When the instructor entered and began class, both Joe and Mary were attentive and engaged with the lesson. However, there was a striking difference in their behavior in the classroom. Joe actively participated in the classroom discussion. He asked questions, responded to questions from the instructor and his classmates, and took an active role in the social interactions of the class. Mary, on the other hand, sat quietly. She nodded as she followed the classroom conversation, but rarely added to it.

Both Mary and Joe are adult students—undergraduates 25 or older. In order to reach their educational goals, they must pass a college-level mathematics course. For students who have not been exposed to formal mathematics for several years, this may present a challenge. Factors that influence adult students' success in college mathematics courses are difficult to

identify (Meeks, 1989; Trutna, 1992). One factor that influences the success of all students in mathematics courses is their level of engagement with the materials, their classmates, and their instructor (Boaler, 1998; Howard & Baird, 2000; Hsu, Murphy, & Treisman, 2008). Although past studies have identified instructional practices that encourage classroom participation (Mesa, 2010), and identified factors that influence traditional-age students' participation in classroom discussions and activities (Crombie, Pyke, Silverthorn, Jones, & Piccinin, 2003; Fritschner, 2000; Howard, Short, & Clark, 1996; Karp & Yoels, 1976), little research has been conducted focusing on factors that influence adult students' participation, especially in mathematics courses for which adult students are often ill-prepared. Because many adult students enroll in college with less academic preparation in mathematics than traditional-age students (Kasworm & Pike, 1994; Calgagno, Crosta, Bailey, & Jenkins, 2007), adults may behave differently in mathematics courses than in their other college courses. In addition, many adult students harbor negative attitudes towards mathematics (Coben, 2000; Meader, 2000) which may further influence their learning behaviors in the mathematics classroom. The purpose of this qualitative study is to develop a deeper understanding of adult students' learning behaviors in college mathematics courses. The central research questions for this study are:

1. What learning behaviors do adults exhibit when enrolled in a multi-age college mathematics course?
2. What factors influence the learning behaviors of adult students?

For this study the term adult student refers to undergraduates pursuing a 4-year degree who are 25 years or older. Learning behaviors refer to the observed and reported behaviors students use to learn the material in a mathematics course. These include interactions with classmates and faculty during class, the formation of study groups and collaboration on homework, meeting with faculty during office hours, and the use of school-provided tutoring labs or private tutors. Although behaviors outside of class will be noted, the main focus of this study is the learning behaviors adult students exhibit during class, and in particular, the social interactions in the classroom.

This exploratory study used a qualitative, embedded case study methodology (Creswell, 2007) in order to gain a deeper understanding of adult students' behaviors, and the reasons behind the behaviors, of two adult students in a mixed-age, freshman-level mathematics course in a 4-year university in central Texas. The social constructivist philosophy of learning, that views "the individual constructing her meanings in response to experiences in social contexts" (Ernest, 1999, p. 2), formed the theoretical framework for this research. Especially in mathematics, social constructivism "locates students' mathematical development in social and cultural context" (Cobb, 2000, p. 152). Social constructivists emphasize the importance of interactions that occur between classmates and between students and the instructor (Bauersfeld, 1994; Bishop, 1985, Callahan, 2008). Because of this, the focus of this study was on the verbal interactions that adult students engaged in during the classroom sessions.

Literature Review

Characteristics of Adult Undergraduates

Adult students are one of the fastest growing demographic groups on American campuses today (Van der Werf, 2009). In 2008, over a third of students at degree-granting institutions in the

United States were 25 or older; this is expected to increase to over 40% by 2017 (National Center for Education Statistics, 2009). These adult students enter college with unique characteristics that distinguish them from traditional-age students. Adult students often enroll in college with less academic preparation than traditional-age students (Calcagno et al., 2007; Horn, Cataldi, & Sikora, 2005; Kasworm, Polson, & Fishback, 2002; Kasworm & Pike, 1994). Adult students are more likely to work over 30 hours per week, have dependent children, and commute to campus than younger students (Choy, 2002; Horn et al., 2005; Kasworm & Pike, 1994; Kasworm et al., 2002; Sandmann, 2010). Because of their complicated lives, adult students have little time to participate in campus activities or to seek academic help outside of class (Donaldson & Graham, 1999; Graham, Donaldson, Kasworm, & Dirkx, 2000; Kasworm, 2008). All these factors put adult students at risk for not completing their college degrees (Adelman, 2006; Astin, 1999; Tinto, 1987).

