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"Bio Buddies:" Peer Tutoring as an Instructional Strategy

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Abstract

Peer tutoring (PALS) is an instructional strategy where peers act as "instructional agents" for fellow students. In this study, 10 high school biology students participated in a ten day peer-tutoring intervention to determine whether peer tutoring would 1) facilitate student academic success, 2) enhance student focus as well as engagement in biology class, and 3) favorably affect students' behavior in class leading to fewer off- task behavioral problems. Baseline data included scores on academic tasks, student surveys, student reflection journal entries, teacher observation field notes, and behavior checklists. Similar data types were collected for ten days after peer-tutoring was initiated. Student scores on most academic tasks were higher after peer-tutoring, with the exception of scores on the unit assessment. More students completed homework after peer-tutoring. After peer-tutoring, off-task behavior in class was reduced. Most students "agreed strongly" that working with peers led to greater understanding, better focus on -task, and more enjoyment in studying biology.

Keywords: PALS, peer assisted learning strategy, peer-tutoring, peer partners, instructional strategy

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My classmates offered useful comments and criticism, without which this paper would have been impossible to complete. I thank them for their sense of commitment and their sense of humor.

Obviously, I could never have accomplished this research without my 5th period biology class. Their unique personalities and challenges gave me raw material to study peer-tutoring, a strategy that I have wanted to investigate for some time. I won't forget this incredible group of kids for a long time.

Lastly, I would also like to thank my husband and daughter, for their support during the hours I spent working on this project (and the soccer games I missed).

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Introduction

I teach in a small (71 students in total, 6th through 12th grades), suburban private school located in upper Westchester, on a sprawling 14- acre wooded campus. Students who attend my school typically have not been successful in public schools for a variety of reasons, including need for a small class setting with a low student to teacher ratio (usually a maximum of 11 students per class). Some of the students have learning disabilities (with Individual Education Plans, IEPs) and/or emotional and behavioral disabilities. Some students have mild autism. Numerous students are math and/or science phobic, largely because they have been unsuccessful academically in these subjects for years. Despite being in secondary school, such students have reading levels equivalent to sixth graders. For these students, reading a science textbook can be difficult and anxiety provoking.

My passion for teaching science is rooted in my being able to teach students using hands-on, interactive, inquiry-based activities. In my classes, we perform many lab activities, most of which involve multiple-step, detailed procedures. In my fifth period biology class especially, my students frequently show difficulty listening and understanding the directions. The kids struggle with adhering to the lab or activity protocol. I have tried multiple ways of getting students to be active listeners, when directions for the labs are being discussed: *I* read the instructions, *students* read the instructions, students *paraphrase* the instructions after I read them, I *model* the lab using manipulatives, etc. Despite these efforts, I have not been successful in getting my students to follow my instructions correctly. When students aren't listening actively, the lab results are often spurious and the students struggle with successfully completing the analysis questions.

As a practitioner, I am increasingly frustrated by my inability to get students to listen actively. And, I find that while I am repeating myself, the students who are less challenged become bored and frustrated. This frequently leads to behavioral problems in the classroom. Classroom management is increasingly more problematic for me, as students are off task. Others students appear completely lost, with a "deer in the headlights" look on their face.

Recently, I had an "a-ha" moment in which I realized just how much instructional time I use (and waste) repeating instructions. Hendricks (2009) describes this as a reflection-in action: a teacher gains insight into her practice as the action is occurring. We were doing a lab on

meiosis and sexual reproduction, using play dough to mimic chromosomes. Students were directed to cut two different colors of play-dough into designated lengths and then align their "chromosomes" accordingly. I explained and demonstrated how to do this, at least four different times. Yet some students still were unable to do this correctly! Such "knowledge-of-practice" is what Cochran-Smith and Lytle (2001) define as the ability of a seasoned practitioner to "inquire" about one's practice and learn from these autobiographical experiences. In that moment I remembered that in another graduate education course at Pace, I had briefly researched peer-assisted learning as an instructional strategy to accommodate students of diverse learning ability. So, I wondered why not try peer-tutoring with *this* class?

The research area I wanted to focus upon in this project involves a "teaching/ learning issue" that affects my daily practice (Class Power Point, 1/27/10). The purpose of this research is to explore the usefulness of the peer-tutoring strategy in facilitating academic success in all students, including those with learning challenges. This research also tests my hypothesis that students' active engagement in instruction may be associated with a decline in behavioral classroom management issues and more instructional time. My major research question is "*Can peer-tutoring be utilized to facilitate students' academic success (defined by informal and formal assessment of content mastery)?" Secondary questions are: "Is peer-tutoring negatively associated with classroom management issues and positively associated with increased instructional time?"*

Literature Review

Since my practice involves teaching students with learning and emotional disabilities, I found myself looking for an instructional strategy that would accommodate an array of diverse learners. Peer-tutoring is such an instructional strategy which provides small group, intense, focused instruction that allows students an opportunity for active responding and immediate student feedback. In peer-tutoring groups, teachers assign students to tutoring dyads, matching higher and lower performing readers into pairs. Fuchs, Fuchs, and Burish (2000) at Vanderbilt University collaborated with local school districts to develop a specific peer-tutoring instructional strategy entitled Peer-Assisted Learning Strategies (PALS). PALS was envisioned to scaffold all students, including students with disabilities (SWD), in reading comprehension

and decoding strategies (Fuchs et al., 2000). PALS was initially conceived for elementary school students; however, this strategy has been extended to also work with students at the middle school and secondary school level (Fuchs, et al., 2001). PALS incorporates three components: Partner Reading (one student is tutor, the other is tutee), Paragraph Shrinking (summarizing the main idea), and Prediction Relay (teaching students to make predictions and "chunk" larger amounts of text for reading comprehension). PALS procedural fidelity requires extensive teacher training and classroom implementation at least three times a week for ≥ 12-16 weeks.

According to Schloss, Schloss, and Schloss (2007), peer-tutoring is an instructional strategy where peers act as "instructional agents for their fellow students" (p. 355). Through peer-tutoring, students learn to collaborate in pairs, to improve listening, understanding, and reading comprehension (Sporer & Brunstein, 2009). Typically, students with lower reading or academic abilities (e.g. SWD) are paired with students of higher ability. One student, the tutor, asks the questions involving facts or details while the other student, the tutee, must respond to the tutor either verbally or by a written response. When the tutee responds correctly, the tutor reinforces the tutee's response and proceeds through the assigned material. When the tutee responds incorrectly, the tutor must provide the instruction for the tutee, with the teacher providing the necessary scaffolding. To motivate students and keep them on task, competing tutor-tutee teams can be assigned with students earning some reward (such as points) for their work. Through peer-tutoring, both tutor and tutee can learn how to ask questions, determine correct responses, and provide corrective feedback (Schloss et al., 2007). Besides affecting academic skills, peer-tutoring also increases the frequency of interactions between students, which is especially important for SWD who might otherwise have fewer interactions with typical students in the classroom. In this way, peer-tutoring potentially may also decrease behavioral problems in the classroom.

Peer-tutoring was originally designed to improve the reading performance of high-, average-, and low-performing students including SWD at the elementary school level (Fuchs & Fuchs, 2000). A decade of quantitative research comparing peer-tutoring with traditional direct teacher instruction (control group) has shown statistically significant gains in reading

comprehension and reading fluency in this group of students. Fuchs and Fuchs (2000) meta-analysis of PALS studied students in many trials, from grades kindergarten to high school. Pre- and post- testing of reading comprehension and reading fluency were done in all trials and a control group was included in each study (direct instruction). Calhoon (2005) studied the impact of PALS on teaching phonological skills and reading comprehension to 38 middle school students (6^{th}- 8^{th} grades) with reading disabilities (reading at the 3^{rd} grade level and below). PALS was statistically significant in improving post-test reading comprehension in reading subtests of word identification, word attack, passage comprehension, and reading fluency, compared with the control group. Calhoon (2005) also observed that PALS improved student engagement in reading (qualitative data). This study suggests that students persist longer on a task when they are actively engaged and take an active role in their learning.

Research trials (Fuchs, Fuchs, & Kazdan, 1999) examining the extension of peer-tutoring as an instructional strategy at the middle school and high school level have also been performed, with peer-tutoring success assessed as improvement in reading comprehension and strategy related test tasks (inferring, predicting, summarizing) compared with pre-strategy test tasks. Students engaged in peer-tutoring scored statistically significantly higher on standardized comprehension tests and achieved higher scores on procedural measures of summarizing strategies. A trial of peer-tutoring with secondary school students in social studies (Mastropieri, M.A., Scruggs, T.E., Spencer, V., & Fontana, J., 2003) has shown significant improvements in scores on chapter tests (with both open-ended and multiple-choice questions), favoring students who experienced peer-tutoring over students who received only guided notes.

A meta-analysis of seventeen studies (including 460 students with learning disabilities and 643 students at risk for mathematics disabilities, with 18% at the secondary level) utilizing peer-tutoring in mathematics revealed that there was a moderate effect size ($ES \geq 0.50$) for peer-tutoring in general education classrooms and a small-to-moderate effect size ($ES \geq 0.20$) for special education classrooms ((Kunsch, Jitendra, & Sood, 2007). One study of 213 8^{th} grade students in an inclusive science class revealed significant increases (compared with pre-test scores on content unit assessments) in the *individual* and *mean* unit posttest scores in the peer-tutored groups (compared with direct instruction control group), but the effects for both disabled

and typical students were not statistically significant (Mastropieri, Scruggs, Norland, Berkeley, McDuffie, Tornquist, & Connors, 2006). When compared with direct instruction, peer-tutoring of 39 high school chemistry students with mild learning disabilities over nine weeks revealed that students in the PALS group outperformed students in the traditional methods group and the highest gains were with the SWD, with 42% improvement in post-test scores (Mastropieri, Scruggs, & Graetz, 2005).

Overall, trials assessing the efficacy of peer-tutoring to promote academic success in secondary students in general and in science in particular are fewer in number and have shown a more modest effect in improving students' academic success, both for typical students as well as students with disabilities. Those trials which have been performed with secondary science students have had a smaller sample size, a shorter period of peer-tutoring implementation, and greater difficulty in motivating students to participate in the peer-tutoring strategy. A limited number of peer-tutoring trials have included student satisfaction surveys in the data collected (Bowman-Perrott, Greenwood, & Tapia, 2007; Fuchs, Fuchs, & Kazdan, 1999; Fuchs, Fuchs, Mathes, & Martinez, 2002).

Fewer peer-tutoring trials have evaluated whether peer-tutoring can also reduce off-task classroom behavior. Researchers (Bowman-Perrott, L.J. et al., 2007) have proposed that by promoting academic success, peer-tutoring may facilitate students' active engagement in the curriculum and thus reduce problematic off-task behavior. Class-wide peer-tutoring was utilized for nineteen secondary students with learning, emotional and behavioral disorders in teaching science to students in 5^{th}-12^{th} grades at alternative schools with low teacher pupil ratios. Class wide self-management training was also added to class-wide peer-tutoring (student assessment of their classroom behavior). The study showed a trend toward fewer instances of disruptive classroom behavior after peer-tutoring was implemented. The mean percent of time on task increased 77% from baseline in the peer-tutored group. Student satisfaction surveys revealed that the majority of students (85%) preferred peer-tutoring. Class-wide self management skills encourage students to be aware of their own behavior and to learn to control it. In this study, on-task classroom behavior is correlated with student academic performance.

Sutherland and Snyder (2007) also investigated whether PALS may be a useful intervention for disruptive classroom behavior, as students with learning and emotional disabilities may engage in negative behaviors because of inability to keep up academically. In their study of middle school students (6^{th} – 8^{th} grade), PALS helped such students increase "active responding" in the classroom and increase reading fluency. The authors reported that the PALS intervention achieved a decreased incidence of disruptive behaviors, with students developing enhanced social skills through their peer interaction. Fuchs, et al. (2002) aimed to answer whether peer-tutoring offers an improved social standing for students with disabilities. Students were also questioned about their peer acceptance and "how I feel about others" survey. The number of student "smiles received" was used as the observation tool; a greater number of "smiles received" was associated with the PALS instruction. PALS seemed to mediate improved social standing and self acceptance.

Utilizing peer-tutoring as a learning strategy is potentially important to both general education as well as special education teachers. Any content enhancement strategy that allows an educator to deliver instruction in a way that is organized and presented concretely, and where students are actively involved can improve the chances of student success (Schloss et al., 2007). Peer-tutoring increases academic engagement and ownership of learning among students (Mastropieri & Scruggs, 2003). In one study of high school students (including SWD), peer-tutoring helped to improve reading skills in both tutor and tutee (Marchand-Martella & Martella, 2000). Peer-tutoring encourages students who would not normally be engaged in class to stay focused on task. Additionally, peer-tutoring requires that students –and therefore educators - to focus in on "the big ideas" and "enduring understandings" that we want our students to learn. As Wiggins and McTighe have stated in *Understanding by Design* (1998), highly qualified educators need to question, "What do I want my students to know and what do I want them to be able to do?" When students are clear about the big ideas, they are much more likely to be engaged and remain on academic task (Tomlinson & McTighe, 2006).

