The Effect on Learning of Paired Traditional and Non-Traditional Students in a Lab Setting

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ABSTRACT

Understanding how traditional and non-traditional learners interact in a lab setting is particularly important to Dunwoody College of Technology teachers, because the non-traditional student population is growing (Power Campus Data Base, 2008). Knowing how to help traditional and non-traditional learners work together will help them be more successful. This knowledge could be specifically helpful in a lab setting.

Dunwoody College of Technology has been pairing up students for various class lab projects for many years. Knowing how to pair up students would give teachers the ability to look at who their students are and pair them up in a ways that would achieve better learning. In some cases traditional students have been paired with traditional students, non-traditional students have been paired up with non-traditional students and in some cases, non-traditional students

have been paired up with traditional students to complete their lab assignments. The effectiveness of this pairing has not yet been determined. If teachers continue to allow this pairing to occur at random, learning may not increase and may even decrease if the pairing has negative effects on learning. Once the effectiveness of this pairing is determined, this information could be shared with other teachers to correct the problem.

The purpose of this study is to determine if learning is enhanced when traditional students work with traditional students, non-traditional students work together with non-traditional students or when traditional students work with non-traditional students in groups of two in a lab setting at Dunwoody College of Technology.

The results of this study show that pairing up students with different prior knowledge and/or experience can produce better learning. For best results, a teacher must explain to each student why he or she paired them up the way he or she did and why it is important to use each other's prior experience and knowledge to enhance their learning experience in a lab setting.

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Chapter I: Introduction

Founded in 1914, Dunwoody College of Technology is a private, non-profit, endowed institution of higher education located on the western edge of the city of Minneapolis, Minnesota. A prominent Minneapolis businessman, William Hood Dunwoody, left three million dollars in his will to establish what was then called The William Hood Dunwoody Industrial Institute. Dunwoody College of Technology is the oldest institution of its kind in the upper Midwest, with an international reputation for outstanding technical educational programs (Academic Quality Improvement Project, 2007).

Dunwoody offers a Bachelor of Science in Applied Management degree, AAS degrees or technical diplomas in 24 different technical program offerings that fall under the headings of manufacturing technology, transportation technology, computer technology, and construction and construction design technology. Students can opt to enroll in one-year certificate programs. To meet general education requirements, there are 45 different arts and sciences courses (Academic Quality Improvement Project, 2007).

Delivery methods include traditional lecture, lab, and on-line learning (Academic Quality Improvement Project, 2007). Dunwoody employs 204 faculty and staff. Of these, 81 are full-time instructors. The total unduplicated student headcount in 2007-2008 was 1841. Dunwoody students come from all over the world. Most students are from within a 50 mile radius of Minneapolis, Minnesota. The Heating Ventilation and Air Conditioning (HVAC) service program has 135 students (Power Campus Data Base, 2008.)

Dunwoody College of Technology faculty members have indicated that they struggle when teaching traditional and non-traditional students together in a lab setting in order to achieve maximum learning (Dunwoody College of Technology, 2007). In classes such as automotive

service production lab, electrical construction lab, or HVAC service lab, it is common to pair students in groups of two to perform lab experiments. During faculty meetings and department meetings Dunwoody faculty members frequently ask, "Is it a better learning experience to pair traditional learners with non-traditional learners or should they be paired with the same type of learner" (Dunwoody College of Technology, 2007, p. 1).

The Dunwoody student body is made up of 61.5% traditional students and 37.5% non-traditional students. Currently the average age of a Dunwoody student is 25.3 (Power Campus Data Base, 2008). This data indicates there are enough students (both traditional and non-traditional) at Dunwoody to cause this researcher to look further into this issue.

Predictions suggest that the influx of non-traditional students will continue to grow (Bishop-Clark & Lynch, 1992). Dunwoody faculty and staff must be concerned with understanding the mixed-age classroom and with teaching effectively in it. With this understanding, Dunwoody teachers could adjust their teaching strategies for optimum learning.

On the second Thursday of every month during the school year, Dunwoody faculty meet to discuss teaching and learning. The problem of teaching traditional and non-traditional students as lab partners is often discussed during these sessions, which are led by the dean of learning and the program directors. When this topic comes up, Dunwoody faculty indicate that it would be helpful to know how to pair traditional and non-traditional students together in a lab setting in order to achieve maximum learning (Dunwoody College of Technology, 2007).

Differing student and institutional expectations of the teaching and learning environment frequently result in unnecessary conflict of interests. The early resolution of this conflict and establishing an environment of compromise may prevent student withdrawal (Laing, Chao & Robinson, 2005). As the number of nontraditional students on college campuses continues to

climb, educators must become increasingly aware of the issues regarding the mixed age college classroom (Lynch & Bishop-Clark, 1993).

Understanding how traditional and non-traditional learners interact in a lab setting is particularly important to Dunwoody College of Technology teachers, because the non-traditional student population is growing (Power Campus Data Base, 2008). Knowing how to help traditional and non-traditional learners work together will help them be more successful. This knowledge could be specifically helpful in a lab setting.

Statement of the Problem

Dunwoody College of Technology has been pairing up students for various class lab projects for many years. Knowing how to pair up students would give teachers the ability to look at who their students are and pair them up in a ways that would achieve better learning. In some cases traditional students have been paired with traditional students, non-traditional students have been paired up with non-traditional students and in some cases, non-traditional students have been paired up with traditional students to complete their lab assignments. The effectiveness of this pairing has not yet been determined. If teachers continue to allow this pairing to occur at random, learning may not increase and may even decrease if the pairing has negative effects on learning. Once the effectiveness of this pairing is determined, this information could be shared with other teachers to correct the problem.

Purpose of the Study

The purpose of this study is to determine if learning is enhanced when traditional students work with traditional students, non-traditional students work together with non-traditional students or when traditional students work with non-traditional students in groups of two in a lab setting at Dunwoody College of Technology.

Research Questions

The following research questions will be used to help guide this study.

1. In a HVAC service lab setting, does a traditional student learn more when paired with another traditional student?
2. Does a non-traditional student learn more when another non-traditional student is his or her lab partner in a HVAC service Lab?
3. Does a traditional student learn more when a non-traditional student is his or her lab partner in a HVAC service Lab?
4. Does a non-traditional student learn more when a traditional student is his or her lab partner in a HVAC service Lab?

Importance of the Study

This study is important for the following reasons:

1. Non-traditional students represent the fastest growing segment of the student population. According to U.S. Census Bureau Reports (1996) 6.2 million college students in the United States (40.9%) were 25 years of age or older. Dunwoody College of Technology's non-traditional student population is 37.5% (Power Campus Data Base, 2008).
2. When compared to traditional age students, many adult learners (25 years old and older) fail to complete their higher education goals, even though most older adults possess a willingness to work hard (National Center for Education Statistics, 2007). If Dunwoody College of Technology's teachers were able to understand how to help non-traditional students learn more effectively, it is likely that the retention rate of non-traditional students would increase.

3. If Dunwoody teachers were able to help non-traditional students be more successful in a lab setting, students might be able to reach their goals.
4. Literature that focuses on the mixed-age-classroom suggests that the addition of older students to the classroom creates problems that are not apparent in the traditional classroom. For example, a number of authors argue that younger students have negative attitudes toward older students (Collette-Pratt, 1976; Weinberger & Milhan, 1974). Such attitudes could be eased if Dunwoody College of Technology's teachers understood how to best pair up students in a lab setting.
5. Moreover, Dunwoody College of Technology teachers could enhance learning opportunities if they understood that it is better to pair up traditional with traditional students, non-traditional students with non-traditional students or traditional students with non-traditional students in groups of two in a lab setting.
6. This study will be limited to the opinions and backgrounds of the students surveyed. The opinions will represent one class, but it is acknowledged that backgrounds and experiences can vary from class to class and person to person.
7. This study will be limited to literature and information cited regarding traditional and non-traditional students. Although much time and energy was put into the research background of this study, not all information relating to this study is included. Every effort has been made to emphasize the most important information relating to this study.

Definition of Terms

Endowed institution - to furnish with money or its equivalent, as a permanent fund for support; of an institution (Merriam-Webster, 6/26/08).

Lab setting – A learning environment with students doing work such as projects, experiments or service (Academic Quality Improvement Project, 2007).

Mixed-age classroom – A classroom with students of multiple ages (Cross, 1988).

Non-profit - An incorporated organization which exists for educational or charitable reasons, and from which its shareholders or trustees do not benefit financially. Also called not-for-profit organization (Merriam-Webster, 2008).

Non-traditional student - An older student, usually the age of 25 or older (Cross, 1988).

Private - Conducted and supported primarily by individuals or groups not affiliated with governmental agencies (Merriam-Webster, 2008).

Traditional student – A student who is still in high school or graduated from high school and is entering into college directly after high school and usually younger than age 25 (Cross, 1988).

Assumptions of the Study

This study assumes that there is an effect on learning that is somewhat dependent on the make-up of the members of a paired group in a lab setting.

This study is limited to one section (class) of HVAC students with one teacher during one quarter of instruction. This is an effort to keep the learning environment consistent. The main variable is how students are paired up in a lab setting.