In spite of these challenges, many adult students are successful in college (Donaldson & Graham, 1999; Kasworm & Pike, 1994). One reason for this is the high level of motivation` many adult students exhibit (Meeks, 1989; Ross-Gordon, 2003). For adult students, completing a college degree often has been a long term goal. Adults view their experience in college as a "purposeful choice for a new and different future, a future of hope and possibilities" (Kasworm, 2008, p. 27). A second reason is the life experiences adult students bring to the classroom. These experiences can form a framework that enables adult students to process and assimilate new information and situations (Compton, Cox, & Laanan, 2006). In addition, these life experiences may foster a determination for adult students to overcome any disadvantages they encounter (Carmichael & Taylor, 2005).

Although adult students are generally highly motivated and have demonstrated the ability to earn high grades in college courses (Graham et al., 2000; Kasworm & Pike, 1994), they complete their educational programs at a lower rate than younger students (Bradburn, 2002; Calcagno et al., 2007; Choy, 2002; Horn et al, 2005; McGivney, 2004; Schatzel, Callahan, Scott, & Davis, 2011; Taniguchi & Kaufman, 2005). While this may be due in part to non-academic factors, many researchers have demonstrated that high school preparation, particularly in mathematics, plays a major role in students earning their bachelor's degree (Adelman, 1999, 2006; Trusty & Niles, 2003). Calcagno, Crosta, Bailey, and Jenkins (2007) found that while adults complete their educational programs at a lower rate than traditional-age students, after controlling for incoming mathematics ability, adults finish their programs at a higher rate than younger students. Calcagno et al.'s study illustrated the pivotal role that mathematics plays in the success of adult undergraduates.

Adult Students in College Mathematics Courses

Because of poor high school preparation and the lapse of time since being in an academic setting, mathematics is an area of particular concern for adult undergraduates (Calcagno et al., 2007; Horn et al, 2005). Research on adult students learning mathematics has given an ambiguous portrait of how adult students compare to traditional-age student in college mathematics classrooms. Adult students reported low levels of confidence to do mathematics in some studies (Civil, 2003; Leonelli, 1999; Peters & Koretecamp, 2010), but high levels in others (Elliott, 1990; Lehmann, 1987). Especially in preparatory and entry-level college mathematics, adult students reported the need to overcome negative attitudes and a lack of confidence in order to succeed in their mathematics courses (Civil, 2003; Lawrence, 1988; Leonelli, 1999). Studies comparing mathematics anxiety in adult and traditional-age students also resulted in conflicting findings (Ulrich, 1988; Zopp, 1999). Some adult students express the belief that they are incapable of ever understanding mathematics (Wedege & Evan, 2006). These beliefs and attitudes may affect the classroom behavior of adult students.

Past studies have emphasized the importance of active learning and group discussion for adults learning mathematics (Civil, 2003; Miller-Reilly, 2000; Safford, 2000). Unfortunately,

some older students report a reluctance to participate in group learning activities because of fear of exposing their ignorance (Nonesuch, 2006). The factors that influence adult students' participation are not well understood.

Student Participation in the College Classroom

Learning occurs most effectively when students are engaged with the material, other students, and their instructor (Howard & Baird, 2000). In addition, the mathematics reform movement has placed emphasis on student-centered learning and has been concerned with students' experiences in the learning process (Callahan, 2008). Research findings have demonstrated that students learn more when they take an active role in learning—"when they are engaged participants rather than passive recipients of knowledge" (Howard & Henney, 1998, p. 400). In the mathematics classroom, this is implemented by encouraging student participation in class with whole class discussion, small group activities, and facilitating students' reflection on their learning (Callahan, 2008).