Implementing peer-tutoring in my classroom qualifies as action research. According to the North Central Regional Educational Laboratory, action research requires focused inquiry by practitioners who improve their performance by analyzing the data they collect (Blackboard,

Teacher as Researcher ED 690 notes). Anderson, Herr, and Nihlen (2007) describe action research as that done by practitioners who use their own classrooms to conduct inquiry research. Hendricks (2009) states that action research provides educators with quantitative and qualitative information that can improve their practice.

The peer-tutoring method is especially attractive to me as a topic for my action research for several reasons. It allows my students to work together in small groups, "bouncing ideas off of each other." My students definitely appear more relaxed and seem to feel "safer" when they can brainstorm together. Also, I am becoming increasingly frustrated at having to repeat instructions so many times. This leads to unnecessary loss of precious instructional time. Even more importantly, my students are not reaping the full benefit of instruction, especially during lab activities. This has negative implications in understanding the science topic we are learning. I have already tried peer-tutoring a few times informally with this class. I do believe it was successful in that the students listened to each other and followed the protocols more closely. For example, we were studying a unit on the cell cycle and cell division, where students were having difficulty remembering the sequence of the phases. I had pairs of students engage in a jigsaw-like activity. Each pair "taught" each other about one phase of the cycle and then "taught" the entire class about that phase, etc. This strategy was engaging and helpful to the students.

Specifically, I wanted to investigate whether peer-assisted learning (tutoring, mentoring) would augment my particular students' ability to understand and engage in the science curriculum more fully, compared with direct teacher instruction. Would peer-tutoring enhance student academic success, as judged by both informal and formal assessment on verbal and written assignments? Some of my students have learning disabilities and are challenged in following directions verbally. Some of my students have behavioral difficulties and attentional issues, which make it difficult for them to stay on task and engaged. Conversely, some students are sophisticated in science inquiry and are frustrated by waiting for the others to "catch up." I then find these students off task, talking aloud or doing something else.

The research method for this project can be considered "descriptive" in that it focuses on "knowledge development; surveys, interviews, observation" (Class Power Point, 1/20/10).

However, it is also an "intervention study" in that I will be measuring baseline data, implementing a strategy (peer-tutoring) and then measuring post-strategy variables (Class Power Point, 1/20/10). Ideally, this project should be done in an experimental research format, with a non-peer tutored control group, (Class Power Point notes, 1/20/10) to make any claims that are generalizable outside of my classroom but of course this is not possible given the constraints of the study. Action research involves choosing individuals to participate in the study who are important to the teacher's practice (Hendricks, 2009). So, although outcomes from this study may not be transferable for other educators, this research could ideally be a starting point for a quantitative study where statistical methods could be utilized (Hendricks, 2009).

My research questions are: "*Can peer-tutoring be utilized to facilitate students' academic success (defined by informal and formal assessment of content mastery)?" "Can peer-tutoring be utilized to keep my students engaged (e.g. increase time focused on task, enjoyment) in science class?" "Can peer-tutoring favorably affect students' behavior in science class (i.e. reduce behavioral problems in class)?"*

These research questions are really sub-questions of each other. The action research process is a "research inquiry cycle" (Class handout, 1/27/10) in that designing a study, analyzing data, and taking action may actually lead to other research questions being addressed and then answered. I believe that student success is inherently associated with engagement, which minimizes behavioral and classroom management problems. If indeed the premise that behavioral problems are directly related to lack of students' ability to be successful academically and to be engaged, then a positive result for questions #1 and #2 should lead to a positive result for question #3.

My research contributes to existing peer-tutoring research in that I explored whether this strategy will be successful in promoting academic success, at the high school level in a science (biology) curriculum, in a class composed of students with and without learning disabilities. Additionally, since I collected data about student satisfaction and student on-task behavior (through a teacher observation log, teacher field notes, student questionnaire, student journals, and a behavior checklist), I tried to correlate student academic success with student engagement in the curriculum and decreased off-task classroom behavior. My review of the research

literature on peer-tutoring has revealed few articles which have captured all of this information, especially at the secondary school level in science content.

Methodology

Context of the Study

For this project, I studied my 5th period Biology class, composed of 10 students in 9th and 10th grades (9 in 9th grade, 1 in 10th grade). This class generally meets daily, directly after lunch and recess, except on alternate Fridays when it meets the first period of the day. The class consists of six boys and four girls. Eight students are Caucasian and two students are African-American. Nine students are of middle-class economic status; one student is on financial scholarship. Four students are new to my school this academic year. Five students have learning disabilities and two students have emotional disabilities. One student is dyslexic. One boy has been in a "fragile child" program at a public school until this year; he is socially awkward and hypersensitive to smells, noise, and tactile stimuli. Several of the boys have hyperactive Attention Deficit Disorder (ADD). One boy is unable to sit for the entire 42-minute period and must take several "bathroom breaks" in order to retain focus. One girl has mild brain damage from lack of oxygen at birth and must be frequently re-directed. Two other girls are severely school phobic and have frequent absences due to overwhelming school anxiety. One girl was recently hospitalized in a psychiatric facility for anxiety, depression, and suicidal ideation. Accommodations and modifications in the Instructional Educational Plans (IEPs) for these SWD include: the need for redirection and re-focusing, on-task cueing prompts, extra time for written test completion, and simplified directions, including paraphrasing and reading directions to the students. The dyslexic student must have written assessment questions read and explained to her.

A number of the students in this class told me at the beginning of the academic year that they disliked science and have historically found science difficult to learn. With that knowledge in mind, I provided classroom instruction during the first week of school in how to read a science textbook as well as in organizational skills, such as keeping a science binder and note-taking skills. Students receive copies of my teacher notes and I provide study guides to direct students in reading the text. I work with several of the students in their study halls and during lunch and I

collaborate with the study skills teacher in reinforcing more challenging concepts. I use many visual and kinesthetic aids to teach the curriculum and a number of the unit assessments are project-based.

My class is held in the science lab, which is in a separate building from the main school. Students sit at lab tables, in groups of two to four. The science room is decorated with many artifacts, including posters, plants, picture books, a model human torso, a DNA spiral, and lab equipment. Student work is displayed on the walls of the room. A schematic display, as well as pictures of my classroom set-up, are included in Appendix A.

From the beginning of the academic year, I teach my students to "observe like scientists," be skeptics, understand the big ideas, and think "outside the box." As a class, we frequently emphasize this approach throughout each unit. All students complete an "Interest Inventory" (Heacox, 2002) at the beginning of the academic year so that students' preferred styles of learning can be ascertained. My pedagogic style includes some mandatory whole-class instruction as well as many small group-based, hands-on inquiry activities in the form of labs and class projects.

Because our school's population is small (71 students, to date), students are constantly on "the radar screen." As mentioned previously, although our school is a college prep school, many students are "alternative learners." As teachers, we have the opportunity to know our students-and how they learn-well. The headmaster meets with all the teachers weekly to discuss the students' academic progress and behavioral issues. The challenges which I have described above are more universally noted by other teachers in other classes. Issues of student comprehension and off-task behavior are germane to all of us. Successful implementation of a peer-tutoring strategy, for both instructional gain and behavior management, could have an enormous school-wide impact.

As lead teacher in my classroom, my role was both as an active observer as well as a research participant in this study. Most of the time I was a "privileged, active participant" where my "participation was secondary to observation" (Class Power Point notes, 2/17/10). Hendricks (2009) states that teachers, as practitioners who study their students, must be participant-observers in that teachers facilitate as well as observe, while collecting observational data. This

is true because I observed how my students are learning in peer groups and how engagement in the curriculum and classroom behavior are affected by this strategy. However, since I also was actively scaffolding the students during implementation of the peer instructional strategy, I was also an "active participant observer" where "observation is secondary to participation" (Class Power Point notes, 2/17/10. My research can be classified as classroom action research in that I made interpretations from data I collected on my own students in my own classroom (Hendricks 2009). My research study included autobiographical reflection, "reflection-on-action and reflection-in-action" (Hendricks 2009, p. 25). I "observed from within," similar to Smiles (2008) in her study of the efficacy of peer-led literacy circles in middle school. The students and I were "co-researchers" in that we explored together whether peer-tutoring would work to help my students understand the science curriculum and be more engaged in science learning. The outcome from my study will definitely affect my teaching practice. Hopefully, the outcome from my study will also be useful for other teachers at my school who share the same students.

In one sense, my investigator stance for this research can be best described as "post-positivist" in that I "explored, documented, described, explained and critiqued the complexity" of my classroom situation which then "informed [my] theory and practice" (Class Power Point notes, 1/27/10). In a post-positivist study design, the teacher and students are participants and co-researchers and data is obtained through observation, surveys and student artifacts (Class Power Point notes, 1/27/10). However, I am also somewhat "positivist" in that this research study includes an intervention which is descriptive and exploratory, tests a hypothesis, and seeks a "knowledge that can be codified" (Class notes, 1/27/10).

Action Taken

I implemented a peer-tutoring/mentoring instructional strategy with my 5th period biology students, that is a "modified" (see below) version of the PALS protocol, developed by Fuchs et al. (1999, p. 309-311; http://kc.vanderbilt.edu/pals/about/). The peer-tutoring strategies, based on the PALS procedure, which I utilized included:

Partner Reading: students read together to practice basic reading skills, throughout a period of shared reading activities.

Paragraph Shrinking: learning the skills of summarization and main idea identification

Prediction Relay: a set of reading exercises that requires students to derive their own predictions from the reading material and check the validity of the predictions they have made as they continue reading the subsequent passages of the text (Fuchs et al., 1999; Fuchs et al., 2001).

Actual Research Study Protocol

Prior to implementing the peer-tutoring strategy, I collected baseline observational data (teacher observation log, teacher field notes, student behavior observation checklist), student artifacts ("do now" activities, quizzes, lab write-ups, unit written assessments), and inquiry data (student questionnaires and student journal notes) over ten school days. During this time, students continued to sit/work at three laboratory tables in my classroom: two tables of four students each and one table with two students. Typically, students work independently on their assignments in class but occasionally they "brainstorm" ideas with other students at their lab table. However, students never previously engaged in any of the component parts of the peer-tutoring strategy described. Specifically, students did not previously receive training or participate in Partner Reading, Paragraph Shrinking, or Prediction Relay (Fuchs et al, 2000). For the intervention portion of this study, I assigned students into dyads. Each student worked with one (same throughout) peer partner with whom he/she had not previously worked at the lab tables.

I then instructed students about how to engage in peer-tutoring "tutor-tutee pairs" during 42-minute class periods, over the course of four classes. Students utilized the peer-group strategy for ten additional days of classroom instruction. I then collected post-intervention data during these two weeks. My intention was that student pairs remain the same over the two-week course of the intervention. In general, students of greater ability and/or diligence were assigned as tutors. The more academically challenged students were generally assigned as tutees. Some students were assigned as tutors not because they are the most gifted academically but because they demonstrated desire to learn and ability to focus on the curriculum and keep the peer group on track. Student personality "fit" was also a consideration in assigning the student dyads. As the teacher, I circulated around the room to provide each group with scaffolding on as "as needed" basis. The same observational data, student artifacts, and inquiry data collected during

the baseline period were also gathered during the implementation of the peer-tutoring strategy intervention.

Assumptions

Fuchs et al. (1999, p. 313) state that in their experience implementing the PALS strategy at the high school level required a more structured "reinforcement system" with "tangible reinforcers." Fuchs et al. (2001) awards points for demonstrating appropriate tutoring behavior. At the end of each week, the class applauds the tutor-tutee pair with the most points! I did not provide extrinsic reinforcers for this project, but instead recruited "natural reinforcement" (Crimmins, Farrell, Smith & Bailey, 2007, p. 29) in my students, to see if students would work more diligently in the peer groups to improve their learning and understanding.

The students with whom I work fall into Piaget's formal operations stage, ages 11-12 through adulthood (McDevitt & Ormrod, 2004). At this stage, students should possess the ability to "reason about abstract and hypothetical ideas" which are essential for following the steps of the scientific method and analyzing data from lab activities (McDevitt et al., 2004, p. 152-3). "Typical" high school students probably learn these skills more gradually than Piaget exposed; learning and emotionally disabled students definitely learn these skills later (if at all) and have significant difficulty generalizing these operational skills across disciplines. Peer-tutoring as an instructional strategy may serve to facilitate this operational ability. Piaget's theory also states that "cognitive development is, to a considerable degree, propelled by intrinsic motivation" (McDevitt et al., 2004, p. 157). Piaget also believed that "interactions with peers may promote cognitive growth" (McDevitt et al., 2004, p. 162). Will peer-tutoring substantiate these statements and lead to a positive outcome for my students?