Information collected and on the survey instrument will be conducted during one designated time period. The survey will be conducted by this researcher who serves as the Dean of Learning at Dunwoody College of Technology. Questions on the survey will be derived from the background and experience of this researcher (who is the Dean of Learning at Dunwoody College of Technology).

Methodology

This study will be conducted during the spring quarter of the 2008-2009 school year at Dunwoody College of Technology in Minneapolis, Minnesota. Information collected during this study will be analyzed and the results published for others to use in the classroom or for additional study. The procedures are explained in greater detail in the Methodology section of this study.

Chapter II: Literature Review

The purpose of this study is to determine if learning is enhanced when traditional students work with traditional students, non-traditional students work together with non-traditional students or when traditional students work with non-traditional students in groups of two in a lab setting at Dunwoody College of Technology.

This literature review will focus on the mixed-age classroom, give an understanding of how traditional and non-traditional students learn, present research regarding traditional and non-traditional learners, show how academic performance can be influenced by the interaction between professor and student, present some answers to questions relating to learning, and give an understanding of cooperative learning.

Post secondary teachers must be concerned with understanding the mixed-age classroom and teaching effectively in it. Predictions suggest that the influx of non-traditional students will continue to grow (Bishop-Clark & Lynch, 1992). Teachers must be aware of their teaching styles, and how to adapt to the increasing numbers of non-traditional students. Teachers must also understand the needs of the mixed age classroom in order to serve them better. With this understanding, teachers could adjust teaching strategies for optimum learning.

An understanding of how traditional and non-traditional students learn is multidimensional and should focus on multiple learning issues in the classroom (Bishop-Clark & Lynch 1998). A knowledge of how traditional and non-traditional students interact with each other will enhance the classroom experience. Teachers should learn how to help traditional and non-traditional students learn more effectively when in the same classroom together. Past research will provide insight on how to enrich the student and teacher experience.

Much of the research and studies published in the past two decades regarding traditional and non-traditional learners has focused on understanding motivation, behavior, learning styles, and faculty observations. Profiles were often based on this information, yet little advice was given on how to transform this research into more effective teaching techniques for better learning. More recent literature (published in the last 10 years) has focused on the results of more qualitative study to help understand how traditional and non-traditional students prefer to learn, as well as faculty observations of what worked better (Strage, 2008).

People learn in different ways, and older learners are no different. According to Truluck and Courtenay (1999), most research has been conducted with young children and young adults. Their research indicates that traditional students learn more in a traditional classroom atmosphere. The little research done on older adults found that they prefer more structure, as well as more auditory and mobile learning (Truluck & Courtenay, 1999). Non-traditional learners possess a background that influences their learning approach. Many approaches to enhance learning have been suggested to meet such needs, with a reflective and observational learning environment showing great promise (Truluck & Courtenay, 1999). However it is clear that no single learning style is preferred by non-traditional students.

On the other hand, research conducted by Lynch and Bishop-Clark (1994) found that most students preferred to not work with students their own age. Most students enjoyed being in a classroom with students of various ages. Older students tend to be insecure about their background, and consequently, tended to be more assertive in the classroom. However, the younger students did not feel that the older students monopolized the classroom. Younger students tend to be less serious about class work, a characteristic that created a conflict in learning values between traditional and non-traditional students.

More research by Bishop-Clark and Lynch (1998) found that enhanced learning took place when teachers encouraged students to appreciate what traditional and non-traditional students have to offer each other. When this appreciation was nurtured, older students could be assigned to work with younger students, a situation that allowed each age group to contribute to the learning of each other. As a result, an enhanced learning experience occurred that would not have developed if the same age worked together. This research suggests that faculty must guide this appreciation by not over appreciating non-traditional students and under appreciating traditional students. Faculty should also guide both types of students to encourage better learning by identifying the strengths that each group brings to the learning environment.

In another study by Lynch and Bishop-Clark (1993), it was determined that a more dynamic learning environment could be created when teachers encouraged traditional and non-traditional students to appreciate each other's differences. One way teachers could guide these interactions was to help point out what traditional and non-traditional students have to offer, thus setting a more positive interactive tone. It was concluded that by being aware of the potential problems of a mixed age classroom and addressing them, teachers can help foster a more effective learning environment.

Non-traditional students bring past experiences and accomplishments to the classroom that can enrich the entire learning environment. Stydinger and Dundes (2006) declared it an "uphill battle" for undergraduate non-traditional students to attend a traditional college. While it is important to not single out students, it was determined that the older the non-traditional student is, the more important it is to pay attention to the needs of this older non-traditional student. It was also suggested that the value older students bring to the classroom should not be ignored.

Further evidence showing that it is best to have traditional and non-traditional students interact in–person is from Skopek and Schuhmann (2008). On-line learning demand continues to increase, and non-traditional learners are taking advantage of this type of program and flexible course delivery because of job and family responsibilities. Traditionally, on-line learning tends to keep students apart physically and therefore less interaction among learners. Work done by Skopek and Schuhmann found that there is increased learning when students have the opportunity to physically meet each other face-to-face. As a result, it was recommended that colleges that offer on-line classes should encourage teachers to find ways to promote group dynamics with study groups, cohort groups, and/or specific meeting times to enhance learning and personal interaction.

Academic performance can be influenced by the interaction between professor and student. Results from a survey done by Rosenthal, Folse, Alleman, Soper and Von Bergen (2000) showed that the interaction between students and their teachers, specifically one-to-one, has an effect on learning. Both positive and negative interactions were examined between professor and student (both non-traditional and traditional). The results of their study showed that traditional and non-traditional students responded to these interactions in a similar manor. The results of their survey showed that if students had positive interactions (specifically one-to-one) with their professor they felt that as a result of this positive interaction, their academic performance was better.

Other research shows that the expected learning environment is different between traditional and non-traditional students. Work done by Strage (2008) focused on the differences between traditional and non-traditional student perceptions of what the "ideal" course would be. Strage found that traditional students were more likely to prefer a learning environment similar

to high school or an extension of high school. Non-traditional students were more interested in being properly prepared for future careers and less about the learning environment. Strage also found that traditional and non-traditional students have different goals and motivations. Although Strage's work does not give any recommendations on how to use this information, it continues to demonstrate the differences between the expectations and attitudes of traditional and non-traditional students.

To find answers to questions relating to learning, researchers often get help from or refer to Noel-Levitz (2008). Noel-Levitz is a recognized leader that helps colleges and universities survey their students so they can use the resulting information to reach their goals for marketing, enrollment and student success. One area on the student satisfaction inventory that Noel-Levitz produces is instructional effectiveness. This part of the survey measures the student academic experience, commitment to academic excellence, and curriculum. Results from a 2002 national student satisfaction report conducted by Lana, Bryant (2002) reported students put high importance on, but have low satisfaction with, statements like "the college shows concern for students as individuals" (p. 106-B) "faculty are understanding of students' unique life circumstances" (p. 106-B) "the school does whatever it can to help me reach my educational goals" (p. 106-B) and "the school shows concern for students as individuals" (p. 106-B). These statements show that students want to be identified more as individuals and want individual help.

Much of the published information concerning traditional and non-traditional students seems to support topics such as motivation and interest of traditional and non-traditional students. One such study by Bye, Pushkar and Conway (2007) compares motivation to academic achievement or interest and is then correlated to academic performance. Other research takes the approach of managing the expectations of non-traditional students where teachers are told that

students have unrealistic expectations but no advice is given on how to help the student learn (Laing, Chao & Robinson, 2005).

Finally, when studying student interaction and the resulting learning in a group, an understanding of cooperative learning is helpful. Cooperative learning is when students work together to accomplish (cooperatively) shared learning goals and maximize their learning (Johnson, Johnson & Smith, 1998). Cooperative learning can increase students' achievement levels, increase intrinsic motivation levels, create positive attitudes towards learning, and contribute to the acceptance of classmates (Serrano & Pons, 2007). Group productivity and individual achievement may increase when group processing to achieve results become more a part of group interaction (Johnson, Johnson & Stanne, 2001).

Chapter III: Methodology

This study investigated the effect on learning of paired traditional and non-traditional students in a lab setting. The study used survey questions that were developed to answer questions that relate to the learning experiences of students paired an in lab setting. Students answered the questions in writing. The students that participated in the survey were exposed to the same learning experience. In other words, they were from the same class, had the same teacher, listened to the same lectures, and took the same tests. The only difference in their learning experience was who they were paired with as a lab partner.

Selection of Subjects and Setting

The setting was a sixth quarter HVAC service lab during spring quarter 2008/2009 at Dunwoody College of Technology in Minneapolis, Minnesota. The lab was conducted by a principle instructor who has developed and taught this lab for 13 years. The class was selected because it represented a typical example of many classes at Dunwoody that pair up students in lab. The class was also selected because the class size was larger than most classes at Dunwoody and would therefore give results that would represent a more valid cross section of students. Although the lab class was not taught by this researcher, control of the independent variable remained in tight control by the teacher in charge. In other words, the only thing that made the learning environment different was whom students were paired up with in lab.