For adult students who often have family and work obligations, the college experience is almost entirely limited to the classroom (Graham, et al., 2000). Adult students often do not have the time to take advantage of faculty office hours or meet with classmates outside of class (Bourgeios, Duke, Guyot, & Merrill, 1999; Kasworm, 2006). The classroom environment becomes especially important and the behaviors adult students exhibit in class impact their success to a greater extent than for traditional-age students who have time to seek academic help outside of class. Understanding how adult students perceive their participation and engagement in mathematics classrooms and the factors that influence their participation can inform instructors how to aid adult students to be successful in mathematics courses.

Adult Students' Participation in the College Classroom

Karp and Yoels (1976) were pioneers in studying social interactions in the college classroom. Regardless of the size of the class, Karp and Yoels found that only a small percentage of students responded to the instructors' questions or asked questions in class. They referred to this phenomenon as the "consolidation of responsibility" (p. 429), in which a few students take on the social responsibility of asking and answering questions while the other students engage in "civil attention"—paying sufficient attention to appear attentive without risking active participation. These findings were confirmed by later researchers (Fritchner, 2000; Howard & Baird, 2000; Howard et al., 1996).

There are conflicting findings in regards to adult participation in the college classroom. Some researchers report that adults participate in classroom discussions and activities at a higher rate than traditional students (Howard & Baird, 2000; Fritschner, 2001; Weaver & Qi, 2005; Kasworm, 2006). Others report that adult students may be reluctant to join classroom discussions (Nonesuch, 2006; Spellman, 2007). Still others have found no difference between adult and traditional-age student behaviors (Justice & Dornan, 2001; Faust & Courtenay, 2002).

The conflicting results of these studies illustrate the need for closer examination of the factors that encourage adult participation in the college classroom. In entry-level courses, there seemed to be little difference between the participation levels of adult students and traditional-age students (Fritschner, 2000; Faust & Courtenay, 2002). This may reflect the initial insecurity of adult students who are unsure of their academic abilities (Kasworm, et al., 2002), and may account for the lower participation reported by Spellman (2007) and Nonesuch (2006). As adult students gain confidence in themselves as learners, they may develop into the assertive, proactive students found by Fritschner (2000), Weaver and Qi (2005), and others (Howard & Baird, 2000; Kasworm, 2006). Few of the studies above focused on the mathematics classroom. Nonesuch, who found adult students reluctant to participate in classroom activities, was the only researcher cited above to study a mathematics classroom. Because adult students often enter college with lower mathematical skill and more negative attitudes towards mathematics than

younger students, they may feel insecure in the mathematics classroom. This may lead to a low level of participation in the mathematics classroom.

Adult behavior in college mathematics courses has not been an extensive focus of research. Most of the research in this area focuses on mathematics courses designed for a homogenous class of adult students. These studies showed that adult students are more comfortable and open to participation when in an adults-only mathematics classroom (Civil, 2003; Safford, 2000). Studies that focus on adult learning behaviors in a mixed-age classroom are limited.

Summary

The literature gives a confusing portrait of adult students in mathematics courses. Some studies show that adults perform as well in mathematics as traditional-age students. Others suggest that adult students have disadvantages in that they enter with lower academic preparation and have less time to devote to their studies than traditional-age students. Understanding how adult students negotiate the college mathematics classroom and the learning behaviors that help or hinder their success is important to ensure adult students' ability to reach their educational goals. This study focuses on the interactions of adult students in college mathematics courses in order to understand their engagement in the classroom. In addition, the reasons behind the level of participation in the classroom are explored.

Methodology

A qualitative, embedded case study methodology (Creswell, 2007) was used to explore the classroom learning behaviors of two adult students in a multi-age freshman mathematics course. How and why these two students interacted with their instructor and their classmates during and outside of class was examined using surveys, classroom observations, and interviews. In addition, the instructor of the course was consulted throughout the semester to verify student responses to survey and interview questions. Exploring the motivations behind the behaviors of these two students gave insight into the attitudes and beliefs adult students have about college mathematics and how these beliefs and attitudes affected their classroom behavior. Although an in-depth understanding of the behaviors of these two adult students was the focus of this study, it was also important to place these behaviors in the context of the multi-age college algebra classroom. For this reason, information was collected from all students in the class to compare the behaviors of the two adult participants to the norms of the classroom.