Vygotsky proposed that "complex mental processes begin as social activities" and that students "internalize the processes they use in social contexts and begin to use them independently" (McDevitt et al., 2004, p. 165. Similarly, peer-tutoring directly speaks to these strategies. The "zone of proximal development" is defined as tasks which students are not yet able to perform independently but which students can learn with scaffolding (McDevitt et al., 2004, p. 166). In essence, peer-tutoring can provide the scaffolding that is required for my students.

Peer-tutoring as an instructional strategy may help to alleviate problem behavior in the classroom. Crimmins et al., 2007, p. 8-11) discusses the use of "positive strategies" to reduce problem behaviors in students with learning and emotional disabilities. The authors state that if "a child's behavior is functional, it meets some need for the child" (p. 9). A "setting event" (such as a learning or emotional disability) coupled with an "antecedent" (e.g. whole class direct instruction) may lead to an "alternative problem behavior" (p. 9). The natural "consequences" of this problem behavior is teacher re-direction and possibly student reprimand. This "A-B-C" sequence is the basis of many behavioral issues in the classroom. Peer-tutoring can be considered a positive strategy that will "prevent and replace" the problem behavior (Crimmins et al., 2007, p. 13).

Pavlov, in his classical conditioning model, discusses how "environmental triggers elicit automatic behaviors or reflexes" (Crimmins et al., 2007, p. 18-19). For students with learning and emotional disabilities, repeatedly being unable to fully comprehend an academic activity may serve as an "environmental cue" that triggers an "automatic" off task behavior. This "conditioned response" is a learned reaction (Crimmins et al., 2007, p. 18). Thorndike stated that "positive outcomes strengthen behaviors and that negative outcomes weaken them" (Crimmins et al., 2007, p. 18). The goal of peer-tutoring is to augment students' ability to understand the biology curriculum more fully, to avoid negative behaviors in class. Bandura (Crimmins et al., 2007, p. 20-21) discusses "social learning" or "modeling" in which children exposed to appropriate behaviors are more likely to adopt these behaviors. Can peer-tutoring serve as a successful model to help students with disabilities complete their academic tasks successfully as well as avoid off-task behaviors?

Data Collection

The data from this research project is both qualitative and quantitative. As part of my qualitative data, I had students complete an initial "pre" peer-tutoring student survey to evaluate how students feel about current strategies for classroom instruction and whether it is easy or difficult for them to understand lab and activity instructions. Students then completed a survey after each session of a peer-tutoring activity, to assess whether they felt that the peer-tutoring

strategy fosters biology understanding. I also had a Behavior Checklist that evaluated behavioral issues pre- and post- peer-tutoring.

Quantitative data included student performance on formative and formal, summative assessments, such as observations, verbal presentations, "Do-Now" activities, worksheets, lab activities, homework, quizzes and unit tests.

Research Questions and Data Sources

Research Question	***Data Source:***	***Data Source:***	***Data Source:***
"*Can peer-tutoring facilitate students' academic success?"*	**Quantitative:** "Do Now" activities, homework, quizzes, lab activities, unit assessments	**Qualitative:** Student surveys (questionnaires), student journal entries, informal observations	**Qualitative and quantitative**: Teacher Field Notes and Observation Log; Observations of student verbal presentations
"Can peer-tutoring enhance student engagement in science class (i.e. time focused on task) ?"	**Qualitative/ Quantitative**: Student questionnaires	**Qualitative:** Behavior Checklist, Teaching Log (observations)	**Qualitative:** Teacher Field Notes and Observation Log, student journal entries
"Can peer-tutoring favorably affect students' behavior in science class (i.e. fewer behavioral problems in class)?"	Qualitative: Behavior Observation Checklist	Qualitative: Informal Teacher Field Notes, Teacher Observation Log	Quantitative: Off-Task Behavior Graph

Research question 1. "*Can peer-tutoring facilitate students' academic success?"*

Given the time constraints of our project, I collected baseline (before peer-tutoring) observational data (teacher observation log, teacher field notes). I kept a log of my on-going student observations by date for 5th period biology class over ten days (baseline data) prior to the peer-tutoring intervention. I observed (informally) how students were learning, by student comments and actions and also by monitoring student behavior. I also collected student artifacts ("do now" activities, quizzes, lab write-ups, unit written assessments) and student questionnaires (about their mastery of the curriculum) over these ten days. In addition to completing questionnaires, students also journaled their reflections on class instruction, both before and after ten days of peer-tutoring was implemented. The students were given verbal prompts before each written journal reflection. I specifically asked them to reflect on the efficacy of the peer-tutoring strategy, in facilitating their own learning. Academic content mastery was assessed by examining the same types of artifacts as utilized at baseline, for ten days after starting the peer-tutoring strategy.

Research question 2. *"Can peer-tutoring enhance student engagement in science class (i.e. time focused on task)?"*

I collected baseline (before peer-tutoring) observational data (teacher observation log, teacher field notes, behavior checklist), students completed pre-strategy questionnaires regarding their time focused in class, and students kept journals of their reflections over ten days before peer-tutoring was instituted. Student engagement in class (i.e. time focused on task) was assessed after peer-tutoring by observational data (teacher observation log, teacher field notes, behavior checklist), student questionnaires, and student journal entries after finishing ten days of the peer-tutoring instruction. I specifically asked students to reflect on the efficacy of peer-tutoring in keeping them focused on task.

Research question 3. *"Can peer-tutoring favorably affect students' behavior in science class (i.e. fewer behavioral problems in class)?"*

At baseline, a teacher observation log and field notes, a behavior checklist, and student questionnaires and journals were obtained over ten days before peer-tutoring was implemented. I documented daily observations as teacher field notes, looking for specific examples that

explained the pre-existing situation in my class (kids not performing well, kids off task, class management issues, etc.). Students' behavior in class was assessed by examining the same instruments as utilized at baseline, after ten days of implementing the peer-tutoring strategy. I specifically asked students to reflect on the efficacy of peer-tutoring in helping them self-regulate their behavior. I kept a Peer-Assisted Learning Groups Checklist (based on Hendricks 2009, p. 95) to record behavior/activity for students in my class, with regard to the items identified in the table. I completed this both before and after the peer-tutoring strategy observation. This focused on behavior issues and ability of the groups to stay on task.

Justification of Research Design

To be credible, action research should be supported by triangulation of data sources: obtaining and analyzing multiple forms of data (Class Power Point notes, 2/17/10; Hendricks 2009). The data collection techniques for triangulation of sources in action research include "experiencing (through observation and field notes), enquiring (when the researcher asks) and examining (through using and making records)" (Class Power Point notes, 2/17/10.

Anderson (2007) describes action research as that which involves "self-reflective inquiry" to improve educational practice (p. 3-4). Anderson (2007) discusses "internal validity" (the ability to trust the inferences from data collected in the action research) versus "external validity" (the ability to generalize the information learned by action research to a larger context (Anderson, p.35). Henderson (2009) states that action research should have "truth-value validity," "democratic validity," "process validity"and"catalytic validity" (p. 113). My research study has truth-value validity, process validity, and democratic validity in that I triangulated my data sources, provided "persistent and prolonged observation," recorded and interpreted data accurately, included member checks (in which my students as participants will be involved in discussing the interpretation of the data), and outlined an audit trail (Hendricks, 2009). Because I engaged in ongoing reflection on the results of my research with the intent to affect my teaching practice, my study also has catalytic validity (Henderson 2009).

I have also followed the steps outlined by Falk-Ross and Cuevas (2008) in designing a teacher research project (p. 16). The research plan not only specified where and when the project was conducted, but outlined who the participants were as well as the timeline for the project,

taking into account course time constraints (Falk-Ross & Cuevas, 2008). Likewise, I included pre- and post-testing, surveys/questionnaires and rating scales along with written reflections, both from my students and myself (Falk-Ross & Cuevas, 2008).

I collected observational data because this gives direct evidence of student interest and engagement (i.e. time focused on task) and positive student behavior (fewer behavioral problems in class). My observational data consisted of teacher observation logs, field notes, and student off- task behavior checklist and behavior scatter plot performed during the course of the research (starting before the peer-tutoring is implemented). Hendricks (2009) notes that observational data is most important in action research because it helps the practitioner decide whether the "intervention has had an impact" and how "the context of the setting impacted the study" (p. 90). The type of observational data must be organized to answer the research questions directly (Hendricks, 2009, p. 90-91). My research questions address the impact of peer-tutoring on student academic performance, engagement in science, and students' behavior in class.

I collected student artifacts because these give direct evidence of student mastery of curriculum content. Student-generated artifacts (homework, worksheets, lab reports, quizzes, unit tests) represent data that reflects student achievement prior to and as a result of implementing the peer-tutoring strategy. Copies of grading rubrics were included with the student artifacts since rubrics provide the student with a clear understanding of what performance is expected (Hendricks, 2009, p. 85). Verbal student responses, worksheets and homework assignments, short quizzes and "do-now" activities provide informal (formative) assessments while unit tests, lab reports with analysis questions, and long-term projects provide summative assessments (Hendricks, 2009, p. 81-82).

I collected inquiry data to "gather information from participants about their beliefs, experiences, opinions, attitudes or perceptions" (Hendricks, 2009, p. 97). Student surveys/questionnaires and reflection journal entries are useful data to record "learning struggles, successes, or personal accounts of growth and learning" (Hendricks, 2009, p. 83). I assigned a numerical value scale for student questionnaire responses, so that I could present this information quantitatively in my data analysis. The collection of inquiry data is directly aligned with all three of my research questions.

Analyses and Results

Data Analysis

I triangulated my data sources to answer each of my three research questions. I presented my data in tables, graphs, and charts. Graphs and charts were created in Excel 2007. Specifically, quantitative assessment of student achievement was presented as grade point averages on lab reports, quizzes and tests before and after peer-tutoring. Creating graphical displays makes data easiest to understand (Hendricks, 2009, p. 141). Rubric-scored work was utilized as appropriate. Student satisfaction with the peer-tutoring strategy was also quantified in this format, since the student survey/questionnaire has a quantitative rating scale or closed-ended survey item (Hendricks, 2009, p. 130).

Informal assessments were quantified as ability to successfully show evidence of understanding/completing an assignment (perhaps given a value = l) versus inability to complete assignment (value scale = 0).

Student behavior was displayed as a Behavior Checklist for each group in the class before and after peer-tutoring was implemented. I tallied the number of times each day that a) all members of a group were actively participating, b) group members were focused on task, c) group members were behaving well and no behavior problems were noted, and d) group members completed the assignment successfully (measured by the ability to recite information to each other and the teacher observer).

Other observational data (e.g. Teacher Observation Log) was descriptive and supportive of what was recorded in the Behavior Checklist. Hendricks (2009) states that observational data and field notes can be "coded as text" for "thematic analysis" (p. 143-144). Hendricks states (2009) that because [reflection] "journals are already in text form, no recording is necessary" (p. 151).

Research Question 1: "*Can peer-tutoring be utilized to facilitate students' academic success (defined by informal and formal assessment of content mastery)?"*

Data Source 1: Student Artifacts. Student artifacts from the students in Biology 5 collected during this study include a "Do-Now Activity," an in-class activity (lesson), laboratory

exercise with analysis questions, two quizzes, one unit assessment, and homework completion both before and after the peer-tutoring strategy was implemented. Ten students were in the class at the start of the study but one student left the school before the study ended so that some of the post- peer-tutoring data is only available for nine students (see Graphs 1-6). All student artifacts were graded on a scale from 0 to 100 percent. Students performed better on all post peer-tutoring assessments with the exception of the unit assessment, where student scores were higher on the unit test before peer-tutoring was utilized. Pre- and post- peer-tutoring student scores on assessments are shown in Graphs 1 through 6 (Appendix C).

Only three of ten students completed *all* homework assignments before peer-tutoring while six of nine students (67%) did so after peer-tutoring was initiated. This data is shown in Graph 7 (Appendix D).

Graph 8 in Appendix D shows the variability of student performance (shown as standard deviation) on all of the six academic tasks that students completed before and after peer-tutoring. The standard deviation after peer-tutoring for each academic task, with the exception of the laboratory activities, show students' performance to be more uniform after the intervention.

Data Source 2: Observational Data. During the course of the peer-tutoring intervention, a Teacher Observation Log for PALS (Appendix F) and Sample Teacher Field Notes (Appendix G) recorded through informal assessment whether academic success was facilitated by students working with peer partners. Informal observations of student verbal presentations after peer-tutoring suggested that more students understood the information presented and were more willing to share what they had learned with the rest of the class. Student verbal presentations were also more scientifically accurate.

Data Source 3: Inquiry Data. The data collection initial and follow-up student survey questions on peer group learning are included in Appendix B. Student questionnaires were completed after students participated in both a class lesson as well as a laboratory activity, before and after peer-tutoring. A rating scale of 1-5 (with 1 being "disagree strongly" and 5 being "agree strongly") was utilized. Student rating scales for the class lesson and the laboratory activity were averaged to yield one score value. Student responses to whether peer-tutoring made understanding the lesson or lab easier are included in Appendix H, and in Appendix I,

Graph 9. Before peer-tutoring, three of ten students (30%) "agreed strongly" that this strategy would help improve understanding of the curriculum. However, after peer-tutoring, six of nine students (67%) "agreed strongly" that peer-tutoring helped them improve their understanding of biology.

