LEARNING STYLES:
THE LEARNING METHODS OF AIR TRAFFIC CONTROL STUDENTS

by

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Dedication

I would like to dedicate this research to my loving family. Your support helped make this possible.

Acknowledgments

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Abstract

In the world of aviation, air traffic controllers are an integral part in the overall level of safety that is provided. With a number of controllers reaching retirement age, the Air Traffic Collegiate Training Initiative (AT-CTI) was created to provide a stronger candidate pool. However, AT-CTI Instructors have found that a number of AT-CTI students are unable to memorize types of aircraft effectively. This study focused on the basic learning styles (auditory, visual, and kinesthetic) of students and created a teaching method to try to increase memorization in AT-CTI students. The participants were asked to take a questionnaire to determine their learning style. Upon knowing their learning styles, participants attended two classroom sessions. The participants were given a presentation in the first class, and divided into a control and experimental group for the second class. The control group was given the same presentation from the first classroom session while the experimental group had a group discussion and utilized Middle Tennessee State University's Air Traffic Control simulator to learn the aircraft types. Participants took a quiz and filled out a survey, which tested the new teaching method. An appropriate statistical analysis was applied to determine if there was a significant difference between the control and experimental groups. The results showed that even though the participants felt that the method increased their learning, there was no significant difference between the two groups.

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CHAPTER 1 – INTRODUCTION

The purpose of this study is to help students in the Air Traffic Collegiate Training Initiative (AT-CTI) program learn to identify aircraft successfully in the Air Traffic environment. There have been a wide range of studies that identify the learning styles of aviation student pilots but none that focus on those of Air Traffic Control (ATC) students. Studies have shown that students learn better when they understand the material and it is related in a way that fits their particular way of learning. All students think and understand in various ways and this has a huge effect on the way they understand information. In Air Traffic Control, trainees are required to learn and understand a vast amount of information in a short period of time. This information can range from rules and regulations to aircraft identification. In an interview with Gail Zlotky, head Instructor for the Middle Tennessee State University (MTSU) AT-CTI program, she stated the main difficulty for students in the program is aircraft identification. If AT-CTI students are better prepared before they are given on the job training, there will be a significant reductions in the amount of trainees who washout from the Federal Aviation Administration (FAA) Academy.

Aviation is an intricate profession that requires an understanding of all the rules and regulations geared toward a specific career track. This requires many hours of studying these regulations to go from just some words in a book to habit. Most students are able to understand the material easily but for others this can be difficult. What instructors focus on is finding a way to get all students to grasp the material. Kanske, in his study of learning styles on aviation college students, stated that. ”Learning styles focus on how a student learns, as opposed to the subject matter” (2001). This means

students do not feel that the material is difficult; this means that the student does not understand how to relate that material so that they are able to comprehend the given subject. To understand the relationship between knowledge and the way it is taught, we must first see the psychology that is studied to support learning.

Educational Psychology

It can be difficult to teach a student if they do not know how to relate or understand the material. A teacher's number one goal is to have their student comprehend and grasp the intended material they are teaching. This can become difficult when educating a broad range of students. Teachers, over the years, have used a number of techniques that focus on reaching a great number of students within their classrooms, but even these techniques have flaws. For instance, a given method can be used that is successful with reaching roughly seventy percent of a classroom. This method works well because out of ten students, seven will come out of the class understanding the material. However what about the other three students? There is no easy way of reaching a whole classroom due to the varied styles of learning of the students.

Teachers are taught different learning styles and techniques they can utilize in order to reach a wide range of students. Learning styles and learning methods have been identified and studied to help better the education process. Before discussing different learning styles, it is important to understand what learning styles are and how they are useful. The term learning styles originated through the study of human behavior in psychology, which can be broken down into particular categories such as occupational psychology, clinical psychology, criminal psychology, educational psychology, etc. (Srivastava, 2006). When talking about the study of one's learning or the ability to learn,

the focus is on educational psychology, which includes learning methods, styles and behaviors. Hence, educational psychology is just one of the many branches of applied psychology, and educational psychology can be defined as the study of experiences and behavior of a learner in relation to the educational environment (Srivastava, 2006). It is important to note that teachers are given different tools at their disposal that allow them to do their jobs correctly and effectively. Learning styles is just one of many tools that teachers can use to help students better understand a given subject, but teachers are not only taught learning styles. Other factors within educational psychology are:

1. The learner;
2. The learning experiences;
3. The learning process;
4. The learning situations or environment;
5. The teacher (Srivastava, 2006).

When studying learning styles, the focus area is on the learning process. The learning process involves applying the right learning experiences so that the learner is able to properly understand the given material with ease and convenience (Srivastava, 2006). In essence, the learning process studies the topics in learning such as the laws, principles, and theories of learning, transfer of training, remembering and forgetting, ways of effective learning, and so on (Srivastava, 2006). A learning style is simply a learning process that is used to have the learner better understand and recall that information. Educators believe that just about anyone can learn any subject matter, depending on the way that it was presented to the student. The rate at which a person

learns the subject matter varies due to each person's way of thinking and from the way the subject matter is presented to them. Different, learning styles can be used to help relate subject matter to a student that may have difficulty understanding a subject. By understanding the way a student comprehends information, a teacher is able to relate that subject better to the student. Also, the correct use of learning styles can be practiced to considerably shorten the length of time a student would normally take to learn a subject or craft. This is the practice used in educational psychology. Many studies have been done to better understand the way people learn and understand information. These studies have been done for many years and more than 71 different learning style methods have been created (Coffield, F., Moseley, D., Hall, E., & Ecclestone, K., 2004).

When dealing with the principles of learning, psychologists have researched good and bad practices. The best practices that have been developed are used widely, and some of them have been listed as common laws of learning (Srivastava, 2006). These standards of learning are still researched and studied today. The laws used that focus closely on learning styles are the law of effect, the law of exercise, the law of readiness, and the law of belonging (Srivastava, 2006).

Laws of Learning

The Law of Effect. The law of effect studies the response of a specific individual and that individual's feelings towards a given subject matter or experience (Srivastava, 2006). In principle, the law of effect shows that a response tends to be repeated if the situation is followed or accompanied by a satisfied feeling, but the response tends to be eliminated if it is accompanied or followed by an unsatisfied feeling (Srivastava, 2006). The law of effect can be seen throughout a person's lifetime and is one of the laws that

are that are easily relatable. For example, as a baby, infants were given instances that were pleasurable, such as receiving a bottle of milk from their parents to feed. However, there are instances that were not pleasurable, such as touching a hot stove and being burned. The pleasurable experience teaches the child that the bottle of milk tastes good and satisfies a particular urge the baby has. So the child learns that this bottle is meant to nourish him/her, so when the child is hungry again they cry or ask for it. The not so pleasurable experience teaches the child that touching the stove results in pain in their hand. Due to this experience the child learns not to touch the stove again and the child avoids doing so in the future. Though these examples are simple, we can see how this effect resonates with children as they are growing and learning other things that are more complex.

Psychologists believe that our actions are seldom energized by a single motive (Srivastava, 2006). A lot of times an unsatisfying experience can lead to a satisfying one. Such as, a boy enters college in order to achieve the goal of becoming a lawyer, although the boy dislikes school. He enters an unsatisfying experience, such as school, in order to achieve the satisfying experience of one day becoming a lawyer. In essence, the unsatisfying experience becomes dominated due to the desirable goal of one day being a successful lawyer. This is the more complicated portion of the law of effect, where "we tend to adapt to learn any behavior that leads us to goals that satisfy our motives," (Srivastava, 2006, p.225).