Participants and Context of Study

The participants in the research were two adult students enrolled in a freshman mathematics class designed for liberal arts majors at a large university in central Texas. The class met five days a week from 8:00 a.m. until 8:50 a.m. and continued for 8 weeks. The course was designed to illustrate the use of mathematics in practical, real-world situations that students could expect to encounter in their lives after college. The topics included financial mathematics, probability, statistics, and logic. More than half the students in the class were enrolled in a program designed to provide extra services and encouragement to students who had been identified as high-risk students. This particular class was chosen as the context of this study because of the number of adult students enrolled and the willingness of the instructor to open his classroom for observation. There were fifteen students (nine female and six male) enrolled in the course.

All the students in the class had taken one of two sections of a developmental mathematics course during the first eight weeks of the 16-week spring semester. One of the developmental sections was composed entirely of students in a special program, FOCUS,

designed to provide extra support for students deemed at high risk of being unsuccessful in mathematics courses. The other section was open to all students. The current course merged these students into one class during the second half of the 16-week semester. The students in the FOCUS program continued to have strict attendance requirements and were required to attend two hours of tutoring per week. The other students did not have these requirements. The two students participating in this study—Joe, a military veteran majoring in social work; and Mary, a criminal justice major—were chosen from the class by meeting the criteria of being adult students and by their willingness to participate in an interview.

Data Collection

Three methods were used to collect data. As the first step in data collection, I conducted six observations of the classroom throughout the semester. During the first observation, I was introduced as an observer in the classroom studying student participation. I did not participate in the classroom discussion nor did I attempt to engage students in private conversations. During each observation, a tally of the number and types of interactions (student initiated questions or remarks, responses to instructor questions, or student-student interactions) was kept on a seating chart. The gender (male or female) and age group (traditional-age or adult) of each student was noted on the seating chart. In addition, extensive field notes were taken recording my impressions of the interactions.

Second, at the end of the third week of class, a survey was given to all students in the class. This captured both in-class and out-of-class learning behaviors and the reasons students give for their learning behaviors. The survey included items about the frequency of classroom participation (answering questions posed by the instructor, asking questions about the course material, and responding to classmates' questions), reasons for the students' level of classroom participation, and out-of-class study behaviors. The survey included an invitation to adult students to participate in an individual interview.

Finally, two adult students were chosen from the class to be interviewed. The interviews were recorded and transcribed. The interviews focused on classroom participation as well as attitudes towards mathematics and past experiences in mathematics that affected their classroom participation.

As a further check on the validity of the findings, the instructor of the course was consulted to verify the responses of students on the class surveys and interviews.

Data Analysis

Because research shows that that active engagement with the material, instructor, and classmates promote learning (Howard & Henney, 1998), the data collected in this part of the study was analysed from a social constructivist framework. Adult students' perceptions of their participation and the factors that encouraged or inhibited participation were explored. Because learning occurs in context, the interviews and observations were analyzed in the context of classroom social norms and expectations. Results from the observations and survey were analyzed to determine the classroom social norms and to determine any general differences between the behaviors of adult and traditional-age students. Next, the transcripts of the interviews of the two participants were coded and analyzed in order to better understand the perceptions of adult students regarding their participation.

Results

The results of the classroom observations, the class survey, and personal interviews were viewed together in order to understand what learning behaviors adult students exhibited in a college mathematics course and why adult students chose to behave in the ways they did. After

the classroom norms were established through classroom observations and a class survey, the interviews of the adult students were examined in order to understand how these students fit into the normal behavior of the classroom and the reasons behind their participation in classroom discussions.

Classroom Observation Results

Six observations during the semester revealed the overall patterns of participation in the class. The instructor for this class had an interactive style; he would often stop and pose a question, waiting for students to respond. He asked an average of about 20 questions per 50-minute class period. Consistent with the research of Karp and Yoels' (1976) model of "consolidation of responsibility", it became apparent that only a few students were responding to the majority of questions posed by the instructor. Four to five students actively answered and asked questions in a typical class session. Some students never spoke in any of the sessions observed. Of the "talkers" (Howard & Baird, 2000), three were adult students and two were traditional-age students. Interestingly, the students who accepted the responsibility of being "talkers" changed through the semester. Some, who were very active in the beginning of the course, became quiet as the semester progressed, and some students became more active. This seemed to depend on the particular topic being studied at the time.