Similarly, student reflection journal entries before peer-tutoring suggested that students were "skeptical" that working with a peer would facilitate understanding of the lesson/lab, help students stay focused, or help them enjoy biology class more. However, student comments after peer-tutoring were overwhelmingly positive with comments such as, "My Bio Buddy and I worked more efficiently," "I got more work done [with my buddy] than I ever did," "Working with my buddy helped me understand more," "I learned so much more with my Bio Buddy," "I did better on my quiz after working with my Bio Buddy." Samples of student reflection journal entries are included in Appendix I.

Summary. Taken as a whole, these data suggest that the peer-tutoring strategy helped students achieve greater understanding of biology and helped them become more successful in completing academic assignments.

Research Question 2: *"Can peer-tutoring be utilized to keep my students engaged (e.g. increase time focused on task, and increase enjoyment) in science?"*

Data Source 1: Observational Data. During the course of the peer-tutoring intervention, a Teacher Observation Log for PALS (Appendix F) and Sample Teacher Field Notes (Appendix G) recorded that students were more focused on task and seemed to enjoy science class more after peer-tutoring was initiated. Informal observations of student verbal presentations revealed that students appeared to be more focused as well as more confident in discussing the curriculum than they were prior to the peer tutoring intervention. Students were less hesitant to ask questions about facts they did not understand and more willing to take "risks" in answering queries. Soon after the peer-tutoring was implemented, the students dubbed the strategy "Bio Buddies" and looked forward to working closely with their peers as much as possible. Behavior Observation Checklists before and after peer-tutoring are displayed in Appendix J. More students actively participated in the class assignment, were focused on-task, behaved well, and completed the assignment successfully after working with their peer partners.

Data Source 2: Inquiry Data. On average, two of ten students (20%) "agreed strongly" that peer-tutoring would help them stay focused prior to initiating peer-tutoring. After peer-tutoring, this number increased to 83%. This data is presented in Graph 10 of Appendix K.

Student enjoyment of biology class was definitely enhanced by working with a peer partner. Fifty percent of students "agreed strongly" that peer-tutoring would increase their enjoyment (satisfaction) of studying biology prior to implementing peer-tutoring. After peer-tutoring, 89% found that peer-tutoring helped them enjoy learning biology more. This data is presented in Graph 11 of Appendix L.

Before peer-tutoring was implemented, 50% of the students stated that they "very much" (rating scale 5) liked working with peers; however, after peer-tutoring was implemented eight of nine students (89%) "very much" preferred working with a peer for both a lesson as well as a lab activity. Student preferences for working with a peer partner before and after peer-tutoring are shown in Appendix M, Graph 12.

Student reflection journal entries are included in Appendix I. Student comments included, "I was much more focused due to my Bio Buddy," and "I actually pay more attention [because of my Bio Buddy]." Samples of student reflection journal entries are included in Appendix L.

Consistently, one student dyad did not enjoy working with a peer. This pair did not find that peer-tutoring facilitated understanding, staying focused in class, or help to make biology more enjoyable.

Summary. Taken as a whole, these data show that students were more focused and enjoyed biology more as a result of peer-tutoring.

Research Question 3: *"Can peer-tutoring favorably affect students' behavior in science class (i.e. reduce behavioral problems in class)?"*

Data Source 1: Observational Data. The Teacher Observation Log (Appendix F) and Sample Teacher Field Notes (Appendix G) suggest that students' overall incidence of off-task behavior declined after peer-tutoring was instituted. These observations were noted both during class lessons/activities as well as during laboratory exercises. Similarly, The Behavior

Observation Checklist before and after peer-tutoring (Appendix J) also show that more students behaved well and completed the assignment successfully after working with their peer partners. Student off-task behavior before and after peer-tutoring is displayed in Table 1 and 2 and Graph 13, Appendix N.

Data Source 2: Inquiry Data. Student reflection journal entries are included in Appendix I. Students recorded that they strongly believed that they were better behaved after working with their peer partners and were less likely to engage in off-task activities. One student stated, "My behavior has definitely improved and I actually learn more. This has been shown through my improved grades." Students also reminded me verbally many times during the intervention that they had learned "self-control" through this strategy.

Summary. Taken as a whole, students behaved better in biology as a result of peer-tutoring with fewer instances of classroom behavior management issues.

Discussion/Conclusion

The purpose of this research was to explore whether peer-tutoring would facilitate academic success in all students, including those with learning challenges. I also wanted to learn whether students' active engagement in instruction would be associated with fewer behavioral issues and more instructional time.

Response to Research Question 1

My first research question asked whether peer-tutoring as an instructional strategy could facilitate students' academic success. The data collected over the course of five weeks suggested that for these ten students working with a peer partner improved their grades on most written assessments, including in class-activities, lab activities and analysis questions, homework, verbal presentations, and quizzes. Interestingly, the scores on the unit assessment after peer-tutoring were lower than those on the pre- peer-tutoring unit test. However, the unit covered after peer tutoring was on DNA and molecular genetics, which is a more abstract and challenging unit than the prior unit on genetics. In the five years that I have been teaching high school biology, students consistently have shown more difficulty with this unit and scored lower on this assessment compared with other units. The positive response to research question 1 is especially

interesting because the students in this class are largely students with learning challenges and behavioral/emotional difficulties. Of the three sections of biology that I teach this year, this class consistently scores lower on all assessments, compared with the other classes. Finding an instructional strategy which successfully augments student understanding and student scores is most rewarding to both the students and me.

Response to Research Question 2

My second research question had two parts embedded in it: would peer-tutoring help students stay more focused in class and would peer-tutoring increase their enjoyment of biology class. Students overwhelmingly embraced the peer partner strategy. At the start of each class, four of the five groups consistently requested to work together with their self-dubbed "Bio Buddy." Students repeatedly thanked me for allowing them to be Bio Buddies and told me the strategy was most useful to help them stay focused on the day's agenda. One student even made up a sign that he held up each day as we started class: "This would be a good time to take notes and work with your Bio Buddy." The student journal responses reflected their acceptance of peer-tutoring and directly stated that the Bio Buddies definitely contributed to their enjoying class more.

One student group consistently disliked the concept of peer-tutoring from the onset of the trial and remained strongly against working with a peer throughout. The students in this dyad included a female student with hypoxic brain damage, claustrophobia (she could only sit near the door), and other emotional challenges. The male student has a significant learning disability, history of drug abuse, and emotional disabilities. He is actually leaving the school at the end of this academic year, for a self-contained special education institution.

Response to Research Question 3

My third research question had two parts: would peer-tutoring positively affect student behavior, leading to fewer classroom management issues, and would this result translate into more quality instructional time. The behavior checklist and table of off-task behavior before and after peer tutoring revealed a definite improvement in overall student classroom behavior. More students participated in the lesson, behaved well and completed their assignments when working with a peer partner. My students fell into a routine early on in that they would actively seek out

their Bio Buddy and settle into accomplishing their work. This, and the fact that student scores on academic tasks improved, suggests that meaningful instructional time was also enhanced by peer-tutoring.

Implications for Other Educators

My literature review cited many studies using peer-tutoring to scaffold student learning and understanding for all students, including SWD. PALS was initially conceived for elementary school students and most of the studies have been done with this age group. Fewer studies have been done with high school students and the question has been raised whether students who have been unsuccessful for so long can actually show benefit from peer-tutoring when first initiated at the high school level. My "pilot study" suggests that this strategy may be useful at the high school level and that high school students are very receptive to and enjoy working with a peer partner. Notably, there were no "extrinsic" reinforcers used in this study, as has been done with other peer-tutoring trials. Students responded favorably to the peer-tutoring intervention because of their "intrinsic" desire to learn, behave well and enjoy class more. I also believe that students responded favorably to this intervention because they saw that their responses (the student questionnaires and journal entries) were actively solicited and evaluated for ongoing teaching modifications and strategies.

There are even fewer trials in the literature that examine whether peer-tutoring can favorably affect student time on task, class behavior and student enjoyment of the curriculum. In this small study, peer-tutoring had an impressive positive outcome for each of these issues.

It should also be emphasized that the students in this study are mostly those with learning, emotional and behavioral disabilities. Whether more typical high school learners would respond to peer-tutoring similarly would need to be addressed by additional studies.

Lingering Questions

This study consisted of a small group of students over a short time interval. Whether peer-tutoring would prove successful over a longer period of time is unanswered by this study. I would like to continue this study to see if unit assessment scores for all units will also improve as the intervention is continued. Also, although behavior improved, a longer intervention interval is

needed to see whether even fewer incidences of off-task behavior would result from long-term peer-tutoring. Finally, for the one group that failed to respond favorably to peer-tutoring, additional scaffolding and training are necessary so that these two students can benefit from peer partners.

Reflections

Reflection on Teacher Research

I consider myself a reflective practitioner in that I am always evaluating what went well or what went poorly in my classroom. Since some of my students have learning challenges, I am always on the lookout for instructional strategies that will facilitate student learning. In fact, I decided to take graduate courses in special education, so that I could learn more about differentiated instruction. I had been particularly frustrated by my inability to consistently "reach" my 5th period class. As I have mentioned, it is filled with students of diverse learning and emotional/behavioral challenges. They are a social group (to say it politely) and so the idea of doing an action research project on peer-tutoring potentially fit this group really well.

When I started this project, my fifth period biology class was my least favorite class of the day because of my struggles with classroom management and my sense of failure at being unable to reach the students in this class. As I think back on the last five weeks, I am amazed not only at the growth of my students but at my personal growth as an educator. I now look forward to this class each day with excitement at seeing my students enjoy coming to class and looking forward to working hard and understanding more. My students are more open to taking risk now and more willing to explore new topics that they previously considered too difficult and therefore not worth the effort to learn. I see each of my students as individuals with personal strengths and gifts and not a conglomerate of students with learning disabilities. We trust each other more and we trust ourselves more. That my students have implored me to continue the "Bio Buddies" indefinitely and thanked me so often for doing so helps me realize how "lost" these kids felt beforehand. We all feel like our opinions and needs are being heard.

It is not easy to conduct action research and teach at the same time. The constraints of time and other responsibilities make it difficult to teach, observe, record and

interpret data all at the same time. Since this was my own class, I was fortunate to be both a participant as well as an observer and could therefore implement necessary adjustments during the research in order to keep the project on track and address the research questions directly.

I found the process of writing the research paper for this project tedious and challenging, much more so than actually conducting the research project. I am not fluent with APA style. Other professional papers that I have written have concentrated on the actual research protocol, findings, and presentation. I guess I was fortunate to have an "editor" who helped me format the papers to match the style of the publications for which I was writing. My learning curve to produce this paper in the correct style has been a steep one.

Hendricks (2009) states that the purpose of action research is for practitioners to investigate and improve their practices. Action research should enable the practitioner to engage in "systematic, self-critical inquiry (Hendricks 2009, p. 8). Falk-Ross and Cuevas (2008) discuss "leaving room for multiple findings" when the research questions for a project are devised (p. 18). When I started this project, I was unsure if I would find that peer-tutoring has no effect on academic success or may in fact deter students' learning. I was concerned that the student interaction would be too distracting for my students and lead to more time for off-task chatter and games. Happily, this study has a great outcome and enormous impact on both my pedagogy and student success. I engage in less direct instruction and when some direct instruction is necessary, I follow with some interactive peer partner follow through.

A final concern I had was how well my students would accept their role as either tutor or tutee. Would student egos get in the way? With the exception of one group of students previously mentioned, this was not an issue. In the end, my students functioned more as peer partners alternating back and forth between tutor and tutee.

Limitations of Study Design

I do plan to continue with my "Bio Buddies" for the remainder of this academic year. My response to the intervention has been subjectively favorable and I believe that students in this class are better managed and more successful as learners. I will continue to monitor scores from student artifacts to examine whether academic success improves over time with peer partners.

Some students noted on their follow-up survey responses that peer-tutoring intermittently

caused distractions. I am curious to see whether a more prolonged trial of peer-tutoring extinguishes or amplifies these distractions. Students also noted that they needed more time to learn to work more efficiently with their peer partners. A longer period of intervention would address whether students learned to work more efficiently as they have a longer exposure to this strategy.

To support my belief that peer-tutoring is a potent strategy to improve academic success and reduce off-task behavior, I would like to invite a supervising teacher to observe my class to examine the trustworthiness of my study design as well as my "subjective" interpretation of outcomes.

I also would like to see other teachers in other academic subjects at my school pilot peer-tutoring with their classes. Will there be carry-over across disciplines?

I would also like to spend more time training my students in the PALS protocol in depth: *Partner Reading*, *Paragraph Shrinking, and Prediction Relay*. Since my students have difficulties reading the textbook and engaging in higher order understanding and manipulation of curriculum, a more intense PALS training could be of substantial benefit for them.