The Law of Exercise. The law of exercise, also known as the law of "use and disuse," is an act of learning by doing an action repeatedly over and over until it becomes habit (Srivastava, 2006). By doing an action repeatedly over time, the connection with the

individual and the action is strengthened. For example, a student may not know how to accurately write a well transcribed paper, by writing consistently over time, that student becomes more proficient at writing. However, once that action has not been performed over a period of time the connection between the individual and action tends to be weakened (Srivastava, 2006). This law is widely used throughout all industries with the most noticeable ones being retail and restaurants. A new waiter or waitress is trained in a specific task like placing an order in a point of sales system. The waiter or waitress is slow inputting orders into the system at first but over time they become comfortable with the task, thus they become quicker at inputting the orders. The experience gained from a job specific task becomes valuable in that industry. This can be seen in the field of aviation when it comes to pilots and the number of hours they gain. The law of exercise is also the reason why pilots must undergo regular training on the aircraft they fly. This training helps the pilot to remain familiar with the planes they fly and helps to make sure the experience they gain remains intact. This is why, in certain situations, that employers are more willing to hire a person if they have more experience in the position that is vacant. However, it should be noted that, even if someone has years of experience, if they have years when they have not used that experience they may become rusty. This can also be the case when it comes to memorizing certain things such as aircraft identification. If a student is consistently taught the knowledge of a certain subject, the information will become routine and stick into that student's mind. Nonetheless, that student would continually have to be subjected to that material so that this information remains fresh and is not lost over time.

The Law of Readiness. The law of readiness more so affects the teacher than it does the student and this particular law emphasizes the importance of preparing the student to learn (Srivastava, 2006). The psychology of education states that if a student does not feel the need to learn, if they are not ready, it is unlikely that they will learn very much (Srivastava, 2006). This law is based on the principal that if a person is prepared for the given task they are more inclined to learn something from the experience. For example, before a pilot is "ready" to take the controls of an aircraft for the first time, that pilot spends countless hours learning and understanding the controls and physics behind flying. If a pilot in training is sent into the air before they are comfortable with all the instruments and physics involved, then the task may become overwhelming. This can inherently make the pilot in training more hesitant in continuing to fly. It is because of this that Srivastava states that teachers spend more time in presenting the assignments before they do anything in teaching (Srivastava, 2006).

The Law of Belonging. The law of belonging is a strong relationship between the subject matter and the person learning (Srivastava, 2006). Basically, "when we are able to perceive relationships, the speed of learning and the permanence of retention are greatly increased" (Srivastava, 2006, p. 226). In other words, if a person takes the subject matter and relates that to their life in some method, they are able to understand and remember that subject better. This is common practice used by preachers and ministers, due to the nature of the material. The principles taught in religion deal with life morals, and if a pastor or minister is able to correlate the teachings of that religion to a person's life then the person is more curious to learn about the subject. This law is hard to implement because it means relating that subject matter to a person's life and it can be hard to make

that deep of a connection with a student you barely know. Math teachers try to teach the concepts of math by relating adding, subtracting, multiplying and dividing to everyday tasks such as using money. However, when you get into the higher levels of math, like calculus, it can be harder to correlate the topic with other things in a student's life unless that student plans on going into a certain profession that needs calculus.

These laws, along with other methods, are added to the teachers' tool belts to use, depending on the student and subject matter to be presented. Psychological studies are done to understand the full nature of learning and to give teachers better tools in presenting subjects to students. These laws are used in developing an understanding of learning styles. Teachers are taught these laws to better prepare themselves to teach students and to understand ways of relating the material. The basic learning styles of visual, auditory, and kinesthetic are the three most cited styles, but there are also other learning styles that were created that are aimed at a specific industry such as medicine, aviation, or law. When studying how a set of people learn, it is a good to become familiar with learning styles or methods created for that field.

Active Learning

The active learning method is not as old as some of the other methods listed above, but this method has been used by a wide range of teachers over the years. The method of active learning stems from understanding the student or students first (Harmin & Toth, 2006). Students come with a variety of motivations and the motivations studied by Harmin & Toth are as follows:

1. The fully active learners are students who are willing to work, are eager to do the assignment given to the best of their ability, and will do more than what was asked of them;
2. The responsible student is a student who does the assignment given but does not go above and beyond to do that given assignment;
3. The halfhearted workers are students who will do half of the assignment given and what they turn in will be sloppy;
4. The work avoiders are students who will do everything to avoid the assignment given and this student is normally the one to have discipline problems. Harmin & Toth, 2006

These four types of students comprise what is known as the Active Learning Ladder, which is rated from 1, being the model student, to 4, being the trouble making student (Harmin. & Toth, 2006). The idea is to step each student higher and higher until they become a fully active learner. Each student that a teacher will have will fall into one of four categories. If the student is not number one then the job of the teacher is to step that student up until they reach number one. In order for a teacher to affect this growth in a student they must focus on the five key student abilities, which is known as DESCA (Harmin & Toth, 2006). DESCA can be broken down as follows:

- D is for Dignity. Students want to live and work in dignity. They do not want to feel demeaned, unworthy, diminished or unimportant. Classrooms should be run in a way that is comfortable for students and should never feel

depressing. Avoid embarrassing students and communicate care and respect to students.

- E is for Energy. Students want to engage life energetically and hate sitting still for too long. It is normally suggested that teachers should create a classroom assignment that will engage students and allow them to move around.
- S is for Self-Management. Teachers should teach students to be able to think for themselves. Instead of answering every single question they should be encouraged to find the answer themselves, but the teacher should help steer them in the right direction.
- C is for Community. Students want to be able to get along and relate to other classmates. Teachers should create assignments that encourage students to help one another and set up groups that allow students to learn to rely on one another.
- A is for Awareness. Students are very aware beings and they are not meant to be bored. Teachers should find ways of teaching slower learners without boring the faster learners. Harmin & Toth, 2006

The active learning method is a good method to use in a classroom. It has the ability to reach a wide range of students, but this learning method may not work well for college students. At the college level, students are required to take control of their learning and there is much more learning done outside of the classroom then there is inside. Teachers are meant only to guide the student to the answer but it is up to the student to arrive at the answer. The active learning style can be a good approach to

teaching things such as aviation, but college students should be made aware of their particular way of learning. Learning styles are ways for teachers to understand how their students learn, but what if the student is made aware of the same thing? College is the time when a student learns and understands more about themselves, and understanding the way they learn is one of the key things that a student should recognize before graduating. The active learning method can be utilized to help teachers at the collegiate level, but teaching students more about the way they learn could also help them more in their future.

The Basic Learning Styles

Zanzig and Vincent both stated that a good number of teachers use the active learning method described above to teach various subjects, but the active learning approach gets its basis from the three basic learning styles: visual, auditory, and kinesthetic (Zanzig, 2000; Vincent, 2001). When looking at the learning behaviors and characteristics of students, an instructor has to understand the basic learning principles. A student can fall either into one of these three styles or they can have two of the three styles. It is very rare that you will see that someone has all three but is not completely impossible (Vincent, 2001). Each principle describes a certain way that a person can understand the material given to them. Ellerton gives a listing and defines the three basic learning styles as follows: the visual method is learning by seeing it – reading, pictures or diagrams, demonstrations or watching videos, eventually picturing it in their mind; the auditory method is learning by hearing or saying it – CDs, lectures, debates, discussions, and verbal instructions; and the kinesthetic method is learning by getting a feel for it – physical involvement, hands-on, moving or touching, learning by doing (Ellerton, 2010).

Understanding these learning styles is the main basis for any teacher to understand how a person grasps information. The idea is to find a teaching method that correlates with all three styles enough so that all students benefit.