Student-to-student interaction increased greatly as the semester progressed. During the first week, there was very little interaction even though the students were familiar with each other from their previous developmental courses. As the semester continued and the instructor gave more problems to be completed in class, student partnerships formed and by the fourth week of class, the students seemed very comfortable asking each other for help. This interaction was enhanced both by the small size of the class and by active encouragement from the instructor.

Class Survey Results

Three weeks into the course, students completed a survey about their learning behaviors and their level of participation in class. The survey included demographic information, items on participation in class and learning behaviors used outside of class. Although the class enrollment was fifteen, only eleven students were present on the day the survey was completed. Of the eleven students who completed the class survey, seven were between the ages of 18 and 24 and four were 25 or older. Nine of the eleven were part of the FOCUS program.

The responses to the survey questions were tabulated to determine the overall learning behaviors and levels of participation in the classroom and to compare the responses between adult and traditional-age students. Because of the small number of respondents, definite conclusions about the difference in learning behaviors of adult students and traditional-age students cannot be made, but several interesting trends emerged. Although few students reported contacting the instructor outside of class, adult students reported more instructor contact than traditional-age students. In contrast to the reported frequency of instructor contact, the instructor reported that no students had contacted him outside of class. This information was not known at the time of the interviews so this discrepancy could not be explored. Second, adult students reported that they stayed after class to talk to the instructor in greater numbers than traditional-age students. This was confirmed by classroom observations. This may reflect the lack of time adult students have to seek academic assistance outside of class (Bourgeois et al., 1999; Kasworm, 2006). A third difference was in homework and study habits. Adult students were less likely to study or do homework with a classmate. This is typical of adult students who have little time on campus (Kasworm, et al., 2002). Students' perceptions of their participation in classroom discussions were similar for both adult and traditional-age students.

Most students responded that they *sometimes* asked questions in class, *sometimes* answered questions posed by the instructor, and *sometimes* or *often* asked questions of their classmates.

Adult Student Interview Results

Two adult students, both in the FOCUS program, agreed to be interviewed for this research. Joe was very outspoken in class while Mary was very quiet.

Joe

Joe is a military veteran, a husband, and a father who is working on a degree in social work. He attended college for a semester immediately after graduation from high school, but "figured out I wasn't really ready so I went into the Air Force." After his military commitment was completed, Joe worked for a private contractor in the Middle East. After four years in the Middle East, Joe decided to return to college. "I knew I needed something less strenuous, a career. So I came back and decided to go back to school, because I still had the GI Bill." Joe plans to work counseling veterans and active duty military personnel in the areas of substance abuse and post-traumatic stress disorder.

Joe's past experiences with mathematics were mixed. While he had no strong negative feelings about his high school mathematics courses, Joe acknowledged that he was not particularly successful in mathematics. "I really never got anything out of it. It didn't really stick with me or intrigue me…maybe that was it. But I never disliked math, I just never was really good at it." After high school, Joe's experiences with mathematics became more negative. In his first semester of college, immediately after high school, he just stopped attending his college mathematics course. After returning from the Middle East, Joe took an online developmental mathematics course. "It was online, and I… it was so hard. It was basically teaching yourself. So, I was kind of at my wit's end." Joe avoided taking mathematics courses until the present semester. He explained that now, he has definite mathematics anxiety. "When I go into a math class—oh, math classes especially, something I'm not strong in—I get this feeling of, am I going to be the one that's just behind, not understanding it." Joe applied to the FOCUS program on the recommendation of a friend. He was somewhat less anxious in this class as "everyone is kind of on the same page as you."

It became clear after a few observations in his current mathematics classroom that Joe was a "talker", defined by Howard and Baird (2000) as one of the few students that take responsibility for asking and answering questions in class. When asked what motivated him to speak up in class, Joe explained, "I want to get through it and pass. I mean, really, I want to get through this math and if I have a question, I will definitely address it." He recognized that his willingness to participate in classroom discussion is because of his age. "When I was a teenager or early 20's, you know, it's all about an impression or what people think of you and maybe that has a lot to do with it. But, I'm married with a son and so, I don't care what people think. I care about my grade." This lack of concern about the perceptions of his classmates is consistent with past research on adult learners (Howard & Baird, 2000; Fritschner, 2000; Weaver & Qi, 2005).