Description of Subjects

The sample was made up of 42 men that ranged in ages from 19 to 51. The number of subjects who were age 25 or under (traditional) was 26. The number of subjects who were over the age of 25 (non-traditional) was 16. Although diversity was not a factor, there were 8 students of color and the rest (34) were White or Caucasian.

While the subjects were chosen because they were currently enrolled at Dunwoody College, they also possessed the ideal characteristics for this study. Many of the programs at Dunwoody pair up students in lab, therefore the subjects that were chosen were in a class that is typical of classes that could benefit from this type of research. This selection logic indicates that the subjects that were chosen had the qualities needed to demonstrate valid results for this study.

The subjects were from the same cohort (in other words, students who have been together from the start of their education at Dunwoody College). The subjects were in their sixth quarter of study in HVAC service, a factor that also indicates they have been exposed to the same instruction. The subjects had a history of interacting with each other like other typical students enrolled Dunwoody College. In addition to being in the same learning environment, the subjects were exposed to the same available resources (such as tools, extra tutoring, etc.). Typically students are not paired up in lab in any formal way. Students are told to find someone that is willing to work with them without any criteria. In other words, the pairing up of lab partners is random.

Description of Setting

The setting was a sixth quarter HVAC service lab during spring quarter 2008/2009 at Dunwoody College of Technology in Minneapolis, Minnesota. A principle instructor who has developed and taught this lab for 13 years conducted the lab. The program is six quarters, or two year's in length. The students graduating from this program receive an AAS Degree.

Instrumentation

The effect on learning was evaluated in this study, focusing on paired traditional and non-traditional students in a HVAC service lab setting. Information was gathered using a written survey. Survey questions asked students to reflect on their own learning or increased learning

based on their experience with their lab partner. This researcher developed the written survey. All data was monitored, collected, and analyzed by this researcher.

The subjects were asked the same questions in different ways to increase reliability. Questions relating to their learning in conjunction with whom they were working with in a lab setting were asked. Specifically, most of the questions related to the age of their lab partner and learning. There were a few questions that applied to the research in general.

Specifically, there was one question that asked about the perceived value of prior life experiences of a lab partner, two questions asked if there was more learning because of the student's specific lab partner without referring to age, and there were two questions that asked if students would select a lab partner based on age. These five questions were developed because the research literature indicated that past experience of a partner, and not necessarily age, may contribute to learning. There were six questions that asked if there is more learning if a lab partner is the same age. These six questions were developed because they help to answer the first two research questions posed in chapter one of this research study. There were six questions that asked if there is more learning if a lab partner is older. These six questions were developed because they help to answer the third research question posed in chapter one of this research study. There were six questions that asked if there is more learning if a lab partner is younger. These six questions were developed because they help to answer the fourth research question posed in chapter one of this research study. There were two questions that asked if there is more of a preference toward working alone in lab. Finally, there were five questions that applied to the research in general, including one that asked for comments relating to learning and their experience with their lab partner. The survey was 30 questions total.

The completed survey was given to five teachers at Dunwoody that have a history of pairing up students in lab for review and feedback. These teachers indicated that it would be good to stay focused on the research questions, have multiple questions for reliability, ask a few general questions, give room for the respondents to say why they answered the way they did, and stay specific to the research. Other feedback included word choice and how the questions were written in general. This feedback was used to fine tune the questions and validate readability and reliability of the questions.

Data Collection and Recording

The survey was given during the eleventh week, of a twelve-week quarter, in the sixth quarter of study. Each subject was asked identical questions. Surveying of subjects was concluded before final tests to avoid any possible connection to grades or other "finals week" anxiety that could skew the data.

Data Processing and Analysis

A 2 X 2 matrix correlating research questions to survey questions was developed to categorize the information collected (see Appendix A and Tables 1-12). Data was analyzed to determine the effect on learning with paired lab partners. Specifically, this researcher looked to see if learning is increased based on the subject's lab partner. Answers to questions were put into 4 categories. The first category (A), are answers given by subjects who are traditional students who were paired with another traditional student in a HVAC service lab. The second category (B), are answers given by non-traditional students who were pared with another non-traditional student in a HVAC service lab. The third category (C), are answers given by traditional students who were paired with a non-traditional student in a HVAC service lab. The fourth category (D),

are answers given by non-traditional students who were pared with a traditional student in a HVAC service lab.

This researcher used the results to determine whether there is an effect on learning of paired traditional and non-traditional students in a lab setting.

Limitations

This study is limited to one section (class) of HVAC service students with one teacher during one quarter of instruction. This was an effort to keep as much of the learning environment consistent. The main variable was how students were paired in a lab setting. This study is limited to the survey instrument itself during the designated time period. Questions on the survey are limited to the background and experience of this researcher. This study is limited to the opinions and backgrounds of the subjects surveyed. Backgrounds and experiences can vary from class to class and person to person, but the resulting opinions are from one HVAC service class only. It would be wise to be cautious with any findings of this study due to the restricted nature of the sample population.

Chapter IV: Results

This chapter will summarize the results of the 30-question survey (see Appendix B) and relate the survey answers to the research questions. The survey was conducted during the eleventh week of a sixth quarter HVAC service lab during spring quarter 2008/2009 (specifically May 26, 2009) at Dunwoody College of Technology in Minneapolis, Minnesota.

Description of Sample

The actual sample was 42 total subjects whom were all men. The subjects were from age 19 to 51. The number of subjects who were age 25 or under (traditional) was 26. The number of subjects who were over the age of 25 (non-traditional) was 16. Although diversity was not a factor the number of subjects that were of color were 8 and while the rest (34) were White or Caucasian. Of the 42 total subjects, 7 were not in attendance, of the seven 5 are traditional and 2 are non-traditional. The final amount of subjects surveyed was 35. Of this total, the number of subjects who were age 25 or under (traditional) was 21. The number of subjects who were over the age of 25 (non-traditional) was 14.

Procedures Followed

The survey was given during the eleventh week, of a twelve-week quarter, in the sixth quarter of study. Each subject was asked identical questions. Surveying of the subjects was concluded before final tests to avoid any possible connection to grades or other "finals week" anxiety that could skew the data.

Method of Analysis

A 2 X 2 matrix correlating survey questions to research questions was developed to categorize the information collected (See Appendix A). Answers to questions from the survey were put into 4 categories relating to the 4 research questions developed in chapter I. Category A

is a summary of the answers given by subjects who are traditional students who were paired with another traditional student in a HVAC service lab. Category B is a summary of the answers given by non-traditional students who were pared with another non-traditional student in a HVAC service lab. Category C is a summary of the answers given by traditional students who were paired with a non-traditional student in a HVAC service lab. Category D is a summary of the answers given by non-traditional students who were pared with a traditional student in a HVAC service lab. The results of each survey question were matched up with each research question/category; including comments answering why the respondents answered the question the way they did, on the 2 X 2 matrix. Each survey question was marked with an "X" under each research question/category that would have more importance or indication of significance to the survey results. Many of the questions on the 30-question survey asked the same question in different ways for reliability. All but one question on the survey used a Likert scale where 1 = strongly agree to 5 = strongly disagree. All questions asked why the respondents answered the question the way they did. These questions were combined into 11 major categories, the mean and standard deviation was calculated for each category overall, and for each subcategory relating to each research question as shown in Tables 1, 3, 5, 7 , 9, 11, 13, 15, 17, 19, and 20. Respondent's comments for each category were combined for review in tables 2, 4, 6, 8, 10, 12, 14, 16, 18, and 21. General comments were combined for review in Table 22.

The first question asked about the perceived value of prior life experiences of a lab partner (see Table 1). The overall mean response was 2.7 and the standard deviation was 1.14. This would indicate a small tendency overall that the respondents felt that the prior life experience of lab partner has value. The overall standard deviation of 1.14 would indicate that overall the respondents were split in their thinking. Respondents that were paired with an older

or younger lab partner saw more value in a lab partner's life experience verses the respondents that had a same age lab partner who were more neutral to the idea of prior life experience.

Table 1

Perceived Value of Life Experiences of a Lab Partner

Overall grand total X=2.7, (SD=1.14)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=2.8 (SD=.92)	X=3 (SD=.47)	M=2.7 (SD=1.19)	M=2.5 (SD=1.36)

Respondents were asked to comment about the perceived value of prior life experiences of a lab partner. Some of the respondents that had an older or younger lab partner indicated that they did see the value of past life experience of a lab partner. There were only a few respondents with the same age lab partner that indicated they did not see the value of prior life experience of a lab partner or had no comment at all as shown in Table 2.

Table 2

Perceived Value of Life Experiences of a Lab Partner (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"Younger = lack of motivation."	"Neither of us have worked in the industry."	"We learn both from each other."	"Experiences related to subject helps."
"We both have basic minimal knowledge."	"Worked previously in unrelated field."	"More time in the field."	"He didn't seem interested too much."
"Previous mechanic."		"Older knows a lot of stuff I didn't know."	"Because the math taught nowadays, better prepares younger students to solve problems easier."
		"xxx was more committed and acted in a mature way."	"Electrical wiring knowledge, ability to read instruction manuals."