Learning styles have been studied in multiple ways and those in educational psychology define them as the cognitive, affective, and physiological traits that are relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (Keefe, 1979). Learning styles cover the psychology of the way people take in information. If teachers can understand the way students learn and the students understand how they learn, this can decrease the amount of time it takes for the student to learn a subject. This study will focus on students understanding the way they learn in order to increase their learning. However, it would be naive to not focus on the teaching aspect as well. By taking an active learning approach to teaching aircraft identification and focusing on teaching the subject matter using the three basic learning styles, the rate of learning should increase. Before looking at the different studies that have been done on learning styles, a closer look at the three learning styles used in this study is essential.

Visual Learners. A visual learner responds well to things they see with their own eyes. They learn well by being able to read the subject or by looking at pictures (Walling, 2006). If a person is a visual learner they would prefer to organize information in their minds using colors or maybe even shapes. These learners have the ability to recall information just by seeing a picture of what they learned in their minds. What a visual learner may also find out about themselves is that they may be good drawers or artists. These learners can sometimes be seen closing their eyes during a test in order to

remember the answer. Visual learners excel during classroom lectures when power point presentations are involved. When a teacher or instructor identifies that their trainee or student is a visual learner adding more pictures and visual cues to a presentation would be beneficial to their development. By having the visual cues, these types of learners are able to comprehend what the teacher is referring to due to the pictures given and should be able to easily recall the information (Walling, 2006).

Auditory Learners. An auditory learner is more responsive to information that they hear such as spoken language, music, and rhythms (Walling, 2006). These learners sometimes have issues when it comes to reading and writing. These types of learners can excel well from classroom lectures without the need for visual cues. Auditory learners can be seen moving their lips while reading or even reading aloud. Any type of lesson that incorporates music may also be helpful to the auditory learner. Teachers and instructors may want to give this type of learner handouts and also should emphasize keynotes during lectures. As stated before, an auditory learner can understand a subject better if they are injected into a discussion or a debate (Ellerton, 2010). So, it is important to note that having a classroom discussion about a subject can increase learning for auditory learners.

Kinesthetic Learners. Kinesthetic learners can also be referred to as tactile learners. These types of learners may comprehend a concept better by physical activity and through movement (Walling, 2006). Touch and feel is another aspect of the physical learner. This type of learning style is one of the main styles that simulator based training is geared towards. Another way of looking at the kinesthetic learner is that these types of learners can learn by doing. A kinesthetic learner is unable to grasp the material by

reading, lectures, or presentations so for this type of learner, teachers or instructors have to think of interesting ways for them to understand the material. This style of learner may also benefit from the law of exercise. If a kinesthetic learner is able to practice a given task repeatedly, this will reinforce the information given to them. This learner must have either some physical involvement, hands on experience, and must be able to perform the task in order to learn (Ellerton, 2010).

When these learning styles are combined with the teaching methods discussed earlier, an instructor or teacher can create a well-balanced lesson plan that will affect all three learning styles. Psychologists and teachers have studied these styles and this has led to more in-depth learning styles that are geared towards a particular career field. These studies give us deeper insight into the mind of the human being and it can also help teachers to better understand their students. When formulating a lesson plan it is important to view all the techniques used by others. By researching other learning styles, it is easy to see how all these pieces of educational psychology coexist with one another.

Other Studies in Learning Styles

There have been a variety of learning styles discovered over the years. These styles have been geared towards a specific group and have come closer to depicting that group's style of learning. For instance, in research done by Kanske, it was found that there are two paths of learning styles that have been indicated from the field of psychology (Kanske, 2001). One path is the Pavlovian stimulus-response approach which uses reinforcement of successful completion at each step in a sequential learning process, while the other path focuses on the cognitive processes in learning (Kanske, 2001). Within his research, Kanske showed that a wide range of learning styles was created with

the cognitive process. This process is the means of presenting the task, demonstrating the task, and then the student practicing the method until it is mastered (Kanske, 2001). This research, which was geared towards pilots, works well with a process of learning a giving task like flying an aircraft but can also be effective when it comes to memorizing a set of regulations or identifying aircraft.

An individual's learning style can not only stem from the differences with which a person processes information. Some researchers believe that there is a difference in learning processes between men and women. They believe that gender plays a significant role in aviation classrooms. There are differences in the two genders that make learning different for the two groups. For example, men sometimes prefer debate-like situations when obtaining knowledge, while women like learning and interacting in groups (Karp, 2001). Researchers have also concluded that women are more participatory in their learning styles and men are more independent (Karp, 2001). This makes it harder for teachers to create a generalized lesson plan, and requires the creation of a broader based plan to reach all intended students.

Some researchers also believe that there are other learning styles that do a better job of explaining students' learning. Felder did investigations into learning and teaching styles. In his research he pointed out certain learning groups that should be taken into consideration when teaching students pursuing a science degree. These styles are as follows: visual and verbal input, inductive and deductive organization, active and reflective processing, and sequential and global understanding (Felder, 1993). He states that visual learners get better information from visual images such as diagrams, pictures and demonstrations, while verbal learners benefit from written and spoken words. He

goes on to state that inductive learners learn materials by seeing specific cases such as experimental results and numerical examples, whereas deductive learners tend to begin with general principles and deduce consequences and applications. Felder further concludes that active learners learn a particular subject better by doing something active or trying things out, although reflective learners prefer to work alone or in pairs. Finally, sequential learners receive an understanding of material in small connected chunks, while global learners take in information in small unconnected fragments (Felder, 1993). These groupings give a better insight into the way a person can learn but these learning styles also stem from the basic learning style stated above: auditory, visual and kinesthetic learning.

Simulator Training

As stated before, kinesthetic learners benefit from a simulator based environment. The idea of using simulators is to provide a hands-on-approach to what is taught from lectures. Simulators are used throughout the aviation field to get students comfortable with a given task or job. Since this study will focus on AT-CTI students and will utilize an Air Traffic Control (ATC) simulator in the teaching method, a focus on simulator training and how it has affected learning is important.

Educators and trainers have created multiple ways of teaching groups of people a given trade such as piloting, practicing medicine, and even some sports such as golfing. However, not all training methods are fool proof. When it comes to simulator training, just like other forms of teaching, there are positive and negative sides. Simulator training can help those with high risk jobs learn the skills and techniques of their field without all the risk involved. The issue that may occur during simulator training is there is a divide

with how much a simulator can imitate real world experiences. This divide is known as fidelity. Fidelity is a concept that expresses the degree to which a simulator or simulated experience imitates the real world (Noble, 2002). Noble states that many in the aviation training community holds fast to the belief that the highest level of fidelity is needed in order to reach the highest level of transfer of learning to the actual equipment (2002). This means that the simulator used to imitate that particular environment needs to simulate every aspect of that environment and the trainee needs to feel the risk factor involved with the job in order to reach a high degree of learning. This can be hard to simulate due to the fact that there really is no risk involved when using a simulator. When a student crashes a plane in the simulator, they do not die or get injured and nor does anyone else. The risk that can come into play is the grade factor. A trainee can get nervous and feel the risk involved when they feel that if they do not do well, then the result will be a poor grade. This can give that sense of danger and make the trainee or student want to work hard at making sure they do not botch the simulator training.

Another issue with simulator training is that no matter how good the graphics are or how well the physics are replicated in the simulator, it is hard to simulate every aspect of a profession. For example, simulators have been widely used in helping pilots get ready to perform advanced maneuvers in aircraft, but not all simulators can help a pilot to feel the gravity forces felt during flight. It is because of situations like this that real life training is still the best way of getting someone to learn a given craft, but simulators are a good way of getting trainees to learn the skills before practicing those skills in the real world. Noble also believes that novice pilots can get overwhelmed with higher rates of fidelity (2002). The complexity of the simulation may become so overwhelming that it

can be harmful to the trainee rather than beneficial. With this in mind, trainers and teachers should tailor simulator training to the level each student or trainee is at, and this will ensure they are able to get the best level of training possible (Noble, 2002).