Next Steps

I plan to generalize the peer-tutoring intervention to all of my classes, with appropriate modifications unique to each class that I teach. I am eager to see whether similar results are obtained with students of more diverse learning backgrounds and not just students with learning and behavioral disabilities. I have informally tried jigsaw group learning and cooperative learning with these classes but have not as yet explained the PALS technique or analyzed outcomes in student artifacts and classroom behavior.

I have also given considerable thought to the students' post- peer tutoring survey responses to questions, "What worked well with your peer partner?" and "What did not work well with your peer partner?" Some students had lingering concerns that working with a peer partner can be distracting at times. When setting up the peer-tutoring strategy, it is important to carefully monitor the students so that off-task behavior does not re-surface. As the teacher-

observer as well as the teacher-participant, I must be mindful of what is going on in all the groups as I monitor each peer group's interactions.

The amount of data which I accrued over this short intervention proved overwhelming for me. If I repeat this study formally, I need to manage my data more efficiently and selectively report that which supports my research questions directly. I am learning to appropriately distill the data I collect and skillfully analyze and report it.

Finally, I would also like to receive formal PALS training so that I too have a solid background in the technique which would increase the validity of my study design and outcome.

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Appendix A Schematic Display and Pictures of Classroom

Appendix B

Data Collection/Observation Instruments

Initial Student Survey: Peer Group Learning ***Ms. Romano***

Use the rating scale below to answer these questions:

1. How difficult was it for you to understand today's lesson/lab?

1 (not difficult at all) 2 3 4 5 (very difficult)

2. What would make it easier for you to understand the lesson or lab?

3. How much do you like working with a peer partner in class?

1 (not at all) 2 3 4 5 (very much)

4. How much do you agree with this statement: *"Working with a peer partner makes it easier for me to understand the lesson/ lab?"*

1 (disagree strongly) 2 3 4 5 (agree strongly)

5. How much do you agree with this statement: *"Working with a peer partner makes it easier for me to stay focused on the lesson/ lab?"*

1 (disagree strongly) 2 3 4 5 (agree strongly)

6. How much do you agree with this statement: "Working with a peer partner makes it easier for me to enjoy biology class?"

1 (disagree strongly) 2 3 4 5 (agree strongly)

Appendix B, continued

Data Collection/Observation Instruments

Follow-up Student Survey: Peer Group Learning ***Ms. Romano***

Name: _____

Use the rating scale below to answer these questions:

1. How much did you like working with a peer partner in class?

1 (not at all) 2 3 4 5 (very much)

2. Working with a peer partner made it easier for me to understand today's lesson/ lab.

1 (disagree strongly) 2 3 4 5 (agree strongly)

3. Working with a peer partner made it easier for me to stay focused on today's lesson/ lab.

1 (disagree strongly) 2 3 4 5 (agree strongly)

4. Working with a peer partner made it easier for me to enjoy today's lesson/ lab.

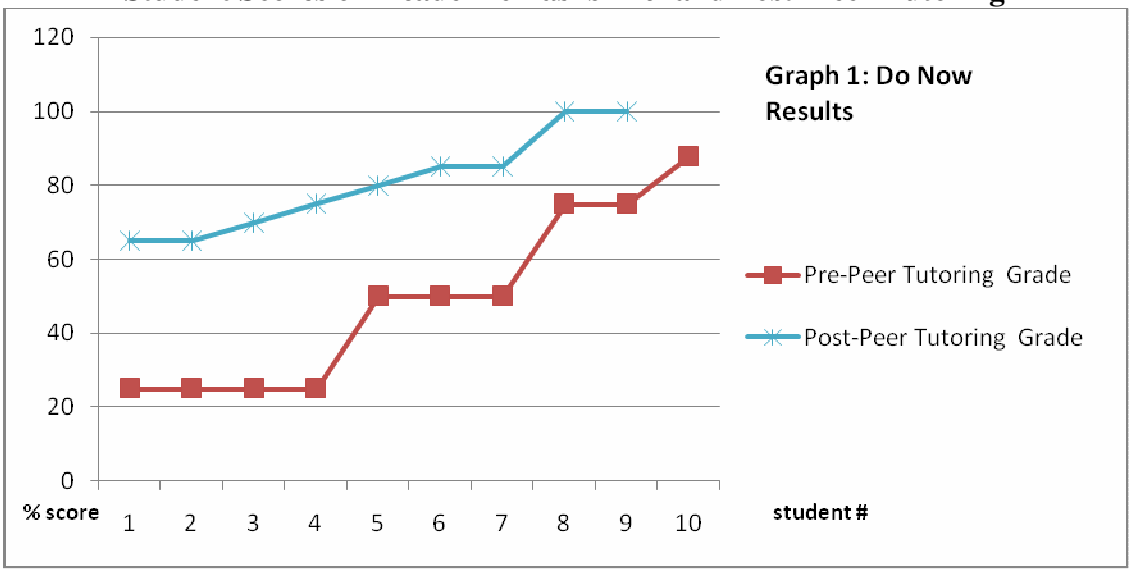
1 (disagree strongly) 2 3 4 5 (agree strongly)

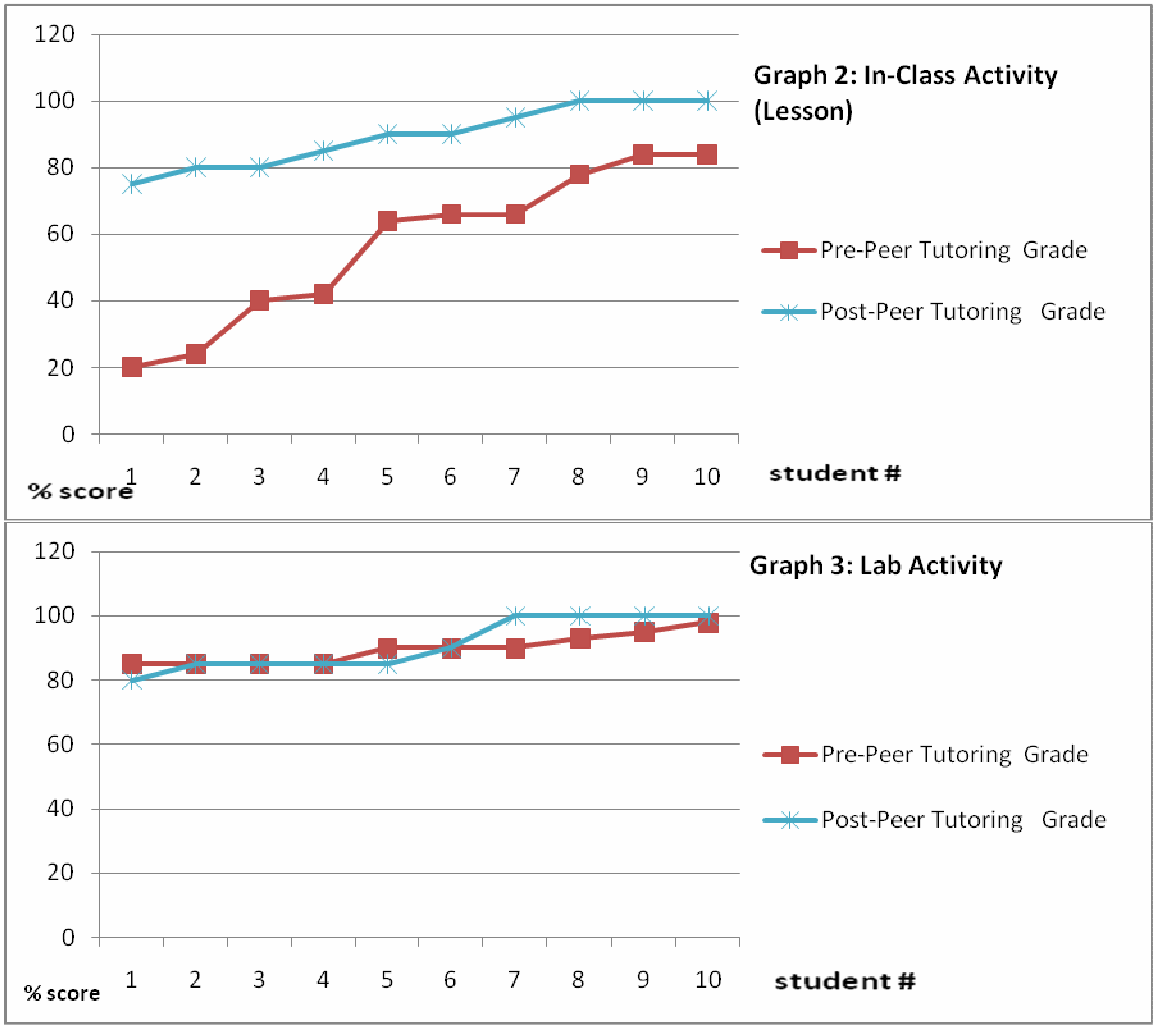
5. What worked well with your peer partner?

6. What did not work so well, with your peer partner?

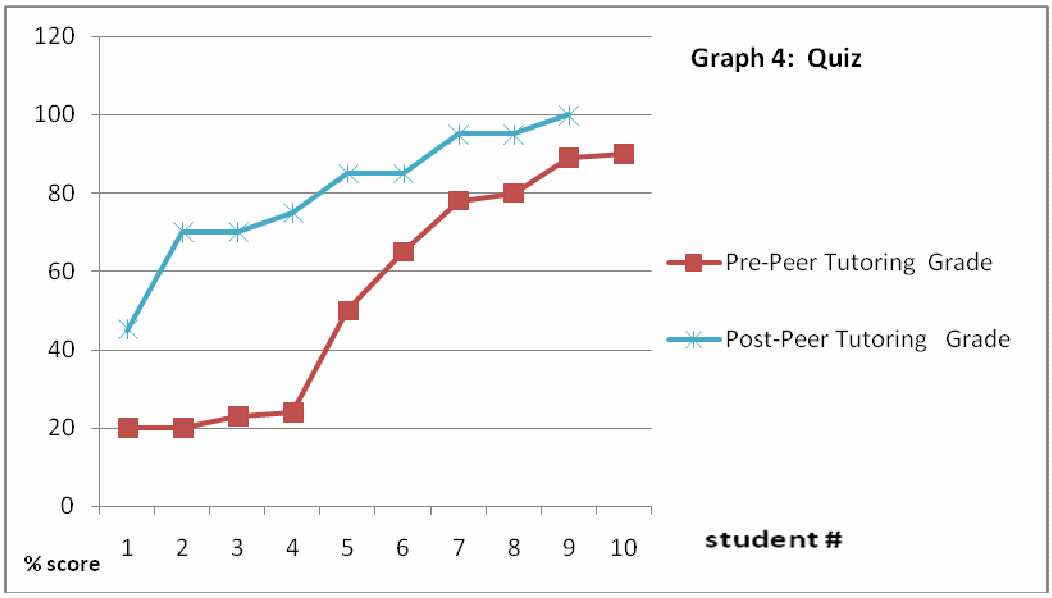
7. What could you and your partner do better next time?

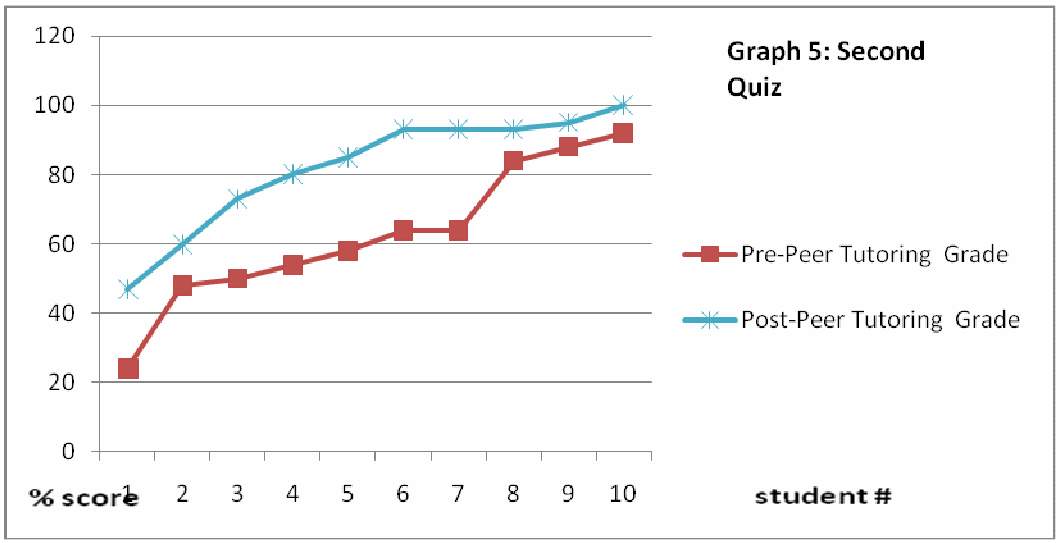
Appendix C
Student Scores on Academic Tasks Pre- and Post- Peer Tutoring