During one classroom observation in the middle of the semester, Joe was surprisingly silent. He seemed to have given up his role as a major contributor to the classroom discussion. When asked about this later, he explained, "It was that section on probability. That stuff gives me the most problems. And it gave me problems in 1311 [the previous class], too." He went on to say that he was still engaged in the class, he was trying to understand the material, but didn't know enough to say anything. "I don't know it; therefore I'm not going to say anything. My not saying anything doesn't mean I'm withdrawn, it means I'm trying to take everything in and trying to learn it and not saying anything to confuse myself even more." This suggested that the topic being discussed influenced participation. This idea was confirmed by the instructor later.

When graph theory was being discussed, the instructor reported that Joe had little to say, while a student in the back row, who hadn't spoken at all since the beginning of the course, became the most talkative student.

Joe also believed that his speaking up in class helped his classmates. He related his experience in a statistics course in which he received more understanding from what other students said in class than what the professor said. "Not to discredit the professor, but things that the other students would say, I understood them more and how they arrived at what they got. Sometimes that can be more effective than what the professor says."

Another issue that affected participation emerged during the interview with Joe. Joe felt a great disruption between the first and second eight weeks of the semester. The current course was offered during the second eight weeks of the regular 16 week semester. To be eligible to take this course, each student had to take the developmental mathematics course that prepares students for this course during the first eight weeks. Two developmental math classes fed into this course. Joe was surprised and uncomfortable with the addition of new students to the class. "We all kind of got to know each other in 1311 and then we got thrown in another portion; and on top of that—a new teacher." Joe felt that classroom camaraderie and participation was hurt. "People's attitudes and the way people responded in 1311 is completely different from how they are here. I think it has affected how many students feel comfortable, how they do on tests, and how they participate." Joe expressed his unease with the change. "It can be hard. I mean, even for me. It's hard to readjust." In spite of his discomfort, Joe said that this discomfort did not affect his participation.

Joe and Mary sat next to each other, and from the third class session on, collaborated on in-class activities. Although both were in the previous developmental class together, they did not sit together or know each other in that class. By midterm of this course, however, they had formed a partnership. Unfortunately, Joe was unable to take advantage of this partnership outside of class. He did most of his homework late at night. "I try to get in three to four hours on top of [mandatory] tutoring—just weekends and you know, at night, when we get our son to sleep." This is consistent with research that reveals that most adult undergraduates have little time to form study groups or use professor's office hours (Kasworm, et al., 2002).

Although not specifically tied to participation and social interaction in the classroom, Joe identified two other factors related to age that affected his performance in class. The first was the use of graphing calculators. "This calculator stuff is new to me. The technology aspect of math seems to not fit me. I can see how they're beneficial if we learn to use them, but…" Joe felt that younger students, who had experience with calculators in high school, had an advantage in the classroom. The second issue was the pace of the course. "I feel like I don't have enough time. I feel like I could do better if I had more time." Joe was referring, not to the time he had to study or do homework, but to the time limits on quizzes and exams. "I need to write stuff down, you know, step by step." He believed that he wasn't given enough time in class to demonstrate his knowledge.

In summary, Joe participated in classroom discussion at a high level. His reasons for his active participation included a strong motivation to be successful in the course, a lack of concern for his classmates' perceptions of him, and a responsibility to help other students in the class. When he was silent in class, it was because he had so little understanding of the topic being discussed that he was concentrating and trying to make sense of the discussion around him. Although he consulted with the student sitting next to him in class, he had little contact with other students in the class, and no contact with either the instructor or other students outside of class.

Mary

Mary is a criminal justice major in her last semester of school. She is a single parent with two children still at home and has a full-time job. She earned her associate's degree right after high school, but decided not to continue her education at that time in order to devote more time to her family. Twelve years later, when her youngest child started school, she returned to school to complete her bachelor's degree. She intends to enroll in a master's program in health psychology and hopes to work in jails and prisons counseling high-risk prisoners.