There are certain jobs that immensely benefit from simulated or simulator training, such as astronauts. Robert Voas stated that astronauts have to be ready for a wide variety of instances that could happen in space flight and it is very cost effective to get astronauts ready on the ground (1960). For instance, all astronauts need to be exposed and familiarized with all the conditions of space flight such as trajectories, astrophysics, propulsion, and astronomy (Voas, 1960). With NASA Space Training facilities having a pretty extensive budget, they are able to put their astronauts through the required training to simulate the massive amount of g-forces felt during lift-off, the feeling of weightlessness from no gravity, and piloting a shuttle during these type of situations. It costs millions of dollars to launch a shuttle into outer space and there is a large amount of risk involved. It is because of these factors that simulating the experiences of space flight can be cost effective and have the astronauts ready for the feeling of space travel.

Simulator training, if used correctly, can help a person get ready for the real thing. This trait is used in aviation by training pilots and controllers, and is also used in the NASA space program as stated above. Simulators have been used by these fields in order to minimize the amount of mistakes and give the trainee the hands on experience needed to execute their job effectively. Using simulators for kinesthetic learners gives them the experience they need to correlate the material lectured with the real world. As stated above, kinesthetic learners learn by doing or having hands on experience, and it is for this reason that an ATC simulator was utilized in this study.

Significance of the Problem

In the world of aviation pilots, controllers, dispatchers, airport owners, maintenance workers, and even security all have to adhere to a set of rules that are in place to regulate the industry. These rules have been in place since the infancy of aviation to help keep those that fly safe. Along with these regulations there are also things that each professional needs to know for their given area. Controllers are no different because they have to not only learn and understand the controller regulations but they also have to be aware of the aircraft they are controlling. Being able to know what a certain aircraft can and cannot do gives the controller extra tools that they can use to properly control that aircraft and get it to its destination airport safely. This knowledge also cuts down the amount of "chatter" on the radio due to pilots having to state what they can and cannot do.

As I have stated before, in an interview done with Gail Zlotky, lead instructor for the MTSU AT-CTI program, it was stated that one of the main issues that AT-CTI students have at MTSU is that they cannot identify a wide range of aircraft correctly. Furthermore, in conferences that Professor Zlotky has had with other AT-CTI schools, they have stated that their students have the exact same predicament. Aircraft identification is a huge concern for students who are to enter this field due to the pace of this profession. Students need to be able to tell the difference between a smaller aircraft, like a Cessna 172, and a larger aircraft, like a Boeing 757. Both aircraft have a completely different set of rules for separation in the air and on the ground. If students are not able to readily identify these aircraft at first glimpse, this could cause difficulty for all involved.

So why is this an issue for students whose majors are in the aviation field? This issue relates to the basics of learning stated above. When referring back to the four laws and looking at the curriculum for AT-CTI students, it is seen that this set of students is not exposed to aircraft like pilot, maintenance or even technology majors. The majority of students in the AT-CTI program are either dispatch or management majors. Even though dispatchers need to know the aircraft they are setting up a flight plan for, they are able to review aircraft specifics as they are creating that flight plan. Aviation management workers are not really required to learn and understand aircraft due to the nature of this profession. However, the other three majors mentioned (pilots, maintenance, and technology majors) are consistently involved with the aircraft seen in the aviation field daily. Looking back at the law of exercise, which states that the more a person is exposed to something the more they retain that information, it can be seen that the amount of exposure for AT-CTI students to aircraft is slim, which leads to their lack of knowledge of aircraft. AT-CTI students are exposed to these aircraft in certain classes but they lose this information over time because they do not see it on a daily basis. There is also a correlation with the passion that AT-CTI students have for aircraft. Most pilots enter their profession because they either love flying, aircraft, or both. Not all controllers are lovers of aircraft and many do not enter the field because of this. With the law of belonging, there is a strong relationship between knowledge and passion. A great deal of controllers who know a lot about aircraft fly themselves, but there are a good number of AT-CTI students who do not fly, nor do they have a desire to do so.

In a field as critical as ATC, where a set number of controllers monitor the skies at all times is needed, there is a lack of controllers that make it through on the job

training. As current controllers are nearing the retirement age, new controllers are needed to replace these controllers. Years ago, the FAA created the Academy to train and develop an aviation workforce that they would provide to certain areas of the aviation community such as Air Traffic Control. The AT-CTI program was made to create collegiate level controllers to not only replace the controllers retiring but to create a better candidate pool for management positions. Another reason for the creation of the AT-CTI program was to give students a quicker introduction into the world of air traffic, thus increasing the amount of knowledge a trainee has before reaching the academy. By using simulators and classroom sessions, students can learn about the environment while obtaining a college level degree. The idea of the program is to have a good base of students that are able to pass the qualifying test and make it through the Academy to replace the already declining work force. During the 60 day process, controllers in training are put through the rigorous task of memorizing airspace maps, regulations, and applying this knowledge either during simulator testing or paper testing. If the trainee makes anything below 80 percent on any of these tests, they are not allowed to continue with the training. Due to the amount of information the trainees have to absorb, the FAA has experienced controllers washing out during this training period. From the information that Mrs. Zlotky provided, aircraft identification is one of the main problem areas for trainees. The air traffic field requires that a person is able to be alert as well as be able to utilize the right regulations for a specific situation. If an ATC student can understand the way that they learn before they enter the Academy, hopefully they will have a higher level of success making it through and not washing out. Based upon the issue ATC students have with aircraft identification, this study set out to answer two questions:

1) Will a teaching methodology that reaches all three learning styles (visual, auditory, and kinesthetic) result in improved performance for AT-CTI students in the subject area of aircraft memorization?
2) Based on student feedback, will this new teaching method be seen as beneficial for the three learning styles?

CHAPTER II – METHODOLOGY

The method of this study involved using EducationPlanner.org, a Prezi presentation, and the use of the MTSU ATC simulator to show the aircraft in the ATC environment. For this study, EducationPlanner.org was utilized to gather and inform participants of their specific learning style. This website, which was created by national educational programs such as the Pennsylvania Higher Education Assistance Agency (PHEAA), gives access to a questionnaire that breaks down the answers given by participants to tell them their learning style. EducationPlanner.org also gives the participants advice on how to study. A Prezi presentation was then given to the class in order to present the aircraft identification lesson. The participants were then split into a control group and experimental group with a good balance of all the learning styles in each group. The control group was given the Prezi presentation again while the experimental group interacted in group discussions and simulator aircraft recognition. Due to the limitations of this group of students, the simulator aircraft recognition only involved the group being able to see the aircraft in an ATC environment. Kinesthetic learners are able to learn better by being hands on and also being in the intended environment. A quiz was then administered, along with a survey, which allowed the participants to give feedback on how the study affected them.

Participants

The participants in this study were first semester AT-CTI students at MTSU in the course AERO 3630, Introduction to Air Traffic Control, which consisted of 35 students. Each student was in their first semester of the AT-CTI program. This group was selected due to their limited exposure to aircraft identification. Out of the 35 students in

that class, 34 students elected to participate. Out of those 34 students, only 29 students were able to attend both classroom sessions. This study was approved by MTSU's Institutional Review Board (IRB), Approval # 14-007. The approval letter can be found in Appendix A, and the informed consent form in Appendix B.

Instruments

To collect the data on the different learning styles, a small questionnaire from EducationPlanner.org was utilized (see Appendix C). A presentation of aircraft identification was also given using Prezi Presentation software from prezi.com. This study utilized one quiz in the data collection process (See Appendix D). This study also utilized a 5 question survey to see if the students felt that they benefited from the teaching method they experienced (see Appendix E).