When respondents were asked if there was more learning because of the student's specific lab partner without referring to age, the overall mean response was 2.8 and the standard deviation was 1.21 (see Table 3). This would indicate that respondents tended to see the value of their lab partner although there was more variability in the responses. Younger respondents that had an older lab partner valued their lab partner the most.

Table 3

More Learning Because of Specific Lab Partner Without Referring to Age

Overall grand total X=2.8 (SD=1.21)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=2.7 (SD=1.02)	X= 2.7 (SD=1.25)	X=2.4 (SD=1.14)	X=2.7 (SD=1.15)

Respondents were asked to comment on if there was more learning because of their specific lab partner without referring to age are. All but one of the respondents indicated that they liked their lab partner and seemed to give value to learning with them as shown in Table 4.

Table 4

More Learning Because of Specific Lab Partner Without Referring to Age (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"Because he took more time on problems and situations."	"We both have the drive to learn."	"Commitment."	"A high GPA student with experience in the field promotes learning."
"We worked together to accomplish the task."	"He has more of an earnest understanding of the importance of learning than I find when I'm pared with a younger student."	"More life experiences."	"Because the area I was weak at, he was strong which brought my level up in this area."
"Worked well together."	"I learn more with interested people."		"We get along good."
"We get along."			"We didn't work together well."
			"We knew each other was willing and had to get jobs done."

When respondents were asked if there is more learning if a lab partner is the same age the overall mean response was 3.3 and the standard deviation was .96 (see Table 5). This would indicate there was a tendency toward not seeing the value of a same age lab partner and would indicate that working with the same age lab partner would not increase their learning. There was also more agreement among the traditional respondents paired with non-traditional lab partner and more variability in responses among the traditional paired with traditional student.

Table 5

More Learning, Lab Partner Same Age

Overall grand total X=3.3 (SD=.96)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=3.0 (SD=1.05)	X=3.8 (SD=.96)	X=3.2 (SD=.80)	X=3.6 (SD=.84)

Respondents were asked to comment on if there is more learning if a lab partner is the same age. Overall, respondents seemed to indicate that they did not see the value of a same age lab partner or gave a "Depends on ...." answer as shown in Table 6.

Table 6

More Learning, Lab Partner Same Age (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"Normally the younger the less they know."	"Depends on the work ethic."	"I do well with any age lab partner."	"Age isn't the problem."
"Depends if your partner is committed to helping on the job."	"This isn't a fair judge of an individual's work ethic."	"Older better knows more from experience."	"Because it might become a competition, instead of a learning process."
"I don't think it matters."	"This is inaccurate to the real world where pair-ups are random or else an apprentice learner pair."	"Too much playing and talking. Not experience."	"Less goofing around."
"Depends on the person, I think."		"Depends on the person."	"Maybe"
		"Depends on the age."	"Older or younger partners may have a different outlook on how things work."
		"More joking around-common interests."	
		"It should be a choice."	

When respondents were asked if there is more learning if a lab partner is older, the overall mean response was 3.0 and the standard deviation was 1.07 (see Table 7). This would indicate that more responses were neutral but with some variability. It should be noted that there was some indication that the non-traditional respondents that were paired with non-traditional partners did not think that there was more learning if a lab partner is older and there was also some indication that younger respondents paired with older lab partners did think that there was more learning if a lab partner is older.

Table 7

More Learning Lab Partner Older

Overall grand total X=3.0 (SD=1.07)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=3.0 (SD=1.02)	X=3.6 (SD=1.04)	X=2.8 (SD=1.00)	X=3.0 (SD=1.12)

Respondents were asked to comment on if there is more learning if a lab partner is older. Many comments, especially from traditional respondents, indicated that the prior life experience of an older lab partner increased their learning as shown in Table 8.

Table 8

More Learning Lab Partner Older (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"Knows more."	"Depends on work ethic."	"Experience with things I haven't experienced."	"It is easier to stay on task."
"Just because someone is older does not mean they are smarter or more experienced in that field."	"I have had older partners that were helpful."	"Done more work, knows tricks I didn't know."	"Maybe, because he or she may have experience."
"If he has experience with the stuff."	"More often than not they take class more seriously."	"Depends on how much the person knows."	"More knowledge."
"Because they are a bit wiser."	"More likely to care about learning."	"It could go either way."	
"It helps."		"Had both younger and older, get more done with an older partner."	
		"I think we all learn somewhat the same."	
		"Experience, committed, and willing to teach."	
		"It is a more serious atmosphere."	
		"They don't talk the hole time to people."	
		"Depends on the person."	

When respondents were asked if there is more learning if a lab partner is younger, the overall mean response was 3.2 and the standard deviation was 1.0 (see Table 9). This would indicate that overall, respondents did not think that there was more learning if their lab partner was younger. It is interesting to note that the traditional respondents paired with a traditional lab partner gave themselves more credit, with a mean answer of 2.8, which would indicate that they believed there is more learning if a lab partner was younger.

Table 9

More Learning Lab Partner Younger

Overall grand total X=3.2 (SD=1.0)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=2.8 (SD=.97)	X=3.6 (SD=.93)	X=3.2 (SD=.95)	X=3.3 (SD=.97)

Respondents were asked to comment on if there is more learning if a lab partner is younger. Non-traditional respondents indicated that younger students had a lack of motivation, and were distracted easily. Non-traditional respondents that had a non-traditional lab partner indicated that they learned more if they had to explain things to their lab partner but did not point the comment directly toward a younger lab partner. Other comments did not seem to indicate more learning because of a younger lab partner as shown in Table 10.

Table 10

More Learning Lab Partner Younger (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"We are all going to school to learn, if we already knew it all, why go to school?"	"Sometimes it helps to explain things though it hinders me if I have a disinterested lab partner."	"Not experienced enough."	"Gives chances to see how one arrives at answers and challenge difference constructively."
	"Only if I have to explain things to them and that's only if they care."	"Depends on the person."	"Younger partners are distracted easily, difficulty staying on task."
		"If I knew the problem, I can also teach it."	"Not motivated enough."
		"I learn more if my lab partner is younger than me."	"To learn, teach, compare and progress on decision discussed."
		"Depends on the person."	"Both sides of thinking involved."
			"The challenges and viewpoint, in the end completion = understanding."

Table 11

More Learning Working Alone

Overall grand total X=3.4 (SD=1.44)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=3.2 (SD=1.65)	X=3.3 (SD=1.25)	X=3.3 (SD=1.14)	X=3.7 (SD=1.46)

Respondents were asked to comment on if there is more learning or preferences toward working alone in lab. Overall, the comments indicated that the respondents preferred to have a lab partner as shown in Table 12.

Table 12

More Learning Working Alone (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"A second mind helps." ""It's nice to have help, not everyone retained the same." "I rather have someone help, in case of possible future mistake I don't know about."	"Only because then I struggle more and have to discover answers on my own."	"Sometimes, sometimes not." "Help is great." "More focus, and commitment." "Sometimes it's better to work alone."	"Not as good memory and not the same experience." "Always get stuck, need ideas to fix." "Because we get to trade ideas on how to arrive at fix." "I don't know what I am doing most of the time."

When asked if students would select a lab partner based on age the overall mean response was 3.1 and the standard deviation was 1.16 (see Table 13). This would indicate that, with some variability, the respondents were somewhat neutral in their thinking with a tendency toward not selecting a partner based on age alone. It should be noted that the traditional respondents that had an older lab partner showed some indication that they would select a lab partner based on age.

Table 13

Select a Lab Partner Based on Age

Overall grand total X=3.1 (SD=1.16)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=3.1 (SD=1.09)	X=3.5 (SD=.76)	X=2.8 (SD=1.4)	X=3.2 (SD=.98)

Respondents were asked to comment on if they would select a lab partner based on age. The comments given were most reveling in that the respondents seemed to be more interested in what the other person had to offer and did not seem to care about the age or their lab partner as shown in Table 14.

Table 14

Select a Lab Partner Based on Age (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"Older may have helped more."	"It really does vary on personality traits such as interested work ethic."	"It has more to do with the person than the age."	"Depends if I get along with that person."
		"More committed and responsible willing to learn and teach."	"To respect one's decisions, and have your decision respected."
		"I would select them based on the person."	

When respondents were asked if they would work with their current lab partner again because they felt they would learn more without age as a consideration, the overall mean response was 2.6 and the standard deviation was 1.32 (see Table 15). This would indicate that the respondents had more of a tendency toward liking their current lab partner with a fair amount of variability. The non-traditional respondents that were paired with a non-traditional lab partner showed the strongest agreement toward working with their lab partner again.

Table 15

Work With Lab Partner Again Without Age as a Consideration

Overall grand total X=2.6 (SD=1.32)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=2.9 (SD=1.44)	X=1.3 (SD=.47)	X=2.5 (SD=1.28)	X=2.6 (SD=1.11)

Respondents were asked to comment on if they would work with their current lab partner again because they felt they would learn more without age as a consideration. There were only a handful of comments made that indicated they did not seem to connect age to their current lab partner experience as shown in Table 16.