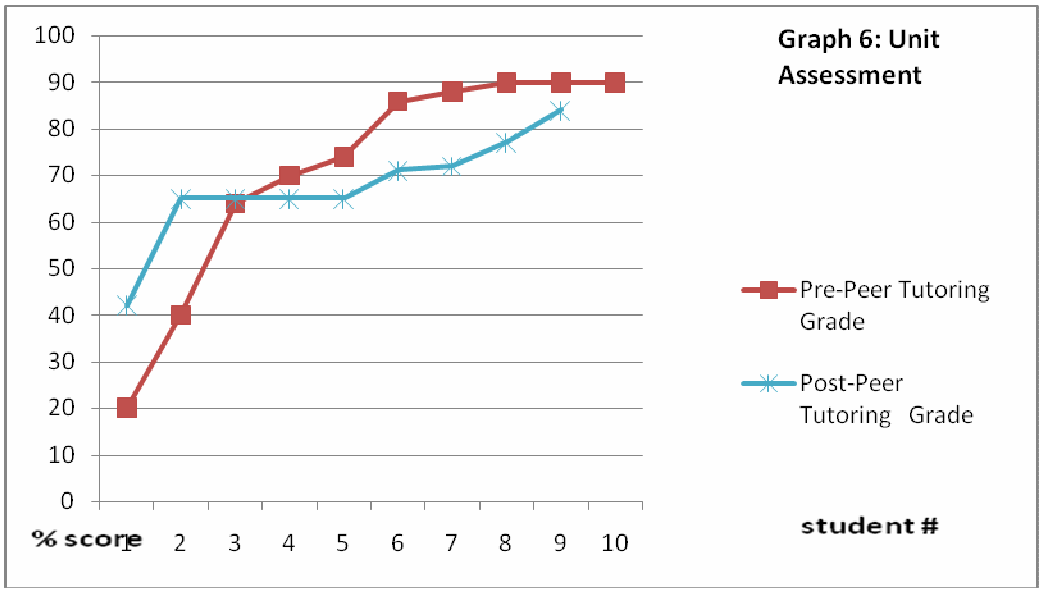


Appendix C, continued
Student Scores on Academic Tasks Pre- and Post- Peer Tutoring

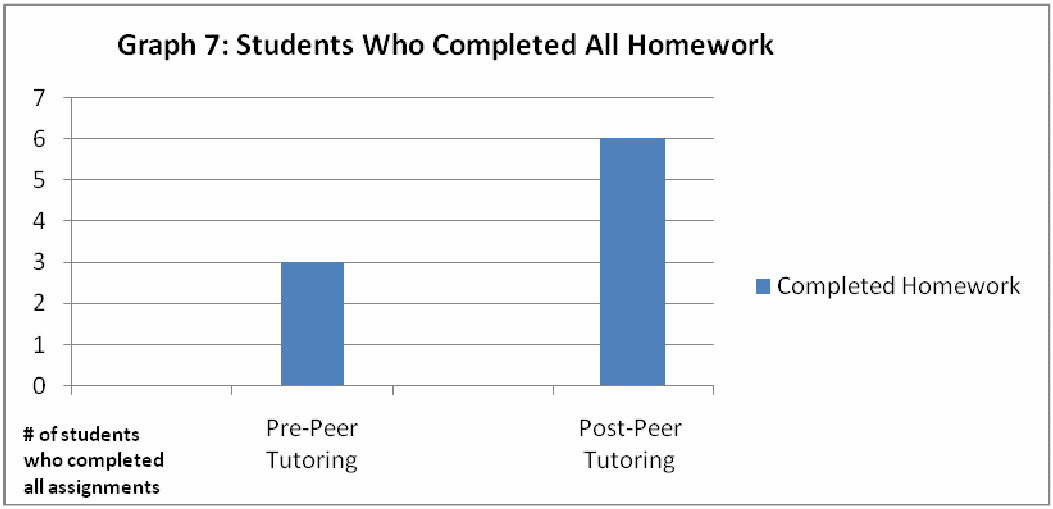




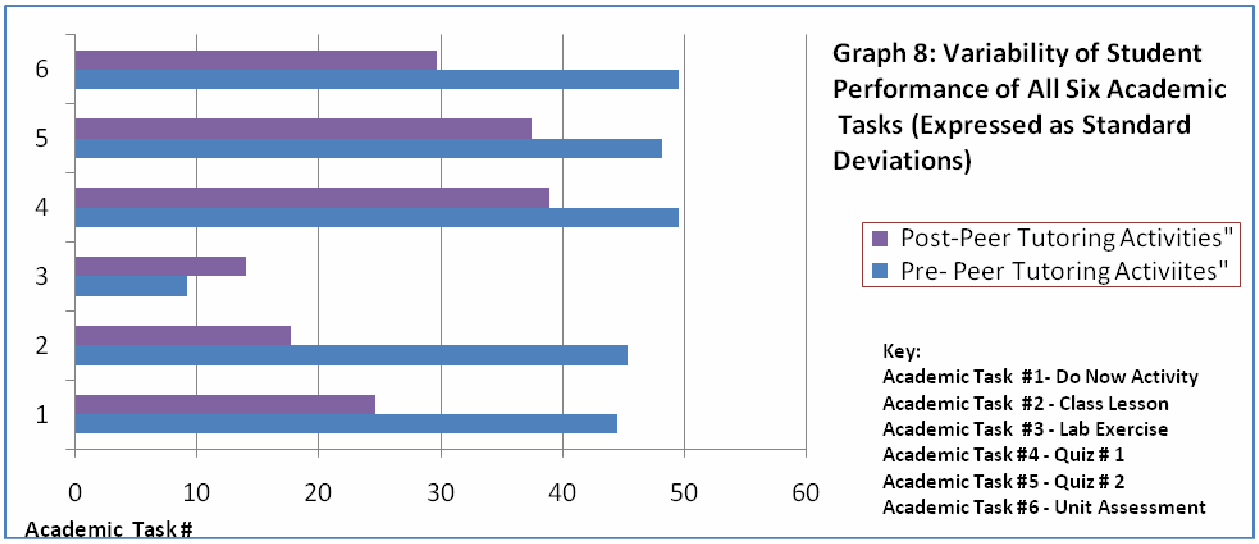
Appendix C: continued
Student Scores on Academic Tasks Pre- and Post- Peer Tutoring


Graph 6: Unit Assessment
100
90
80
70
60
50
40
30
20
10
0
% score
1
2
3
4
5
6
7
8
9
10
student #
Pre-Peer Tutoring Grade
Post-Peer Tutoring Grade

Appendix D
Number of Students Completing All Homework Pre- and Post Peer Tutoring



Appendix E
Summary of Standard Deviations



Appendix F
Teaching Log for Peer Assisted Learning Activity

Date	*Observations*
3/3/10	We had a lunch time review today since the class did so poorly on the Punnett Square quiz. Some of the kids are still not getting it and some just don't care. We again discussed the peer-tutoring intervention and reviewed its parts, so that we can start next week.
3/5/10	This was a direct instruction class using overheads, with students completing study guides. One lab table could not keep themselves engaged and needed re-direction several times. We discussed the procedure for the peer-tutoring program for next week.
3/8/10	We worked on genetic diseases. One lab table group was especially off-task. One of the boys was playing with molding clay and couldn't stop until I took it away from him. I reminded the kids we would begin the peer-tutoring strategy tomorrow and we reviewed how it would work.
3/9/10 **PEER TUTORING INTERVENTION STARTS**	I implemented the peer-tutoring strategy today. The peer buddies worked on a text reading and completed a review sheet together. I moved about the room checking in on each group. The kids were very receptive and worked well together – better than I would have expected. The room was definitely less noisy overall. The kids want to name themselves the "Bio Buddies" and give each of their groups a name. So far so good!
3/10/10	Second day of peer-tutoring. One group did not work at all- students did not speak with each other. One student was "hostile." I spoke with her later and she said her partner just did not "communicate with her." One group was very focused and finished the assignment more quickly than usual. Overall less noisy in class but still "unfocused" members in the other two groups. One group thanked me for implementing the intervention, "I love having a peer buddy." One student in another group "hates" working with a peer because it slows him down.
3/12/10	Peer partners recited the structure of DNA to each other as reinforcement after direct instruction. Verbal presentations, compared with their responses before peer-tutoring, showed that more students seem to be understanding the topic.
3/17/10	We did some whole group instruction on protein synthesis. I then had the students work in peer groups highlighting main ideas and making flash cards using the text book. In a jigsaw like

	activity, each peer group then presented their findings to the rest of the class. Using the jigsaw activity helped the students become more focused and on task and the behavior issues in the classroom decreased today.
3/18/10	The class was a combination of direction instruction followed by 25 minutes of peer group work. We worked on translation codons in RNA, to make proteins. It is a difficult topic and the groups worked well together figuring out the problems. The peer groups were useful to reinforce the direct instruction.
3/22/10	We worked on mutations in peer groups. Students completed sample worksheets on types on mutations with their peer partners. The students easily fell into their "Bio Buddies" routine.
3/23/10	Bio Buddies used flash cards to learn the vocabulary for molecular genetics. The kids easily moved into their groups and settled into working.

(* adapted from Hendricks, 2009, p. 94)

Appendix G
Sample Teacher Field Notes

1/25/10

It takes a great deal of time for my 5th period biology students to get settled, get out their materials and be ready to learn. Every day, I tell them to take out a pen and their notebooks and any handouts they have, before I start the lesson. Would it be more useful to hear it from a peer? This class is also a challenge for me in terms of behavior management with lots of interruptions to re-direct students. I think it is because they don't always understand the work easily and fade out during direct instruction. Might peer-tutoring also help me with classroom management?

I gave directions for a lab activity that had multiple steps to it. I had to re-focus several students multiple times. When it came time to start the lab, some had no idea what to do. So, what if I set up peer groups which can read the lab protocol together, explain it to each other, as I move around the room "checking in" with each group? Will that improve understanding and engagement in the lesson? I previously invited a seasoned teacher into my room to observe. She advised that I "keep it simple:" only read fractions of the instructions and then add on as the students finish each section. Will it help if the students read these sections to each other? I have read about the PALS strategy in a special education graduate class and I think it might be useful with these students.

1/27/10

We did a lab activity today using play-dough to model meiosis and sexual reproduction. It was a very visual and kinesthetic lesson so I thought it would work well with my 5th period (many of whom have learning disabilities and emotional disabilities). It was so difficult for them to follow the instructions! I had to repeat myself several times, even giving them only one step at a time. I noticed that several students starting pairing themselves off, explaining it to each other. My informal observation revealed that the student pairs worked well together: they got the task done correctly and more efficiently. And those students who were successful were engaged and not behavior problems. My "informal assessment" today makes me think that the peer-tutoring project may be worth the test.

1/29/10

I have been observing how individual students work with each other in class, when they are allowed to self-choose partners. I have been giving thought to how I would set up the peer-

tutoring groups. Interestingly, the "tutor" is not necessarily the most gifted academically. It is usually the student who wants to be successful and is interested in learning. Maybe working in peer groups will rub off on the students who are less engaged and less focused?

I had my 5th period Bio students as the first period of the day today, due to the schedule. The students are a lot less "energized" at this time of day (as I usually have them after lunch). They are much more focused and on task. I tried informal "peer-tutoring" as an instructional strategy at 3 different tables today. In two, it worked well for a reading assignment from the text. I used a lot of positive verbal reinforcement for success. I could see that the kids intrinsically felt good too, at being successful learners.

2/5/10

The class had a lot of difficulty staying on task today and following instructions. We did a unit on embryology with a lot of new terms. I stopped the class and spoke with them for about 10 minutes, "What would make this better for you?" Several kids asked me to let them brainstorm together to "paraphrase" (their term) the vocabulary words. I also suggested that we make a vocabulary wall and flash cards. Maybe each team could make its own vocab wall and compare it to that of the other groups?

2/8/10

The kids in 5th Bio class were uncontrolled today. The headmaster came to observe and speak with them. When the headmaster was in the room, they were well behaved and listened carefully to instructions. I didn't have to repeat myself for them to understand. So, perhaps there is a larger behavioral issue that I realized, that accounts for their poor understanding of instructions and content. I need to keep them more engaged. Will the PALS work?

2/10/10

We did an activity on Punnett Squares in Genetics in my 4th and 5th period biology classes. I had the students work individually, just to see how they would do. Several struggled in understanding the letter codes for dominant and recessive. I had them fill out a "pilot" pre-peer-tutoring questionnaire today. Over half of this class stated that they wished they could have worked in groups. Interestingly, many requested more direct instruction and more individual time to reinforce the concepts. I am thinking that if the peer tutors and tutees are carefully chosen, the peer-tutoring method may actually provide both of these requests. Students with

disability (SWD) definitely thrive from direct, intensive, and explicit instruction with reinforcement (Deshler & Schumaker 2006, p. 17). Mastropieri & Scruggs (2003) also state that SWD benefit from opportunities to practice problems, hear information repeated, and receive immediate feedback on their work (pp. 52-53). Peer-tutoring can provide all of this. (See student questionnaires and journal reflections.)