The MTSU ATC Simulator was utilized to allow students to identify the aircraft in a simulated environment. The ATC Simulator puts AT-CTI students in the environment that they can expect once becoming full-fledged controllers. This simulator can replicate the control tower at Memphis International (MEM), Denver International (DEN), and the FAA Academy's Academy Airport (ACC). With the help of retired controllers, students are able to utilize the methods taught to them in classroom discussion in a simulated environment. Using the simulator, students were able to see the basic aircraft that they will see on a normal day on the job. Since the kinesthetic learners can better understand the knowledge given to them by physical involvement and being able to get a feel of the environment, the simulator gave kinesthetic learners more of a feel as to how these aircraft perform.

Research Design

This study utilized the experimental group research method to see if the participants benefited from the classroom discussion and simulator experience. An experimental group research method has the researcher manipulate one group, known as the experimental group, that receives a different method then another group, known as the control group (Gay, 2009). Data was collected from a quiz and survey response. This method allowed the researcher to calculate the difference between the control group and experimental group, and also give the participants a chance to give their perception of the study.

The quiz data was analyzed using a 2 sample t-tests assuming unequal variances, and was also separated by learning style groups. This gave a good assessment of if the groups benefitted from the study, and if the individual learning style groups benefitted. The survey was analyzed using a percentage based equation and graphed into a bar graph to represent the data.

Procedures

Once students consented to the study, they were requested to take a small questionnaire given on EducationPlanner.org that gave a better account of each students learning style. The questionnaire was created to help anyone learn about and understand their given learning style, in hopes that it helps students understand how they need to learn information. Each student was given a percentage matrix that would show them their dominant learning style. The participants were required to complete this questionnaire and submit a copy of their results.

With the students understanding their learning style and having recorded these, the next steps occurred over the next three class periods. During the first class a Prezi presentation was given on the basic aircraft students will see as controllers (see Figure 1). The lecture went over why learning aircraft as controllers was important and showed the picture identification for each aircraft. The lecture for the first day of class lasted for about 30 minutes and students also received a list of the aircraft presented for individual study. During the next class period, the class was split into two groups. Group one (control group) stayed in the classroom and received the same lecture they received from the previous class period by an ATC Instructor and student assistant. Group two (experimental group) proceeded to the MTSU ATC Lab. The group was given instructions to have a discussion about the aircraft presented and to talk about their individual thoughts on a good way to memorize an aircraft. The group was also given a computer with internet access, to look up any references they may have needed for the aircraft, and the group had access to the Prezi presentation. This process was intended to assist those students who have the auditory learning style. This discussion lasted for about 15 minutes. Once the discussion was over, the experimental group proceeded to the ATC Tower simulator where they were able to see some of the aircraft listed in the controller environment. The program simulated 19 aircraft making touch and goes on runway 28R of the Oklahoma Academy Airport (AAC). The students were asked to identify and write down the planes in the sequence they appeared. After the last plane was shown, the students where then told the identification of the aircraft they saw and they compared that to what they wrote down. The use of the simulator showed the aircraft in an ATC environment and was intended to reach those with the kinesthetic learning

style. The whole second day process lasted for about 35 minutes. At the beginning of the third class, all the students were given a quiz, where they had to identify 10 aircraft, and also completed a survey to assess how they felt about the study and also how much studying they did outside of class. These quizzes and surveys were collected to gather the data needed to see if this method of teaching was beneficial.

List of Aircraft					
Airbus	**Boeing**	**Douglas**	**Embrear**	**Bombardier**	**Beechcraft**
A300	B707	DC-8	EMB-135	CRJ-700	Beech 1900
A310	B717	DC-9	EMB-145	CRJ-900	
A318	B727		EMB-120	CRJ-1000	
		McDonald			
A319	B737	**Douglas**	**E-Jet Class**		**Misc**
A321	B747	MD-80	ERJ-170	**ATR**	DHC-8
A330	B757	MD-11	ERJ-190	ATR-42	Saab 340
A340	B767			ATR-72	Bae-146
A380	B777				Fokker70
	B787				
Military Aircraft					
Fighter [F]		**Bomber [B]**		**Cargo [C]**	
F-15		B-2		C-130	
F-16		B-52		C-17	
F/A-18					
F-22					
F-35					
F-117					

Figure 1: List of Aircraft taught to participants. Generated using Microsoft Excel.

It was believed that this was the appropriate way to reach all three learning styles in the area of aircraft identification. The classroom lecture, which is the main teaching method used by most teachers, was utilized to help those students who have auditory and visual as their learning style. However, adding the simulator, which gives a good simulation of the ATC environment, gave those students who learn kinesthetically a

chance to apply what they learned from the lecture. With the discussion time added, those students who had the auditory learning style should have seen better results from having a peer to peer discussion. The grades from the quiz were then compared with each group to see if the experimental group scored significantly higher than the control group.

CHAPTER III – RESULTS

The data from the quizzes were analyzed using a 2 sample t-test assuming unequal variances (*N1* = 13, *N2* = 14). The average from each group was also determined. Also, the participants' perceived effectiveness of the classroom sessions, as collected from the after session survey, were analyzed using a percentage based equation and represented in a bar chart. Data collected is reported after each group.

Analyses

To calculate the significant difference between the classroom lecture versus the extra simulator time and discussion, a t-test on the quiz results was used to verify the difference of the control group (*N1* = 13) and experimental group (*N2* = 14). Data showed that there was no significant difference between the control and experimental group (*t* = -0.99, *t* Critical = 2.06). The average mean of the control group was 26.15%, while the average mean for the experimental was 35%. Based upon the values from the t-test and from the averages of the two groups, was concluded that the scores are not significantly different. The raw results, along with the average scores, are shown in Table 1.

Table 1

Raw data with average scores of Control and Experimental Groups

	Control	**Experimental**
Mean (Average)	26.15	35
Variance	608.97	442.31
Observations (*n*)	13	14
Df	24	
***t* Stat**	-0.99	
***P*(*T* < = *t*) two-tail**	0.33	
***t* Critical two-tail**	2.06	

Note: Microsoft Excel

Each group was then analyzed by each learning style to see if there was a significant difference. A t-test was again used to verify the effectiveness of each group. The sample sizes for each group were too small to fully utilize a t-test but a t-test was used just to see if there was a significant difference or not between the learning styles. Looking at the tactile learners (*N1* = 3, *N2* = 3), the data shows that there wasn't a significant difference between both the control and experimental group with the tactile learners (*t* = -1.75, *t* Critical = 3.18). The mean for the control group was 16.67% while the experimental group was 40%. Just like the last comparison, the scores between the two groups were not wide enough to show a significant difference. The raw data for the tactile learners is shown in Table 2.

Table 2

Raw data with average scores of tactile groups

	Control	**Experimental**
Mean (Average)	16.67	40
Variance	433.33	100
Observations (*n*)	3	3
Df	3	
***t* Stat**	-1.75	
***P*(*T* < = *t*) two-tail**	0.18	
***t* Critical two-tail**	3.18	

Note: Microsoft Excel

The same type of t-test was used for the visual learners to determine significant difference with the quizzes. After analyzing the visual learners (*N1* = 6, *N2* = 7), the data also showed no significant difference between the control group and experimental group (*t* = -0.06, *t* Critical = 2.23). The mean of the quiz scores was 33.33% for the control group and 34.29% for the experimental group. The data for the visual learners is shown in Table 3.

Table 3

Raw data with average scores of visual groups

	Control	**Experimental**
Mean (Average)	33.33	34.29
Variance	866.67	561.9
Observations	6	7
df	10	
***t* Stat**	-0.06	
***P*(*T* < = *t*) two-tail**	0.95	
***t* Critical two-tail**	2.23	

Note: Microsoft Excel

For the auditory learners, the same t-test was used to analyze the data from the quizzes (*N1* = 2, *N2* = 2). Upon analyzing the quiz scores for the auditory learners it was concluded that there was not a significant difference between the control group and experimental group (*t* = 0.45, *t* Critical = 12.71). The mean of the control group was 20% while the experimental group was 15%. The data from the t-test is listed in Table 4.