Table 16

Work With Lab Partner Again Without Age as a Consideration (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"If we work harder, maybe."	"We both want to learn and do the work."	"We work well together."	"Because now I'm comfortable that he will get answer the same as mine."
	"We seem to work well together."	"Commitment and experience."	

Respondents were asked about a their interest in having multiple lab partners over time regardless of age, the overall mean response was 3.0 and the standard deviation was 1.44 (see table 17). This would indicate that overall, the respondents were neutral to the idea of having multiple lab partners over time with a high amount of variability. Only the non-traditional

respondents paired with a younger lab partner indicated an interest in having multiple lab partners over time.

Table 17

Student's Interest in Having Multiple Lab Partners

Overall grand total X=3.0 (SD=1.44)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=3.1 (SD=1.44)	X=3.3 (SD=1.25)	X=3.0 (SD=1.26)	X=2.7 (SD=1.62)

Respondents were asked to comment about their interest in having multiple lab partners over time regardless of age. There were only a few comments that supported having multiple lab partners over time. One comment from a traditional respondent paired with a non-traditional lab partner indicated that "Changing partners causes problems in some cases." as shown in Table 18.

Table 18

Student's Interest in Having Multiple Lab Partners (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"Having three would help more, but may also cause some not to do work."	"Age doesn't matter. Willing to learn is the important thing."	"Changing partners causes problems in some cases."	"I don't think we should stay with the same partner through the whole year."
	"This way I learn to work with more variety of people."	"Everyone knows different things, more people more learning."	

When respondents were asked about their comfort level when working with another student that is older or younger, the mean response was 2.9 and the standard deviation was .82 (see Table 19). This would indicate that more respondents were neutral, however there was a small tendency toward working with a partner that is of a different age. Looking at the data closer indicates that traditional students in general have a higher comfort level working with another student that is older or younger and non-traditional students have a lower comfort level working with another student that is older or younger.

Table 19

Comfort Level When Working with Another Student that is Older or Younger

Overall grand total X=2.9 (SD=.82)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=2.6 (SD=.86)	X=3.5 (SD=.87)	X=2.7 (SD=.46)	X=3.1 (SD=.83)

Table 20

Does the Age of Your Lab Partner Have an Effect on Your Learning?

Overall grand total X=2.6 (SD=1.37)			
Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
X=2.7 (SD=1.11)	X=2.7 (SD=1.25)	X=2.5 (SD=1.5)	X=2.7 (SD=1.55)

Respondents were asked to comment on if the age of their lab partner has no affect on their learning. There were only a few comments from respondents that indicated that it depends on the individual, motivation, or maturity of their lab partner as shown in Table 21.

Table 21

Does the Age of Your Lab Partner Have an Effect on Your Learning? (comments)

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"Depends on how much you want to learn."	"It can if it leads to immaturity."	"It doesn't affect me personally."	"It's all about the individual."
			"Some students are less motivated then others."

The last question asked respondents if they had any further comment that related to their lab partner and their learning experience in lab. Most of the respondent's comments indicated they did not think the age of their lab partner had an effect their learning. One final comment from a traditional respondent was "you seem to learn more when you find yourself teaching them" as shown in Table 22. In other words, you learn a lot when you teach.

Table 22

General Comments Related to Their Lab Partner and Their Learning Experience in Lab

Traditional paired with traditional	Non-traditional paired with non-traditional	Traditional paired with non-traditional	Non-traditional paired with traditional
"I don't think age has to do with anything at all. It's all about the person you're working with. I think you should keep the same partner all year long because you know who they are and how they learn, so it is easier to work together."	"Why would age be relevant? I'm 35 and have no experience in this industry. There are 18 year olds with multiple years of experience in the HVAC industry."	"I've had all kinds of partners and I look at it as you learn off your partner. It is not the age, It's the knowledge they have."	"I think instructors should pair up with someone with little knowledge rather than two who don't know anything."
"I prefer to work alone but when working with a partner I feel age is not a big concern. You learn as long as you apply yourself"	"I don't think it matters too much cause in the real world we are going to have little control of the age of our partners."		"I started my perceptions, as did he, and at times both had strong ideas, that were wrong, but when the final project was completed we took and accepted the right person decision and fixed the problem."
"Younger lab partners seem to be less serious about their work but you seem to learn more when you find yourself teaching them. And or doing more work yourself."			"Life experiences brought to the table, and the willingness to commit time and effort is more important than age."

Chapter V: Summary, Conclusions and Recommendations

This study investigated the effect on learning of paired traditional and non-traditional students in a HVAC service lab setting at Dunwoody College of Technology in Minneapolis, Minnesota. The study used survey questions that were developed to answer research questions that relate to the learning experience of students paired in a lab setting. The students answering the survey questions were exposed to the same learning experience. In other words, they were from the same class, had the same teacher, listened to the same lectures, and took the same tests. The only difference in their learning experience was who they were paired with in lab.

Restatement of the Problem

Dunwoody College of Technology has been pairing up students for various class lab projects for many years. Knowing how to pair up students would give teachers the ability to look at who their students are and pair them up in a ways that would achieve better learning. In some cases traditional students have been paired with traditional students, non-traditional students have been paired up with non-traditional students and in some cases; non-traditional students have been paired up with traditional students to complete their lab assignments. The effectiveness of this pairing has not yet been determined. If teachers continue to allow this pairing to occur at random, learning may not increase and may even decrease if the pairing has negative effects on learning. Once the effectiveness of this pairing is determined, this information could be shared with other teachers to correct the problem.

Methods and Procedures

A 30-question survey was developed and administered to one HVAC service lab class at Dunwoody College of technology in Minneapolis, Minnesota. The actual number of subjects was 35. Of this total, 25 were traditional students and the rest (14) were non-traditional students. The

survey was given on May 26, 2009. All but one question on the survey used a Likert scale where 1 = strongly agree to 5 = strongly disagree. All but one question asked why the respondents felt the way they answered the question the way they did. The last question asked for general comments from respondents related to their lab partner and their learning experience in lab

Major Findings

Throughout the survey more responses indicated a tendency to be neutral to the idea of age and its influence on learning. The respondents that had some experience working with a different age lab partner (traditional students working with a non-traditional lab partner and non-traditional students working with a traditional lab partner) had more to say about their learning experience. This group of respondents indicated that it was the prior experience of their lab partner that enhanced their learning experience. Many older respondents indicated that younger students whom had prior knowledge increased their learning. Some younger respondents also indicated that older students with prior knowledge increased their learning experience. Finally, there were a few respondents who indicated that when teaching their lab partner about something they had knowledge of, it increased their own learning experience. In other words you learn a lot when you teach.

Conclusions

Based on the literature review and survey results, learning may be increased when students are paired in a lab setting if: students are paired with other students that have different prior knowledge or experience and this prior knowledge or experience is shared with each other. This should be done with teacher intervention to ensure that the students understand what each other brings to the paired group. This conclusion was determined in part from the answers to the questions that were researched below:

Conclusions (Research Questions)

1. In a HVAC service lab setting, does a traditional student learn more when paired with another traditional student?

   As established by this study, traditional students may not learn more when paired up with another traditional student based on age alone. When traditional HVAC students were asked if there is more learning when a lab partner is the same age, the respondents were somewhat split in their thinking, although one third of the respondents did value their same age lab partner and the others were either neutral or did not see the value of their same age lab partner. Most responses from traditional students indicated that working with the same age student would not increase their learning because of age alone. Comments from respondents that had a same age lab partner indicated that they did not see that value of a same age lab partner. Many did indicate that the prior knowledge and experience of their lab partner was helpful toward their learning.

2. Does a non-traditional student learn more when another non-traditional student is his or her lab partner in a HVAC service Lab?

   As established by this study, non-traditional students may not learn more when paired up with another non-traditional student based on age alone. When non-traditional students were asked if there is more learning if a lab partner is the same age the respondents, like their traditional counterparts, were also somewhat split in their thinking. This group did indicate that although they liked their lab partner, they were either neutral or did not see the value of a same age lab partner. Comments from respondents that had a same age lab partner indicated that they did not increase their

learning based on the same age lab partner. Many did indicate that the prior knowledge and experience of their lab partner was helpful toward their learning.

3. Does a traditional student learn more when a non-traditional student is his or her lab partner in a HVAC service Lab?

As established by this study, traditional students may learn more when paired up with a non-traditional student. When asked if there is more learning if a lab partner is older, the overall responses were neutral, however many indicated that working with an older lab partner contributed to their learning. There were many comments; specifically from younger students working with an older lab partner, indicating that the prior life experience of an older lab partner increased their learning.

4. Does a non-traditional student learn more when a traditional student is his or her lab partner in a HVAC service Lab?

As established by this study, non-traditional students do not seem to learn more when paired up with a traditional student based on age alone. When asked if there is more learning if a lab partner is younger, more respondents were neutral to the idea of a younger lab partner. In addition, many of the responses did indicate that having a younger partner did not increase their learning. Some comments from older respondents indicated that younger lab partners did increase their learning because of their prior knowledge of math or other ability that the older students did not have.