Mary has always had problems with mathematics. Describing her high school experiences, "I never actually had to do any math beyond first semester of sophomore year. So I have not actually been exposed to math since '87 and I was horrible at it then." When she earned her associate's degree, Mary chose the option of taking a computer course to satisfy her mathematics requirement. Now, mathematics is a source of fear and frustration. "I'm just terrified of it." Mary's frustration comes, in part, from her inability to use what she thought she understood in class:

> I don't have a problem understanding it in the class situation. I can get it in class. It's when I get home and try to go at it by myself and when I sit down to the exam. I just—I see that exam and I just lose it—I forget everything.

Mary also holds a strong belief that she will never be successful in mathematics. "I don't think I will ever understand it, or enjoy it, or (sigh), really grasp it." She believes that even if she received a good grade on an exam, it would be a fluke. "I would be absolutely shocked and I would think that he [the instructor] graded mine thinking it was somebody else's—that somehow my test got mis-graded." This enduring belief is consistent with Wedege and Evan's (2006) research in adult resistance to learning mathematics. Mary's beliefs about her ability to be successful in mathematics have been confirmed by past experiences:

> I've gone in [to an exam] thinking that I know the material, thinking that I've done well. I've looked at the test, and said, yeah, I get this; and I've gotten a C— or a D. And I go, where did I go wrong? I thought I did well.

After failing to pass her second developmental mathematics course by a mere five points, Mary entered the FOCUS program, was able to pass the developmental math course in the first eight weeks of the semester and began her current mathematics course. Mary's behavior in class was markedly different from Joe's. From the first day on, Mary was silent in class. Although she nodded often in response to remarks by the instructor and classmates, she would respond verbally only when called on by name. Mary had only vague reasons for her behavior. "Because that's the way I am. Usually, I'm really quiet, and I just hide." According to the class survey, Mary's reasons for not participating in classroom discussions included, in addition to shyness, not knowing enough to contribute and fear of appearing unintelligent to her classmates and instructor. Mary related that her quiet behavior wasn't unique to her mathematics courses. In her other courses, "I don't talk at all. They don't know who I am from the next person." In contrast to her behavior in other classes, Mary believed that she participated at a higher level in this mathematics course than in her other courses. As the course progressed, Mary would occasionally volunteer an answer in response to a question posed by the instructor and she responded on the classroom survey that she had been told that participation aids learning and that she was trying to be more active in class. Although Mary did not always actively participate in classroom discussions, she appreciated that others were more vocal. "They're usually asking questions that I'm not asking." When asked what kept her from asking questions, she repeated, "That's just the way I am. But I have been trying to [participate] more and more."

In contrast to her lack of participation in classroom discussion, Mary conferred often with Joe, the adult student sitting next to her. When asked about how she initiated conversation with her classmates, Mary responded, "They talk to me first. That's basically it." In spite of her shyness, she was able to form a working partnership with Joe in this class. She explained how this came about:

> We had never talked before. So we just happened to be sitting there in this class and started talking and I had a question one day and I didn't understand something and he started showing me, explaining it to me and so he's helpful because if I don't understand something, he'll explain it to me. And now, today, he didn't understand something and I was explaining it to him.

Mary was similar to other students who felt more able to interact with other students after getting to know them on a personal level (Gregoryk & Eighmy, 2009; Neer & Kircher, 1989).

Similar to Joe, Mary had no contact with either her classmates or instructor outside of class. Lack of time for school was a particular issue for Mary. "As soon as I'm out of class, I head straight to work. I leave work; I pick up my kids; and go home." She fits in time to do homework and to study either at work or after her children go to bed around 10:00. Mary acknowledged that traditional-age students have an advantage over her. "A lot of the other students that live on campus, they can go to SLAC [Student Learning Assistance Center] or whatever when they need help and I can't."

In summary, Mary participated at a low level in classroom discussions because of her innate shyness. She believed that in her other classes, she could be successful without actively participating. Because mathematics is particularly difficult for her, Mary was trying to be more active in class in order to be successful. While not contributing to classroom discussions, Mary formed a bond with a classmate and conferred regularly with him during class. Like many other adult students, Mary did not have time to meet with classmates or the instructor outside of class for help.