2/12/10

We have been working all week on a project that requires the students to do Internet research and then write a two page report. We have spent a few days doing the project in the computer lab, with significant scaffolding: I have been directing students to web sites, helping them organize their paper, providing immediate feedback. This project culminated with their presenting their work in class and engaging in a whole class discussion about their findings. Only 4 of the 10 students were successful in the end. I was disappointed in their performance because we dedicated so much time to the project. I passed out a survey again today and I had them reflect in their journals what went well or wrong. Many felt they needed more one-on-one assistance and that working in groups may have made the project easier. I hadn't considered doing this kind of a project using peer-tutoring. But, I am rethinking this as a subsequent project after I introduce the peer-tutoring strategy. (See student questionnaires and journal reflections.)

2/22/10

We returned from vacation today. My 5th period class was very "lively." Only ½ the class completed their homework assignment. I had to review what I taught on Punnett squares from before the break. We did a lot of reinforcement activities today. Some are definitely struggling with this concept. Will peer-tutoring help with this? I told them I was keeping track of how many times each group required re-focusing per class period, for off task behavior. I ended the class with a "do now" activity to try to formatively assess what they were learning. We have a quiz later this week. I had my students complete the pre-peer-tutoring survey today, about their working together in peer groups.

2/25/10

This class was most difficult to manage today because we have just learned we will have an early dismissal due to the snow. We did a unit on sex-linked traits in genetics as well as the blood groups. The students struggled completing reinforcement activities. I will do a lab on

blood groups with them next week to cement the topic. I also will have them make flash cards for Mendel's laws as well as incomplete dominance, co-dominance, and sex-linked traits. This topic is especially difficult for my student with dyslexia who scored a 0/100 on her quiz!! And we worked together one-on-one for a whole period of review beforehand.

3/1/10

No one in this class did their assigned homework! I reviewed their quiz grades with them (noted 2/24-2/25) and told the class I would have a mandatory review on Wednesday at lunch and then they could re-test. At that time, I will read the questions out loud and draw the Punnett squares for them, to help them visualize the problems. It is so difficult for this class to master the curriculum but I keep trying. The next unit is on DNA and this is a lot more visual and kinesthetic in that I have models and labs where the kids can really see what DNA looks like. I am also going to do some research on my own to see how I can better assist my student with dyslexia. She tries so hard and I could see how upset she was today when she saw her score of 0 on the quiz. We don't have special education teachers or teachers' aides at my school but I think that I need to find a way to read exams to her.

The students are enjoying filling out the student surveys. They told me today that they appreciate my being open to their thoughts and suggestions and vigilance in looking at alternative ways of teaching. They like the fact that the class is so interactive and that their feedback is solicited.

I introduced the idea of peer-tutoring with the class and the component steps we would use: partner reading, paragraph shrinking and prediction relay. I explained that I would assign the pairs. I didn't call it peer-tutoring but peer groups because I don't want students' self esteem to be affected by this process. They are very eager to try the strategy. I will work with the students over this week about the components of peer-tutoring before we actually start the intervention.

3/2/10

We studied sex-linked traits and human pedigree analysis today. It was so difficult for them to grasp. One student just kept saying, "I don't get it." I taught the same lesson to two other classes with little difficulty. Today, I had students read the problems, come to the board to draw out the Punnett squares and recite back to the class the steps involved. I think that the

concept is just too abstract (or math related) for many to grasp. Tomorrow I will hold an extra class review at lunchtime to help this class. I am going to make some manipulatives tonight to serve as visual models that hopefully will help. We have a lab this week on blood groups that also will hopefully clarify things. This is my 5th year teaching this curriculum and I have never had such difficulty getting the information across. But, again, almost every student has a learning or behavioral disability in 5th period biology. I spent an extra period working with two students to bring them up to speed.

3/3/10

The class performed well during the lab on blood groups today. We used food dyes in "well grids" to represent the different ABO blood groups. It was a very visual, hands-on experience. It was effective. The students actually thanked me for the lab! I think that the key is doing as many labs as possible with them; I just have to get them to stay quiet to read the directions carefully before we start. I still had to repeat the directions as least three times before some students understood the intent of the lab.

I also gave an eight question quiz on blood groups and despite the lab, several students did quite poorly. These students have a limited ability to carry over learning from one application to another. I also had the students complete the questionnaire regarding peer groups and journal again today, after the lab activity and the quiz. I thought it would be useful to compare their responses after a lesson as well as after a lab activity. Some kids were annoyed at having to fill out the survey again but many were thankful that I sought their input. They do love to journal though!

I again discussed the peer-tutoring model with the students and explained that we would begin using it next week. We spoke about Partner Reading, Paragraph Shrinking and Prediction Relay. I gave the students examples of how we would use the text book in peer groups and how peers could brainstorm answers to lab analysis questions and worksheets.

3/8/10

Today, we worked on genetic chromosomal diseases and the students were engaged. They had lots of questions about autism. The discipline issues were fewer because they were so interested. I reinforced how the peer-tutoring dyads would work and established the peer partners, based on personality fits and the tutor-tutee structure. We will start tomorrow.

3/9/10

I implemented the peer-tutoring intervention today, to complete an in-class "quiz" (really a review sheet) on karyotyping and genetic diseases. The students changed their lab tables, according to their assigned peer groups. We reviewed the steps of the peer-tutoring process. I allowed the peer pairs to read the textbook together and jointly complete the handout. Peers could ask me questions but only after they were unsuccessful in obtaining answers after brainstorming with their peer partner. Four of the five groups were more focused and definitely working together. The students asked if they could rename the intervention the "Bio Buddies" and if they could name their groups. Of course, my answer is yes and yes! I am thrilled at their acceptance and positive reaction to the first day of this intervention. I also had the students reflect in their journals and am eager to see what they wrote. I actively moved about the room today checking in with each group, making sure students were finding what they needed and were on task.

3/10/10

Today was fascinating! We did a peer-tutoring lab activity in the computer lab on deciphering karyotypes. I can't say that I expected these results! Before class began, a usually quiet student came to me to thank me for implementing this system. He told me that he finds this very helpful to stay focused and get his work done. This student is usually moribund in class and has repeatedly told me how he loathes science. In the lab, things were going well initially with fewer behavioral issues. Then it was clear that one group just couldn't work together. Their body language showed them literally turned away from each other and they refused to communicate with each other. I spoke with both of them to find out the problem (later). The female student said that her peer just wouldn't stay focused, wouldn't answer her, and just turned to another peer group. So, she told me, she "gave up." I stayed with this group for a good part of the period, helping them get through the lesson. I needed to refocus the male student repeatedly. He is one of the most problematic (discipline-wise) in the class and is currently failing the course. He has a severe learning disability. Wow! I didn't anticipate the intensity of this reaction!

One group was absent. The remaining three peer partner groups got their work done overall but two groups needed a fair amount of re-direction. Interestingly, the group that

completed the project in class and worked the most diligently together (successfully) noted in their comments that they did not enjoy working together!! The male student said that his female partner (the tutor) wouldn't wait for him to catch up. This intervention is very new and will take much more practice to work as I envision it to work. Learning to work successfully with another student will take time and patience, on all of our parts. It is not intuitive to work with a partner; it is a learned skill and students must be shown repeatedly how to do it successfully.

3/16/10

We worked on DNA extraction from a strawberry today. The kids loved it! It is fascinating; using a fresh strawberry with detergent and ethanol, one can actually precipitate out the DNA as a white "glob." They were engaged and enthralled. Only one was a behavior issue and less so than usual. It was so interesting to watch the students work together to answer the lab questions. One group now "trusts" each other to bounce ideas off the partner. Interestingly, it really isn't a peer tutor: peer tutee relationship in this group. They seem equals in sharing information. The girl in this group is dyslexic but determined and very conscientious; she is always seeking out extra help. The boy in the group has ADD, hyperactive variant and an unclassified but obvious processing issue. I thought that the girl would lead the group given her perseverance but clearly they are working cooperatively as "equals." This group has been the most successful so far. I really feel like they "get it" in terms of the peer mentoring.

3/17/10

Another interesting day of peer tutoring in 5th period biology! I started the class with direct instruction on RNA and protein synthesis. This is an extension of the topic on DNA which we have been discussing. After literally several minutes of my speaking, most of the students were not focused and talking with each other. So, I converted the lesson to a jigsaw activity with each of the peer groups on the spot. I had them work with their peer buddies making flash cards and taking notes on different sections of the topic which each group then presented to the rest of the class. The change was amazing! The class became more quiet and students were diligently brainstorming with each other within their groups, taking notes about their topic. They then successfully presented the information to the rest of the class.

3/18/10

The topic today was transcription and translation of DNA into RNA and proteins. It is a very abstract concept and traditionally difficult for students. I presented the work as direct instruction briefly but then quickly moved to the peer groups to sort it through. I recognized that I would need to do significant scaffolding but I thought I would try it with the individual groups. The kids are very fond of the peer groups. They are eager to work together as soon as the class starts. I had not anticipated that it would be so welcomed. They seem to find it reassuring that they can bounce ideas off each other. We were able to progress through yet another concept as a result- the extension of DNA misinterpretations- mutations. I did another survey of the peer group activity which supported the use of peer tutoring as an instructional strategy for this class. Again, as I listen to the groups interact, the role of tutor and tutee blend with each student shifting back and forth between these roles.

Group 3 (frequently off- task) commented that they are enjoying the peer tutoring because they are "misbehaving less" and are definitely more aware of their own behavior in class. They suggested I invite the headmaster back in to see how much they have changed!

3/22/10

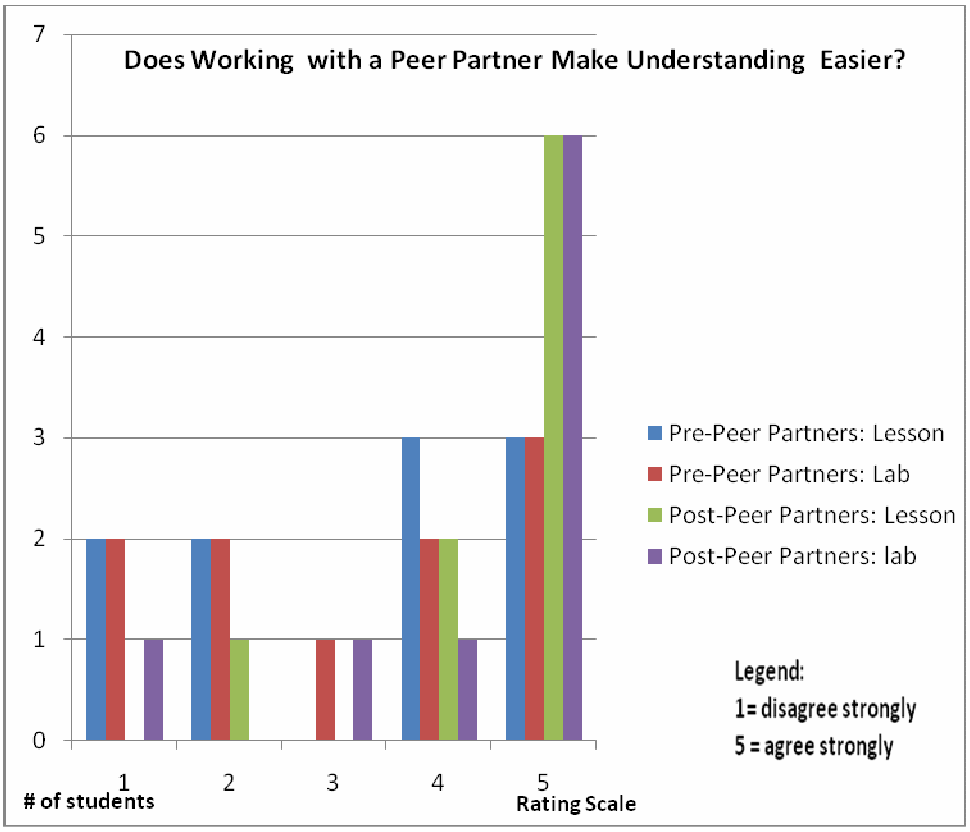
My students now expect to work in peer groups and are disappointed when we don't! One student asked if we could do this indefinitely. If my data analysis suggests that it has been helpful I will certainly extend the "pilot study" for a while longer. On the whole, having the kids take ownership for their learning through peer groups is much preferable to direct instruction, from learning as well as a behavioral perspective.

3/23/10

We used peer buddies to learn the vocabulary for molecular genetics today. The students were happy to separate into their groups and get down to work. Although today is the last day of my formal observations for this intervention, I have decided to continue to use it further since the kids are responding well and enjoy the strategy.

Appendix H

Graph 9: Does Peer-Tutoring Make Understanding Easier?



Appendix I

Sample Student Reflection Journal Entries (attached)

Appendix J

Peer Tutoring Behavior Checklist: 5th Period Biology*, **

Prior to Peer-Tutoring Strategy: Students in this class sit at lab "pod" tables, with 2-4 students per table. For the peer-tutoring instructional strategy, students will work in groups of 2 (pairs).