Conclusions (General)

Based on the findings of the survey and research literature:

- Most HVAC service students do not feel that the age of their partner affects their learning.

- Most HVAC service students felt that the prior life experience of their lab partner did affect their learning.
- Most HVAC service students felt that they learn more with a partner in lab verses working alone.
- Most HVAC service students would not purposely select a lab partner based on age alone.
- Most HVAC service students recognized that older students may have more prior knowledge that could make learning better as a lab partner.
- Most HVAC service students recognized that younger students may have some prior knowledge that could make learning better as a lab partner.
- Based on the literature and research presented, the prior experience of a student could increase the learning of their lab partner.
- Based on the literature review and survey results, learning can be increased when students are paired in a lab setting if: students are paired with other students that have different prior knowledge or experience and this prior knowledge or experience is shared with each other. This should be done with teacher intervention to ensure that the students understand what each other brings to the paired group.

Recommendations Related to this Study

1. It is recommended that if this study were to be reproduced, more than one class should be surveyed to improve reliability. This study used one class with one teacher during one quarter in an effort to increase reliability. It was noticed by this researcher that the comments from respondents were very important to this study, but often hard to come by.

If more than one class was used, this could increase the amount of comments and perhaps give more information to draw from. This may decrease the need for the consistency of one class with one teacher in one quarter.

2. It is recommended that the survey could be replaced or enhanced with interviews so that follow-up questions could be asked depending on answers given. Perhaps the survey could be used for asking initial questions and then follow-up questions could be developed for more in depth respondent answers.
3. It is recommended that the results of this study be shared with teachers during a faculty meeting at Dunwoody College of Technology. In the past Dunwoody faculty have indicated that it would be helpful to know how to pair traditional and non-traditional students together in a lab setting in order to achieve maximum learning (Faculty meeting minutes, 2007-2008).
4. It is recommended that if this study were to be reproduced, more data could be collected related to the past life experience of a lab partner. This past experience could be classified as general, academic (math, English, science, etc.), and work (related to their course of study). This information could be correlated with increased learning based on the past experience of a lab partner.

Recommendations for Future Study

1. It is recommended that the same teacher involved in this study find out what prior knowledge each student has when entering his HVAC service lab class. With this knowledge, students can be pared up based on their prior knowledge and/or experience for better learning. For best results, the teacher must explain to each student why they

were paired up the way they are and why it is important to use each other's prior experience and knowledge to enhance their learning experience in lab.

2. It is recommended that more study be done based on delivery methods. This study did not research how delivery methods could effect learning for traditional and non-traditional students. More research could see if differing delivery methods effect learning for different age groups.
3. Finally, student expectations of their lab partner could be done with all age groups and how those expectations have an effect on learning. This study did not ask what students expected from their lab partner to help them learn. Understanding what students expect from their lab partners could help teachers explain to students how work with each other when paired up in a lab setting.

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Appendix A

2 X 2 Matrix Correlating Research Questions to Survey Questions

The effect on learning of paired traditional and non-traditional students in a lab setting

2 X 2 Matrix correlating research questions to survey questions ("X" indicates may have more importance to that research question)					
Survey Questions		**Research Questions/Categories**			
General info	**Question Number and survey question**	1.(A)	2.(B)	3.(C)	4.(D)
		In a HVAC service lab setting, does a traditional student learn more when paired with another traditional student?	Does a non-traditional student learn more when another non-traditional student is his or her lab partner in a HVAC service Lab?	Does a traditional student learn more when a non-traditional student is his or her lab partner in a HVAC service Lab?	Does a non-traditional student learn more when a traditional student is his or her lab partner in a HVAC service Lab?
Scale		1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
This survey question looks at the perceived value of prior life experiences of a lab partner.	1. In my experience, the prior life experiences of my lab partner contributed to me learning more in lab this quarter.	1.0 2.6 3.4 4.1 5.1 "Younger = lack of motivation.(4)" "We both have basic minimal knowledge.(2)" "Previous mechanic.(2)"	1.0 2.0 3.2 4.1 5.0 "Neither of us have worked in the industry.(4)" "Worked previously in unrelated field.(3)"	X 1.2 2.2 3.4 4.1 5.1 "We learn both from each other.(1)" "More time in the field.(1)" "Older knows a lot of stuff I didn't know.(2)" "xxx was more committed and acted in a mature way.(3)"	X 1.3 2.3 3.1 4.2 5.1 "Experiences related to subject helps.(1)" "He didn't seem interested too much.(5)" "Because the math taught nowadays, better prepares younger students to solve problems easier.(2)" "Electrical wiring knowledge, ability to read instruction manuals.(2)"

This question asks if there was more learning because of the student's specific lab partner without referring to age.	2. I learned more because of working with my specific lab partner this quarter.	X 1.3 2.3 3.2 4.4 5.0 "Because he took more time on problems and situations.(1)" "We worked together to accomplish the task.(4)" "Worked well together.(2)"	X 1.1 2.1 3.1 4.0 5.0 "We both have the drive to learn.(1)" "He has more of an earnest understanding of the importance of learning than I find when I'm pared with a younger student.(2)"	X 1.1 2.6 3.1 4.2 5.0 "Commitment.(2)"	X 1.1 2.3 3.5 4.0 5.1 "A high GPA student with experience in the field promotes learning.(1)" "Because the area I was weak at, he was strong which brought my level up in this area.(2)" "We get along good.(3)"
This survey question asks if there is more learning if a lab partner is the **same age**.	3. In my experienc e, I learn more if my lab partner is the same age as me.	X 1.2 2.1 3.4 4.3 5.2 "Normally the younger the less they know.(5)" "Depends if your partner is committed to helping on the job.(1)" "I don't think it matters.(5)"	X 1.0 2.0 3.2 4.0 5.1 "Depends on the work ethic.(3)"	1.0 2.1 3.5 4.2 5.2 "I do well with any age lab partner.(5)" "Older better knows more from experience.(4)" "Too much playing and talking. Not experience.(4)"	1.0 2.2 3.2 4.4 5.2 "Age isn't the problem.(5)" "Because it might become a competition, instead of a learning process.(4)" "Less goofing around.(4)"

This survey question asks if there is more learning if a lab partner is **older.**	4. In my experience, I learn more because my lab partner is older than me.	1.2 2.4 3.5 4.0 5.1 "Knows more.(1)" "Just because someone is older does not mean they are smarter or more experienced in that field.(5)"	1.0 2.0 3.2 4.0 5.1 "Depends on work ethic.(3)"	X 1.2 2.0 3.7 4.0 5.1 "Experience with things I haven't experienced.(1)" "Done more work, knows tricks I didn't know.(1)" "Depends on how much the person knows.(3)"	1.4 2.1 3.2 4.1 5.2 "It is easier to stay on task.(4)"
This survey question asks if there is more learning if a lab partner is **younger.**	5. In my experience, I learn more because my lab partner is younger than me.	1.3 2.0 3.6 4.2 5.1 "We are all going to school to learn, if we already knew it all, why go to school?(5)"	1.0 2.0 3.2 4.0 5.1 "Sometimes it helps to explain things though it hinders me if I have a disinterested lab partner.(3)"	1.0 2.1 3.5 4.0 5.4 "Not experienced enough.(5)"	X 1.0 2.2 3.5 4.1 5.2 "Gives chances to see how one arrives at answers and challenge difference constructively.(2)" "Younger partners are distracted easily, difficulty staying on task.(3)"
This survey question asks if a student would work with their current lab partner again because they feel they would learn more without age as a consideration.	6. If I could choose, I would work with my current lab partner again because I feel I would learn more.	X 1.3 2.2 3.2 4.3 5.2 "If we work harder, maybe.(3)"	X 1.2 2.1 3.0 4.0 5.0 "We both want to learn and do the work.(1)" "We seem to work well together.(2)"	X 1.2 2.5 3.0 4.2 5.1 "We work well together.(1)" "Commitment and experience.(2)"	X 1.2 2.2 3.5 4.0 5.1 "Because now I'm comfortable that he will get answer the same as mine.(2)"

This survey question asks if there is more learning or preferences toward working **alone** in lab.	7. I would learn more if I worked alone in lab.	X 1.3 2.2 3.1 4.1 5.5 "A second mind helps.(1)" ""It's nice to have help, not everyone retained the same.(5)"	X 1.0 2.1 3.1 4.0 5.1 "Only because then I struggle more and have to discover answers on my own. (2)."	X 1.0 2.2 3.3 4.4 5.1 "Sometimes, sometimes not.(3)" "Help is great.(5)" "More focus, and commitment.(3)"	X 1.2 2.0 3.1 4.3 5.4 "Not as good memory and not the same experience.(5)" "Always get stuck, need ideas to fix.(4)" "Because we get to trade ideas on how to arrive at fix.(2)" "I don't know what I am doing most of the time.(1)"
This survey question asks if students would **select** a lab partner **based on age**	8. If I could change my lab experienc e for better learning, It would it have something to do with my choice of lab partner and his or her age.	X 1.2 2.1 3.4 4.3 5.2 Older may of helped more.(3)"	X 1.0 2.0 3.3 4.0 5.0 "It really does vary on personality traits such as interested work ethic. (3)"	X 1.3 2.2 3.1 4.3 5.1 "It has more to do with the person than the age.(1)" "More committed and responsible willing to learn and teach.(2)"	X 1.0 2.2 3.6 4.1 5.1 "Depends if I get along with that person.(2)"