Table 4

Raw data with average scores of auditory group

	Control	**Experimental**
Mean (Average)	20	15
Variance	200	50
Observations	2	2
df	1	
***t* Stat**	0.45	
***P*(*T* <= *t*) two-tail**	0.73	
***t* Critical two-tail**	12.71	

Note: Microsoft Excel

The last analysis was done on the auditory – tactile learners. The same t-test was used to analyze the data from the quiz scores (*N1* = 2, *N2* = 2). After analyzing the data, it was concluded that there was no significant difference between the control group and experimental group, *t* = -0.78, *t* Critical = 4.30. The average score for the control group was 25% while the experimental group was 50%. As with the analysis with the other groups, there was no significant difference between the two groups. The raw data for the auditory – tactile group are represented in Table 5.

Table 5

Raw data with average scores of auditory-tactile groups

	Control	**Experimental**
Mean (Average)	25	50
Variance	1250	800
Observations	2	2
df	2	
***t* Stat**	-0.78	
***P*(*T* < = *t*) two-tail**	0.51	
***t* Critical two-tail**	4.3	

Note: Microsoft Excel

As for the question, will a teaching methodology that reaches all three learning styles (visual, auditory, and kinesthetic) result in improved performance for AT-CTI students in the subject area of aircraft memorization, it was determined that the teaching method used had no significant difference on either of the learning styles. Even though there was a difference between the averages of both groups, there was not a significant difference made.

Surveys

Questions 1, 4, and 5 of the survey pertained to both the control and experimental group ($N1 = 13$, $N2 = 14$) but questions 2 and 3 were only answered by the experimental group ($N = 14$). All questions in the survey were given to each participant after the quiz was given. Question 1 asked the participant how much of a benefit they felt the class presentation had on their learning of aircraft identification. As seen in Figure 2, both the control and experimental group had a larger percentage of students who felt the class presentation was a positive experience.

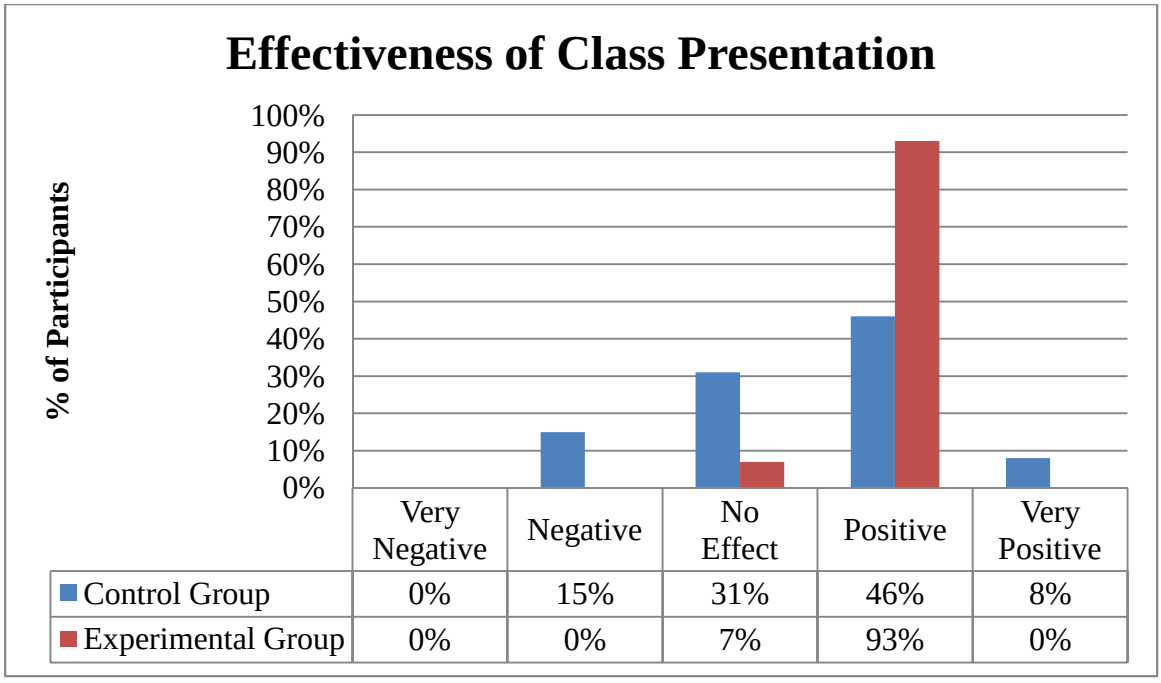

Figure 2: Percentage of participant's to survey question 1 with regard to effectiveness of the classroom presentation. Generated Using Microsoft Excel.

As stated above, Questions 2 and 3 were only asked of those students who were in the experimental group. Question 2 asked the experimental group (N = 14) how much they benefited from the group session in learning aircraft identification. As we can see from Figure 3, the group was somewhat split from those that felt that it was not effective and those that felt it was positively effective. This figure shows that 50% of the group felt the group session was not effective at all and that 43% of the group felt that it had a positive effect.

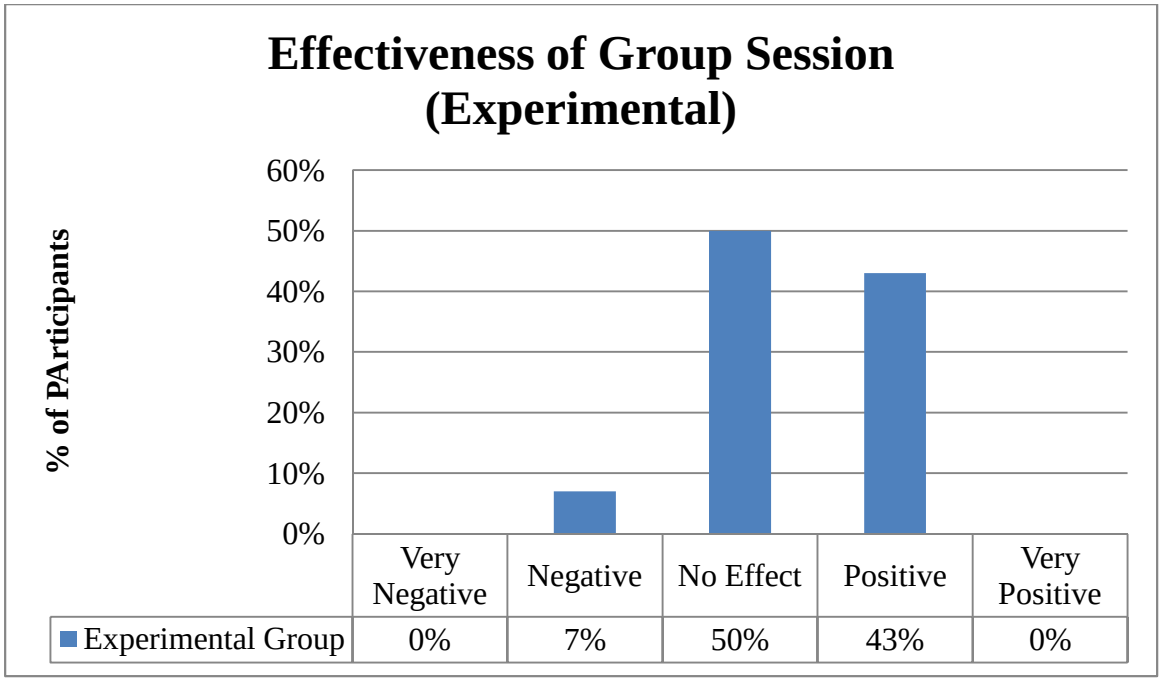

Figure 3: Percentage of participant's to survey question 2 with regard to effectiveness of the group session (Experimental Group Only). Generated Using Microsoft Excel.