Cross-case Analysis

Although Mary and Joe had different levels of participation in classroom discussion, they shared some classroom learning behaviors. They both never missed class; they were always on time; and they were always prepared for the lesson. The classroom observations revealed that the usual attendance for the class was only twelve of the fifteen enrolled students. Of these twelve, it was not unusual for three or four to be late. By showing up and always paying attention to the lesson, both Mary and Joe demonstrated that they were seriously trying to succeed in this course. In addition, Mary and Joe believed they were particularly bad at mathematics. Both avoided taking their required mathematics courses until late in their college careers. Because of this, they felt under great pressure to pass this course.

Mary and Joe also shared concerns about the lack of academic support they felt in this class. Supporting Kasworm et al.'s (2002) assertion that the classroom is the focus for learning for the adult undergraduate, both Mary and Joe had little contact with either classmates or the instructor outside of class and were not able to use college-provided learning assistance. Although Joe could ask his wife for assistance on homework, Mary had no one to help her when she finally started her homework late at night. Even though both students were in the FOCUS program and were required to attend two hours of tutoring each week, they both felt abandoned to do their homework on their own.

Both Mary and Joe exhibited high levels of motivation and determination to succeed in this course. In addition to having perfect attendance and always being prepared for class, Mary

and Joe put forth an effort to be active members of the class. Even though Joe was daunted by the new teacher and students in class, he did not let this affect his level of participation. Mary, who was innately shy, was trying to overcome this and participate more fully in class in order to pass the course.

Mary and Joe agreed that the classroom size and the social atmosphere of the class affected student participation. When discussing the fact that everyone in this class paid attention, Mary remarked, "It's a smaller classroom and he's [the instructor] watching." Joe was particularly concerned with the social atmosphere of the class. While he felt comfortable in one aspect, "I feel like everyone's around the same because we're all together because of our abilities in math—which are limited," he was not comfortable with the change in instructor and classroom that took place at the beginning of this course, "You get used to a certain person and then you have to deal with another teaching method, another style." This change did not seem to affect Mary. She had previously had a course with the new instructor and liked him. "He has a way of teaching it where I can understand it immediately." Ironically, Joe, who was uncomfortable with the change, participated at a much higher level than Mary, who was more familiar with the new instructor. Both Mary and Joe were affected by other students' perceptions of them. Mary reported that she did not offer answers to problems because she did not want to expose her ignorance. Joe, although he denied caring about what other students believed, reported that he was more comfortable in class because he was not the only one to have problems with math.

Factors that influenced Mary's and Joe's participation in classroom discussions and activities can by summarized by the table below:

Factors that encourage Adult participation	Factors that hinder Adult participation
Motivation to Succeed	Shyness
Not Caring about Classmates Perceptions	Fearing Classmates Judgments
Wanting to Help Others	Unfamiliar Material
Personal Acquaintance with Classmates	Social Discomfort

Table 1. Factors that influence adult student participation.

Discussion

Mary and Joe are examples of the growing adult population on America's college campuses. Like many adults returning to college or enrolling in college for the first time, Mary and Joe struggled with mathematics. For both of them, significant time had passed since their last formal mathematics course. Although Mary and Joe had very different behaviors in the classroom, they both had to work hard to succeed in the course.

This study demonstrated the diverse factors that influence adult students' participation in the mathematics classroom. Because many adult students come to college unsure of their abilities, especially in mathematics, instructors need to be aware of the factors that hinder participation and create situations in the classroom for students to get to know each other on a personal level and encourage a supportive environment in the classroom. In addition, instructors should to be aware of the time constraints adult students face and provide opportunities for all students to access extra help with assignments. Because the classroom is the main learning environment for adult students, instructors need to plan carefully to take full advantage of the time in class.

Understanding the factors that affect adults' learning behaviors in the classroom is important in order to encourage adult students to participate fully in class. Since active engagement in the social context of the classroom affects student learning, instructors need to be aware of the factors that influence adult student participation. On the other hand, this study demonstrated that being proactive in classroom discussion did not always counteract other issues. Mary's main issue was time and anxiety, while Joe struggled with technology and the pace of the course. While both students were able to pass the course, how their different behaviors impacted their success remains undetermined. Further study is needed in order to understand the complex issues surrounding adult undergraduates learning mathematics.

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