This survey question asks if there is more learning if a lab partner is **older.**	9. I prefer to have a lab partner that is older than me because I will learn more.	1.1 2.4 3.3 4.3 5.1 "If he has experience with the stuff.(4)"	1.0 2.0 3.1 4.1 5.1 "I have had older partners that were helpful.(4)"	X 1.1 2.1 3.7 4.1 5.1 "It could go either way.(3)" "Had both younger and older, get more done with an older partner.(1)" "I think we all learn somewhat the same.(3)" "Experience, committed, and willing to teach.(2)"	1.0 2.3 3.3 4.3 5.1 "Maybe, because he or she may have experience.(4)"
This survey question asks if there is more learning if a lab partner is **older.**	10. I enjoy working with an older Lab partner.	1.1 2.3 3.7 4.0 5.1 "Because they are a bit wiser.(3)"	1.0 2.1 3.1 4.0 5.1 "More often than not they take class more seriously.(2)	X 1.2 2.5 3.1 4.1 5.1 "It is a more serious atmosphere.(1)" "They don't talk the hole time to people.(2)"	1.2 2.1 3.7 4.2 5.0 "More knowledge.(4)"
This survey question asks if there is more learning if a lab partner is **younger.**	11. I learn more if my lab partner is younger than me.	1.3 2.1 3.5 4.2 5.1	1.0 2.0 3.2 4.0 5.1 "Only if I have to help explain things to them and that's only if they care.(3)"	1.1 2.1 3.6 4.1 5.1 "Depends on the person.(3)" "If I knew the problem, I can also teach it.(4)"	X 1.0 2.2 3.4 4.2 5.2 "Not motivated enough.(5)

This survey question asks if there is more learning if a lab partner is the **same age**.	12. I learn more when my lab partner is the same age as me.	X 1.1 2.4 3.5 4.1 5.1	X 1.0 2.0 3.2 4.0 5.1 "This depends on work ethic.(3)"	1.0 2.0 3.8 4.2 5.0 "Depends on the person.(3)"	1.0 2.0 3.7 4.2 5.1 "Maybe(4)" "Older or younger partners may have a different outlook on how things work.(3)"
This survey question asks if there is more learning if a lab partner is the **same age**.	13. Lab partners should be the same age for better learning.	X 1.2 2.0 3.8 4.0 5.2 "Depends on the person, I think.(1)"	X 1.0 2.0 3.1 4.1 5.1 "This isn't a fair judge of an individual's work ethic.(4)"	1.1 2.1 3.4 4.4 5.0 "Depends on the age.(3)"	1.0 2.0 3.3 4.6 5.1
This survey question asks about a student's interest in having multiple lab partners over time regardless of age.	14. I would rather have multiple lab partners throughout the quarter regardless of age.	X 1.3 2.1 3.2 4.4 5.2 "Having three would help more, but not also cause some may not get to work.(4)"	X 1.0 2.1 3.1 4.0 5.1 "Age doesn't matter. Willing to learn is the important thing.(5)" "This way I learn to work with more verities of people.(2)"	X 1.2 2.1 3.3 4.3 5.1 "Changing partners causes problems in some cases.(5)" "Everyone knows different things, more people more learning.(2)"	X 1.3 2.3 3.1 4.0 5.3 "I don't think we should stay with the same thru the whole year.(1)"
This survey question asks if there is more learning if a lab partner is **older.**	15. If given the choice, I would pick a lab partner that is older than me.	1.0 2.3 3.5 4.3 5.1	1.0 2.1 3.1 4.0 5.1 "More likely to care about learning.(2)"	X 1.1 2.1 3.7 4.0 5.1 "Depends on the person.(3)"	1.0 2.2 3.5 4.1 5.2

This survey question asks if students would **select** a lab partner **based on age**	16. I would prefer to select my own lab partner based on age.	X 1.1 2.1 3.6 4.4 5.0	X 1.0 2.0 3.1 4.1 5.1	X 1.2 2.2 3.3 4.1 5.2 "I would select them based on the person.(5)"	X 1.1 2.1 3.3 4.4 5.1 "To respect one's decisions, and have your decision respected.(1)"
This survey question asks if there is more learning if a lab partner is the **same age**.	17. I work best in lab with students my own age.	X 1.1 2.2 3.7 4.2 5.0	X 1.0 2.0 3.1 4.1 5.1	1.0 2.0 3.7 4.2 5.1 "More joking around-common interests.(3)"	1.0 2.0 3.7 4.2 5.1
This survey question asks if there is more learning if a lab partner is **older.**	18. I work best when my lab partner is older than me.	1.0 2.2 3.7 4.2 5.1	1.0 2.0 3.1 4.1 5.1	X 1.1 2.1 3.7 4.0 5.1	1.1 2.0 3.6 4.2 5.1
This survey question asks if there is more learning or preferences toward working **alone** in lab.	19. I would rather work alone in lab.	X 1.3 2.2 3.2 4.1 5.4 "I rather have someone help, in case of possible future mistake I don't know about.(1)"	X 1.0 2.1 3.1 4.0 5.1	X 1.2 2.0 3.4 4.2 5.2 "Sometimes it's better to work alone.(3)"	X 1.2 2.0 3.1 4.4 5.3
This survey question asks if there is more learning if a lab partner is **younger.**	20. If given the choice, I would work with a lab partner that is younger than me.	1.2 2.1 3.7 4.2 5.0	1.0 2.0 3.2 4.0 5.1	1.0 2.2 3.6 4.1 5.1 "Depends on the person-less experience.(3)"	X 1.0 2.2 3.4 4.3 5.1 "To learn, teach, compare and progress on decision discussed.(2)"

This survey question asks if there is more learning if a lab partner is the **same age**.	21. I feel more comfortable when my lab partner is my own age.	X 1.1 2.3 3.7 4.0 5.1	X 1.0 2.0 3.2 4.0 5.1	1.1 2.0 3.8 4.1 5.0 "Depends on the person.(3)"	1.0 2.1 3.6 4.2 5.1
This question asks if there was more learning because of the student's specific lab partner without referring to age.	22. I learned more this quarter because of working with my specific lab partner.	X 1.0 2.5 3.4 4.3 5.0 "We get along.(2)"7	X 1.0 2.1 3.1 4.0 5.1 "I learn more with interested people.(2)"	X 1.2 2.1 3.1 4.0 5.1 "More life experiences.(1)"	X 1.3 2.1 3.4 4.1 5.1 "We didn't work together well.(5)" "We knew each other was willing and had to get jobs done.(1)"
This survey question asks about a student's comfort level when working with another student that is older or younger.	23. I feel more comfortable working in lab with students that are not my age.	1.2 2.2 3.7 4.1 5.0	1.0 2.0 3.3 4.0 5.1	X 1.0 2.3 3.7 4.0 5.0 "Doesn't affect me.(3)"	X 1.0 2.2 3.6 4.1 5.1
This survey question asks if there is more learning if a lab partner is **younger.**	24. I enjoy working with a younger lab partner.	1.1 2.0 3.10 4.1 5.0	1.0 2.0 3.3 4.0 5.1	1.0 2.0 3.7 4.1 5.2 "Depends on the person.(3)"	X 1.0 2.3 3.4 4.2 5.1 "Both sides of thinking involved.(2)"
This survey question asks if there is more learning if a lab partner is **older.**	25. For better learning, my lab partner should be older than me.	1.0 2.2 3.9 4.1 5.0 "It helps.(3)"	1.0 2.0 3.3 4.0 5.1	X 1.1 2.2 3.7 4.0 5.0 "Depends on the person.(3)"	1.0 2.5 3.3 4.1 5.1

This survey question asks if there is more learning if a lab partner is **younger.**	26. For better learning, my lab partner should be younger than me.	1.1 2.1 3.9 4.1 5.0	1.0 2.0 3.2 4.0 5.1	1.1 2.0 3.7 4.1 5.1 "Depends on the person.(3)"	X 1.0 2.1 3.5 4.2 5.2
This survey question asks when students are paired up in lab, does age have no affect on their learning.	27. When students are paired up in lab, age has no affect on my learning.	X 1.3 2.1 3.5 4.3 5.0 "Depends on how much you want to learn.(4)"	X 1.1 2.0 3.1 4.1 5.0 "It can if it leads to immaturity.(3)"	X 1.4 2.2 3.0 4.3 5.1 "It doesn't affect me personally.(1)"	X 1.4 2.1 3.0 4.4 5.1 It's all about the individual.(1)" "Some students are less motivated then others.(4)"
This survey question asks if there is more learning if a lab partner is the **same age**.	28. When students are paired up in lab they would learn more if they were the same age.	X 1.1 2.0 3.7 4.3 5.1	X 1.0 2.0 3.1 4.1 5.1 "This is inaccurate to the real world where pair-ups are random or else an apprentice learner pair.(4)"	1.1 2.0 3.5 4.4 5.0 It should be a choice.(3)"	1.0 2.1 3.2 4.3 5.4
This survey question asks if there is more learning if a lab partner is **younger.**	29. I work best when my lab partner is younger than me.	1.2 2..0 3.7 4.2 5.0	1.0 2.0 3.2 4.0 5.1	1.1 2.0 3.8 4.2 5.0 "Depends on the person.(3)"	X 1.0 2.2 3.5 4.1 5.2 The challenges and viewpoint, in the end completion = understanding.(2)"