Question 3 asked the experimental group (*N* = 14) how effective the simulator training was to learning aircraft identification. As we can see in Figure 4, the group had more participants feeling that the simulator session helped them to understand aircraft identification. A total of 57% of the experimental group felt the simulator had a positive effective in helping them to learn aircraft identification.

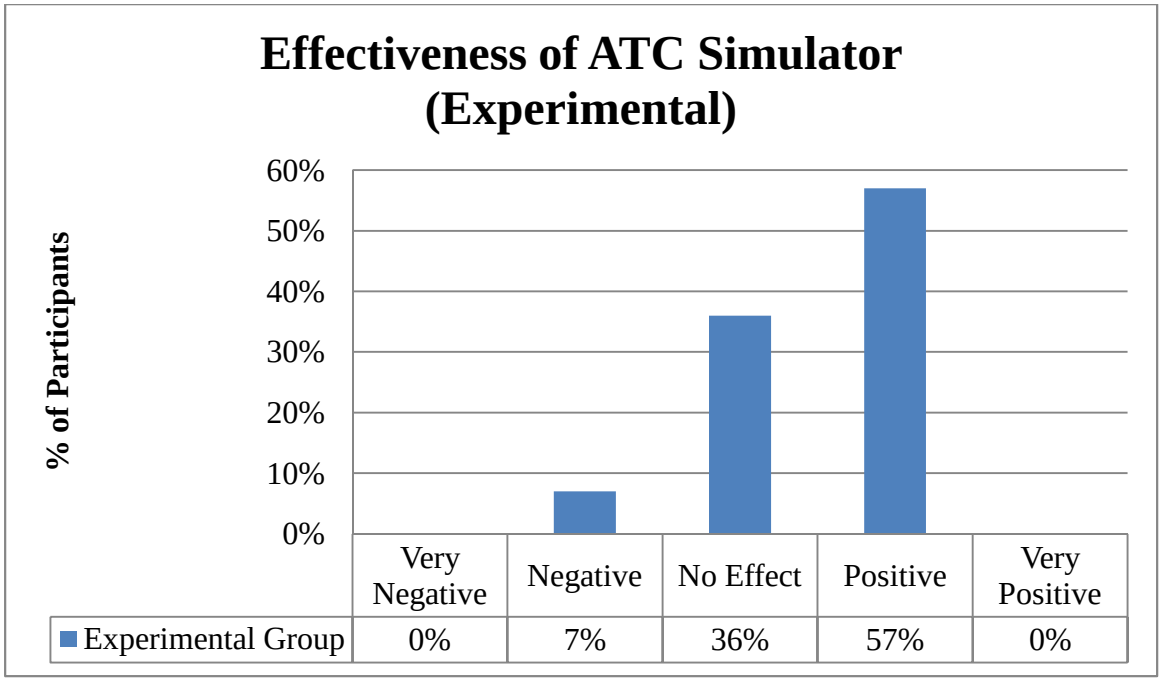

Figure 4: Percentage of participant's to survey question 3 with regard to effectiveness of the ATC Simulator (Experimental Group Only). Generated Using Microsoft Excel.

Questions 4 and 5 were asked of both the control and experimental group (*N1* = 13, *N1* = 14). Question 4 asked how many hours the participants spent outside of class studying aircraft identification. Figure 5 shows that an overwhelming number of students only studied between 0 to 2 hours outside of class. A total of 85% of the control group and 93% of the experimental group studied 0 to 2 hours outside of class while only 15% and 7% studied 3 to 4 hours.

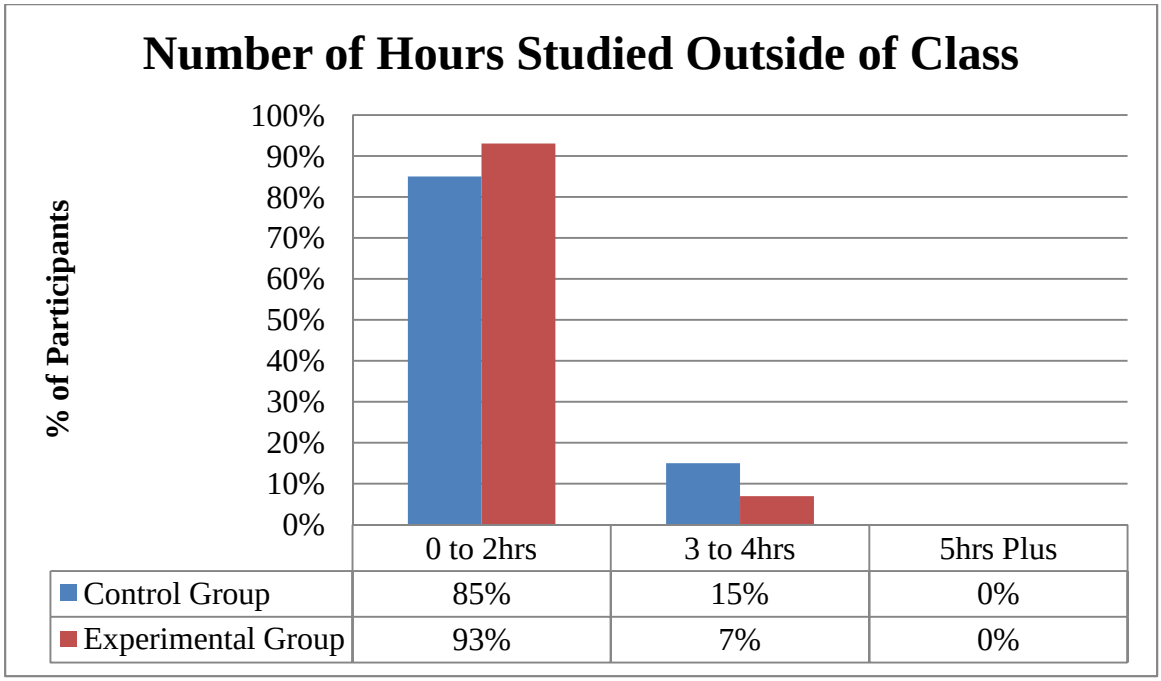

Figure 5: Percentage of participant's to survey question 4 with regard to how many hours the participants spent outside of class studying aircraft identification. Generated Using Microsoft Excel.

Finally, Question 5 asked both groups (*N1* = 13, *N2* = 14) if they felt the extra classroom session was beneficial to them learning aircraft identification. The control group answered with regard to the extra presentation and the experimental group answered to the effectiveness of both the group session and the ATC simulator. Figure 6 shows that a good number from both groups felt that the extra classroom session had a positive effect with 62% from the control group and 64% from the experimental group indicating this. With this data, the question, will the new teaching method be beneficial for the three learning styles with student feedback, the participants felt that either type of extra classroom session had a positive impact on their learning of aircraft identification.