		Date of Observation									
Behavior/Activity		***2/5***	***2/8***	***2/9***	***2/10***	***2/11***	***2/22***	***2/23***	***2/24***	***2/25***	***3/1***
All table members are actively participating in the assignment.	***Table 1***							/	/		
	Table 2							/			/
	Table 3			/		/		/	/		
The table members are focused on task.	***Table 1***								/		
	Table 2										
	Table 3							/	/		
The table members are behaving well and there are no behavior problems noted.	***Table 1***							/	/		
	Table 2							/			
	Table 3							/			
The table members complete the assignment successfully, as measured by ability to recite the information to each other and the teacher (teacher observation).	***Table 1***								/		
	Table 2										
	Table 3			/				/	/		

(*adapted from Hendricks, 2009, p. 95)

/ = all students per table participated, were focused, behaved well, completed the assignment

(*******All table members must participate, stay focused, behave well, and complete the assignment, in order for the group to receive a tally mark.)*

Appendix J, continued

Peer Tutoring Behavior Checklist: 5th Period Biology*, **

Subsequent to Peer-tutoring Strategy:

		Date of Observation									
Behavior/Activity		***3/9***	***3/10***	***3/11***	***3/12***	***3/15***	***3/16***	***3/17***	***3/18***	***3/22***	***3/23***
All group members are actively participating in the assignment.	***Group 1***	/	/	/	/	/	/	/	/	/	/
	Group 2	/	absent			absent		/	/	absent	absent
	Group 3	/	/				/	/	/	/	/
	Group 4			/	/	/	/	/		/	/
	Group 5					absent	/	/	/		/
The group members are focused on task.	***Group 1***	/	/		/	/	/	/	/	/	/
	Group 2	/	absent			absent	/	/	/	absent	absent
	Group 3	/					/	/	/	/	/
	Group 4			/		/	/	/	/	/	/
	Group 5					absent	/	/	/		
The group members are behaving well and there are no behavior problems noted.	***Group 1***	/					/	/	/	/	/
	Group 2	/	absent			absent	/	/	/	absent	absent
	Group 3	/						/		/	/
	Group 4			/		/		/	/	/	
	Group 5					absent					
The group members complete assignment successfully, as	***Group 1***	/	/	/	/	/	/	/	/	/	/
	Group 2	/	absent			absent	/	/	/	absent	absent
	Group 3	/		/	/	/	/			/	/

measured by ability to recite the information to each other and the teacher (teacher observation).	***Group 4***	/		/	/	/	/	/	/	/	
	Group 5					absent	/		/		

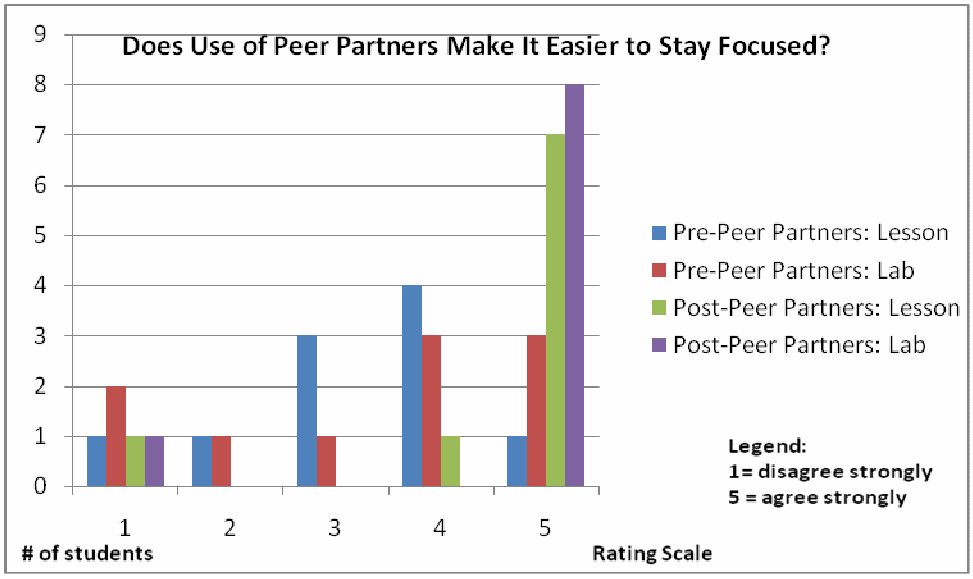
(*adapted from Hendricks, 2009, p. 95)

/ = peer partners participated, were focused, behaved well, completed the assignment

(**All peer group members must participate, stay focused, behave well, and complete the assignment, in order for the group to receive a tally mark.)

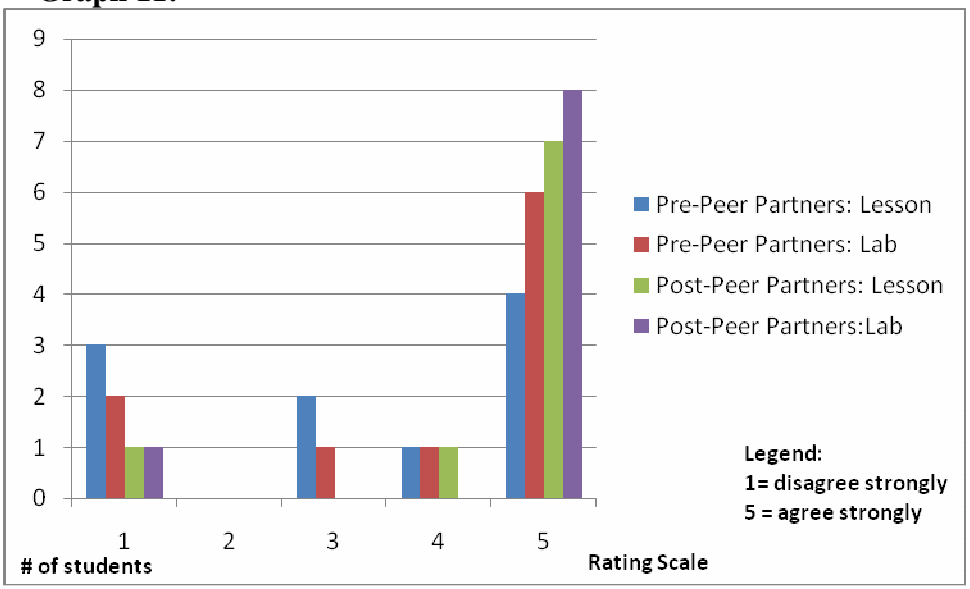
Appendix K

Graph 10: Does Peer-Tutoring Facilitate Student Focus?



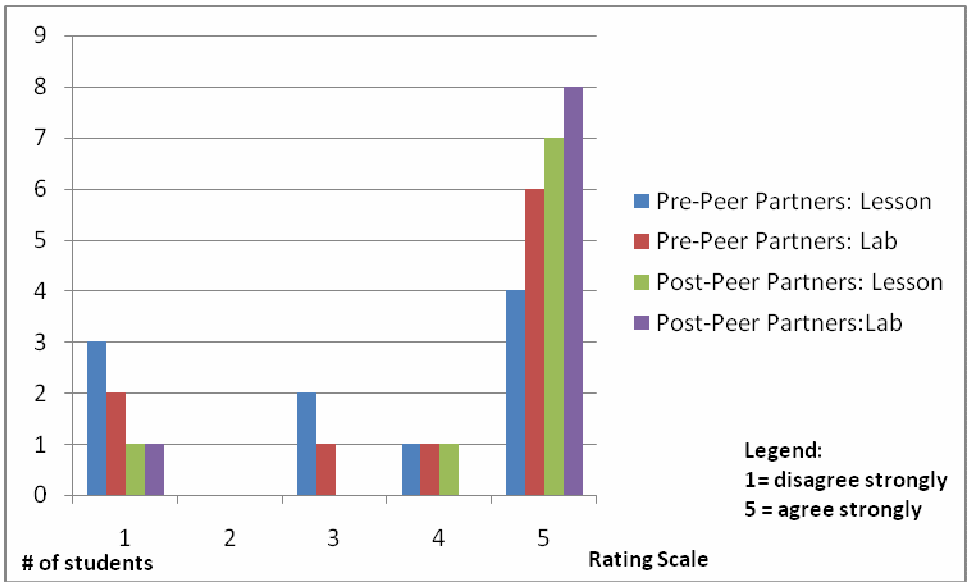
Appendix L

Graph 11: Do Peer Partners Make Bio More Enjoyable for Students?



Appendix M

Graph 12: Student Preferences for Working with a Peer Partner



Appendix N

Incidence of Off-Task Behaviors

Students in this class sit at lab "pod" tables, with 2-4 students per table. For the peer-tutoring instructional strategy, students will work in groups of 2 (as pairs). Target Behavior is defined as any time spent **off** academic task: talking with other students, not paying attention to the teacher, and need for the teacher to redirect the student to work.

Table 1: Prior to Peer Assisted Learning Strategy

Table #	*2/5*	*2/8*	*2/9*	*2/10*	*2/11*	*2/12*	*2/22*	*2/23*	*2/24*	*2/25*
Table 1 (4 students)	*////*	*////*	*////*	*////*	*///*	*///*	*/////*	*///*	*///*	*/////*
Table 2 (4 students)	*//////*	*/////*	*/////*	*///////*	*/////*	*/////*	*/////*	*///*	*///*	*//////*
Table 3 (2 students)	*///*	*///*	*///*	*////*	*//*	*///*	*//*	*///*	*//*	*///*

/ = a "target behavior" event (off task) that requires teacher re-direction

(*adapted from Crimmins, et al (2007), p. 199)

Incidence of Off-Task Behaviors

Table 2: Subsequent to Peer Assisted Learning Groups (Dyads)

Group	3/9	3/10	3/12	3/15	3/16	3/17	3/18	3/22	3/23	3/24
Group 1 (2 students)	*///*	*//*	*///*	*/////*	*/*	*/*	*//*	*/*	*/*	*/*
Group 2 (2 students)	*///*	**absent**	*//*	*/*	**absent**	**absent**	**absent**	*/*	*/*	*/*
Group 3	*//*	*///*	*///*	*/////*	*//*	*//*	*///*	*//*	*//*	*/*

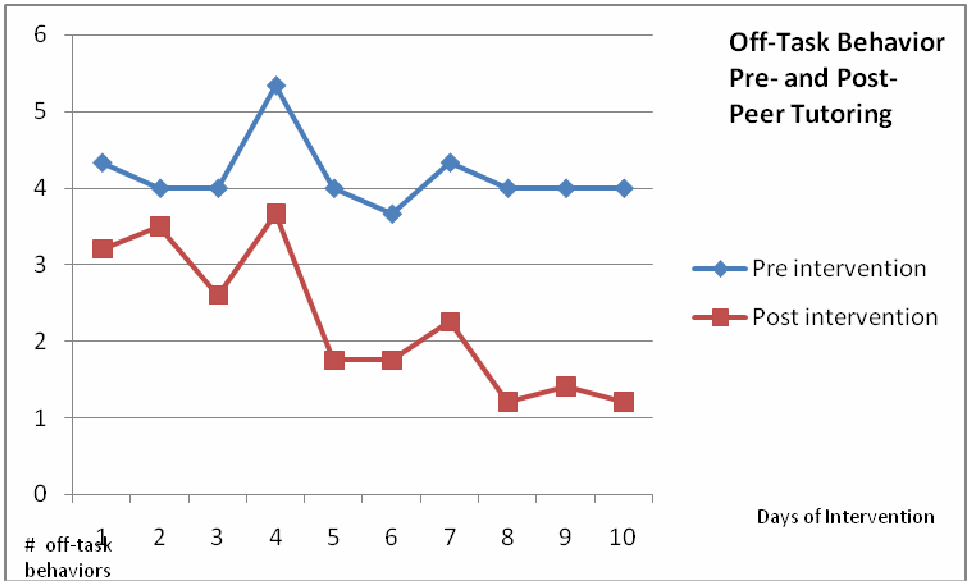
(2 students)										
Group 4 (2 students)	///	////	//		/	//	//	/	/	/
Group 5 (2 students)	/////	/////	///	**absent**	///	//	//	/	//	//

/ = a "target behavior" event (off task) that requires teacher re-direction

(*adapted from Crimmins, et al (2007), p. 199)

Appendix N, continued

Graph 13: Comparison of Off-Task Behavior Pre- and Post- Peer Tutoring



Researcher Biography

I am a career changer, having worked in the medical field for a number of years. I became interested in teaching middle and high school science when my daughter was young and so I went back to school for my MST. I have been teaching middle school and high school science for the last four years at a small private school in upper Westchester county. What I enjoy most about teaching is creating lessons and activities and seeing how my students enjoy and learn from them. Each day is a new and exciting experience for me, even if I have taught the same lesson before. Not a day goes by that I don't learn as much from my students as they learn from me. I can honestly say that I look forward to going to work each day and that each day is a rewarding experience.