	30. Do you have any further comments that relate to your lab partner and your learning experience in lab?	X "I don't think age has to do with anything at all. It's all about the person you're working with. I think you should keep the same partner all year long because you know who they are and how they learn, so it is easier to work together." "I prefer to work alone but when working with a partner I feel age is not a big concern. You learn as long as you apply yourself" "Younger lab partners seem to be less serious about their work but you seem to learn more when you find yourself teaching them. And or doing more work yourself."	X "Why would age be relevant? I'm 35 and have no experience in this industry. There are 18 year olds with multiple years of experience in the HVAC industry." "I don't think it matters too much cause in the real world we are going to have little control of the age of our partners."	X "I've had all kinds of partners and I look at it as you learn off your partner. It is not the age, It's the knowledge they have."	X "I think instructors should pair up with someone with little knowledge rather than two who don't know anything." "I started my perceptions, as did he, and at times both have strong ideas, that were wrong, but when the final project was completed we took and accepted the right person decision and fixed the problem." "Life experiences brought to the table, and the willingness to commit time and effort is more important than age."

		"Age makes no difference, the maturity of the person makes the difference as long as they are mature enough and don't go off all the time and take it serious then age has no effect."			

Appendix B

Survey

This research has been approved by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.

Survey relating to the effect on learning of paired traditional and non-traditional students

Name _____ Date: _____ What is your age? _____
What is your lab partner's name?_____
Is your lab partner older, younger, or the same age as you? _____

Please answer the questions below using a scale from **1 - 5. (1 = strongly agree, 2 = agree, 3 = neutral, 4 = Disagree, 5 = strongly disagree)** Please Circle the number that best represents your answer to the question. Your answers will be used in a research study that could make the learning experience better for students in the future.

1. In my experience, the prior life experiences of my lab partner contributed to me learning more in lab this quarter..... 1 2 3 4 5

   Why? _____

2. I learned more because of working with my specific lab partner this quarter... 1 2 3 4 5

   Why? _____

3. In my experience, I learn more if my lab partner is the same age as me..... 1 2 3 4 5

   Why? _____

4. In my experience, I learn more because my lab partner is older than me..... 1 2 3 4 5

   Why? _____

5. In my experience, I learn more because my lab partner is younger than me..... 1 2 3 4 5

   Why? _____

6. If I could choose, I would work with my current lab partner again because I feel I would learn more..... 1 2 3 4 5

   Why? _____

7. I would learn more if I worked alone in lab..... 1 2 3 4 5

   Why? _____

8. If I could change my lab experience for better learning, it would it have something to do with my choice of lab partner and his or her age..... 1 2 3 4 5

Why? _____

9. I prefer to have a lab partner that is older than me because I will learn more…1 2 3 4 5

Why? _____

10. I enjoy working with an older Lab partner…….. 1 2 3 4 5

Why? _____

11. I learn more if my lab partner is younger than me…….. 1 2 3 4 5

Why? _____

12. . I learn more when my lab partner is the same age as me…….. 1 2 3 4 5

Why? _____

13. Lab partners should be the same age for better learning…….. 1 2 3 4 5

Why? _____

14. I would rather have multiple lab partners throughout the quarter regardless of age……1 2 3 4 5

Why? _____

15. If given the choice, I would pick a lab partner that is older than me…….. 1 2 3 4 5

Why? _____

16. I would prefer to select my own partner based on age…….. 1 2 3 4 5

Why? _____

17. I work best in lab with students my own age…….. 1 2 3 4 5

Why? _____

18. I work best when my lab partner is older than me…….. 1 2 3 4 5

Why? _____

19. I would rather work alone in lab…….. 1 2 3 4 5

Why? _____

20. If given the choice, I would work with a lab partner that is younger than me... 1 2 3 4 5

Why? _____

21. I feel more comfortable when my lab partner is my own age..... 1 2 3 4 5

Why? _____

22. I learned more this quarter because of working with my specific lab partner..... 1 2 3 4 5

Why? _____

23. I feel more comfortable working in lab with students that are not my age..... 1 2 3 4 5

Why? _____

24. I enjoy working with a younger lab partner..... 1 2 3 4 5

Why? _____

25. For better learning, my lab partner should be older than me.....1 2 3 4 5

Why? _____

26. For better learning, my lab partner should be younger than me.....1 2 3 4 5

Why? _____

27. When students are paired up in lab, age has no affect on my learning..... 1 2 3 4 5

Why? _____

28. When students are paired up in lab they should be the same age..... 1 2 3 4 5

Why? _____

29. I work best when my lab partner is younger than me..... 1 2 3 4 5

Why? _____

30. Do you have any further comments that relate to your lab partner and your learning experience in lab?

_____

_____

Appendix C

IRB Approval Letter

STOUT
UNIVERSITY OF WISCONSIN

Research Services
152 Voc Rehab Building

University of Wisconsin-Stout
P.O. Box 790
Menomonie, WI 54751-0790

715/232-1126
715/232-1749 (fax)
http://www.uwstout.edu/rs/

Date: May 5, 2009

To: Jeff Ylinen

CC: Dr. Howard Lee

Susan Foxwell

From: Sue Foxwell, Research Administrator and Human Protections Administrator, UW-Stout Institutional Review Board for the Protection of Human Subjects in Research (IRB)

Subject: **Protection of Human Subjects**

Your project, "*The Effect of Learning on Paired Traditional and Non-Traditional Students in a Lab Setting,*" has been approved by the IRB through the expedited review process. The measures you have taken to protect human subjects are adequate to protect everyone involved, including subjects and researchers.

Please copy and paste the following message to the top of your survey/interview form before dissemination:

This research has been approved by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.

If you are conducting an **online** survey/interview, please copy and paste the following message to the top of the form:

"This research has been approved by the UW-Stout IRB as required by the Code of Federal regulations Title 45 Part 46."

This project is approved through **May 3, 2010**. Modifications to this approved protocol need to be approved by the IRB. Research not completed by this date must be submitted again outlining changes, expansions, etc. Federal guidelines require annual review and approval by the IRB.

Thank you for your cooperation with the IRB and best wishes with your project.

***NOTE: This is the only notice you will receive – no paper copy will be sent.**

Appendix D

Consent to Participate Form

This research has been approved by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.

Consent to Participate In UW-Stout Approved Research

Title: The Effect on Learning of Pared Traditional and Non-traditional Students in a Lab Setting.

Investigator:
Jeff Ylinen
9401 Lake Jane Trail North
Lake Elmo, MN 55042
jylinen@dunwoody.edu
612-381-3085

Research Sponsor:
Dr. Howard Lee
Program Director
715-232-1251
leeh@uwstout.edu

Description:
Understanding how traditional and non-traditional learners interact in a lab setting is particularly important to Dunwoody College of Technology teachers, because the non-traditional student (students older than 25 yrs) population is growing. Knowing how to help them work together in pairs in a lab setting will help all students be more successful.

Risks:
Taking this survey should be of minimal risk to you. There is a risk if students talk about this survey after it has been administered in a harmful way. You should take special precaution to not share your opinion about age and learning in a way that could be disrespectful. This type of conversation could create some discomfort among your classmates and worst case, could be considered harassment.

Benefits:
Teachers are always looking for ways to help students be more successful. The benefits of this study could be great for future students in a lab setting. As a result of this survey and the study it will be used in will help teachers understand how to pair up students in a lab setting for better learning.

Time Commitment and (no) payment:
Your time and commitment to this study will be limited to this survey and the time it will take you to answer the questions. There will be no follow-up, time commitment, or involvement expected of you beyond this survey. This survey is voluntary and there is no payment for taking this survey.

Confidentially:
Your name or identity will not be reveled or included on any documents for this study. This informed consent and surveys will not be kept with any of the other documents completed with this project.

Right to Withdraw:
Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. Should you choose to participate and later wish to withdraw from the study, you may discontinue your participation at that time without incurring any adverse consequences.

IRB Approval:
This study has been reviewed and approved by the University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by law and the University policies. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

Investigator:
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612-381-3085

IRB Administrator
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Advisor:
Dr. Howard Lee
Program Director
715-232-1251
leeh@uwstout.edu

Statement of Consent:
By signing this consent form you agree to participate in the project entitled "The Effect on Learning of Pared Traditional and Non-traditional Students in a Lab Setting."

Signature: _____

Printed Name: _____

Date: _____