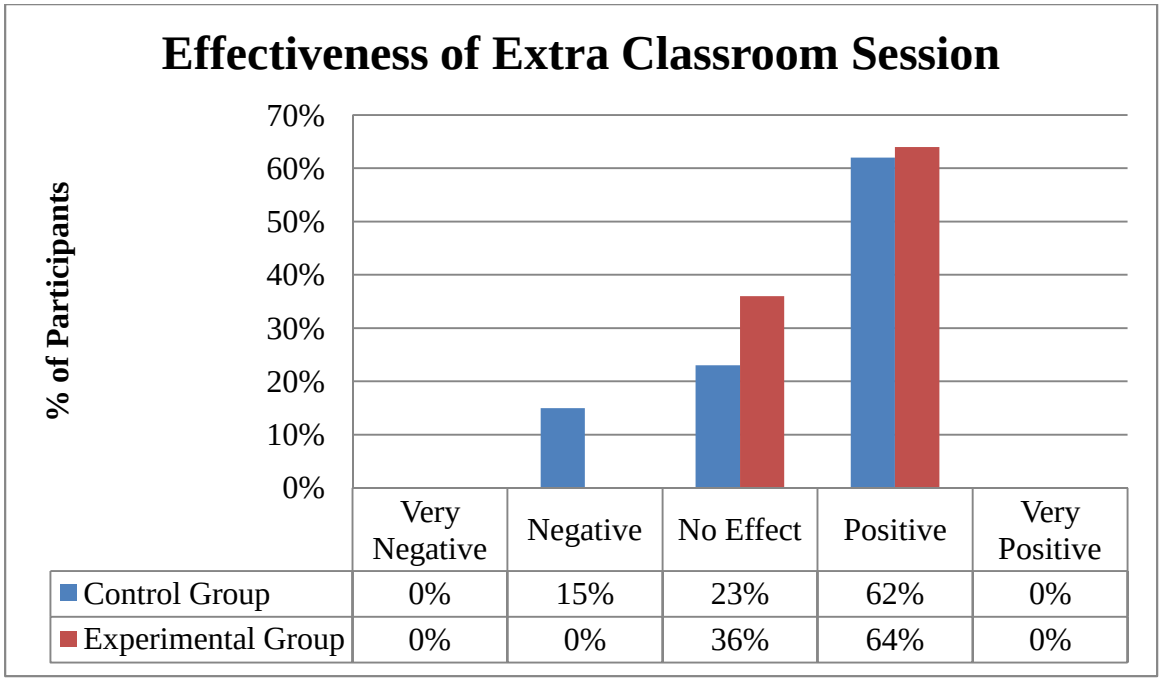

Figure 6: Percentage of participant's to survey question 5 with regard to effective the extra classroom session was to the participants learning aircraft identification. Generated Using Microsoft Excel.

CHAPTER IV – DISCUSSION

This study was designed to see if an effective teaching method could be created to improve the learning of Air Traffic Control students in aircraft identification. The results of this study show that the new method used was not significantly effective enough to cause a positive impact on students learning. The results from the quiz only show an insignificant difference between the control group and the experimental group, which means the slight effect was only circumstantial to both groups learning. In regards to the first research question, will a teaching methodology that reaches all three learning styles result in improved performance for AT-CTI students in the subject area of aircraft memorization, the data shows that the new teaching method was not significantly effective. As seen from the data, the surveys showed that a good number of the participants felt that either extra session helped them learn aircraft identification better. In regards to the second research question, will this new teaching method be seen as beneficial for the three learning styles based on participant feedback, it is concluded that the participants did benefit from the study.

Observations

Throughout the study, there were qualitative observations made of the participants. For instance, during the Prezi presentation, those participants who had a kinesthetic learning style could be seen occupying their time doing other things, while those who had a visual or auditory learning style were listening and also making comments. Another observation was during the discussion portion with the experimental group. Visual learners tended to shy away from the group and had less input during this

phase of the study. Kinesthetic learners were more active and one even took charge in leading the group.

The more interesting observation came from the simulator phase of the experimental group. Kinesthetic learners were more active in the activity along, with the visual learners. The auditory learners found it more difficult to identify the aircraft during the simulator practice and tended to distance themselves from the rest of the group. Also, a group of students were being competitive with their classmates, stating that they could identify more aircraft than the other. This led to more focus within that group of students due to their competitive nature. It was clear that the education planner questionnaire was not far off from pointing out the learning styles of each student. However, it was difficult to know if the students could perceive their own behavior in regard to their learning style.

Limitations

There are a number of things that occurred during this study that could have affected the outcome. As stated in chapter 1, this is the first time this group of AT-CTI students has experienced aircraft identification. The data, from the survey, which suggests that the participants felt that this study helped them to learn the identification, could be the result of a lot of these participants having never being exposed to aircraft identification. As stated with the law of exercise, the amount of times a student is exposed to a subject can lead to the amount they are able to learn that subject. Due to this being the participants first time being presented aircraft identification, they have only just started the learning process of memorizing the aircraft. The data also shows that a great number of students perhaps either did not study or did not study enough outside of class. This study was not only intended to find a method that could help all learning styles, but

also to help students study better by having a good understanding of the way they learn. Nevertheless, the degree to which the participants took this study seriously can be questioned.

During the time of this study, the participants were in their 4th week of school and around this time college students are about to take their first test in their classes. Given that this study was strictly voluntary and had no weight on their academic standing, this study could have been pushed to the bottom of their priority list. When looking at the law of effect, there can be a major effect in learning if the student does not feel some kind of importance to what they are learning (Srivastava, 2006). The amount of pressure a student feels can have an effect on the amount of time that person takes to learn or understand the material, especially when that subject stands in the way of them obtaining their goal. Even though students were told that aircraft identification was a major part in controlling aircraft and that they will later be tested on the material in class, their thought process could have been that they can learn the aircraft on a later date. At the beginning of the Prezi presentation, the principal investigator stated and had classroom participation as to the importance of learning aircraft identification effectively. Unfortunately, some students may have taken this research seriously, while others may have felt that the lack of a weighted quiz wasn't worth their time.

Recommendations for Future Study

Due to the outcome of this study, a few recommendations have been identified that could lead to more accurate results. First, a larger sample size was needed. With more participants, a smaller gap or even a significant difference might have been found. Second, with anything academic, a suggested measure of weight was needed to have

participants take the study a little more seriously. One of the issues that could have led to negative results was the lack of study time that the participants did outside of class. From observation, adding competition into the study could have led to the amount of weight needed to have students focus more on the study. Also, if the data collection stage could have occurred during a time in the semester which the students' focus was not on tests for other classes, this could have led to better results.

Another recommendation would be to add more classroom sessions and add some means of repetition. The law of exercise suggests that the more a person does a particular task, the student has a better connection with that task (Srivastava, 2006). This would show that there is a strong connection with repetition and memorization. If the participants were put in a position where they were subjected to aircraft identification more often, this could lead to better results. With the time constraints of this study it was impossible to extend this study beyond two classroom sessions, as the instructor gave valuable class time in order for this study to be done. The last recommendation would be to use students who have already had experience using the ATC simulator. Due to the participants being first year students in the AT-CTI program, they had no experience in controlling aircraft in the tower simulator. With the inexperience of these students, the procedure used during the simulator portion had to be modified to fit their inexperience. It would be recommended to have the students control these aircraft to phase in the law of belonging into the study. By showing the students that having knowledge of the aircraft can help them execute commands faster to aircraft, this could lead to more of a connection with the aircraft and should increase learning.

More research needs to be done to the learning attributes associated with Air Traffic Control students. As this industry starts to focus more on only allowing people who have been through the AT-CTI program into the ATC field, there will be more of a need to get these students ready for the stresses of this career. There is a considerable amount of research done on the learning styles of student pilots, but barely any research done on student controllers. More research done in this area can create a stronger ATC candidate pool, and could also lower the amount of dropouts the FAA is faced with now. Studying the minds of these ATC students could create an even safer ATC system.

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Appendices

Appendix A: IRB Approval Letter

MIDDLE TENNESSEE STATE UNIVERSITY

July 10, 2013

Dontae Jackson, Dr. Wendy Beckman
Department of Aerospace
dlj3r@mtmail.mtsu.edu, Wendy.Beckman@mtsu.edu

Protocol Title: "Learning Styles: The Learning Methods of Air Traffic Control Students"

Protocol Number: 14-007

Dear Investigator(s),

The exemption is pursuant to 45 CFR 46.101(b) (2). This is because the research being conducted involves the use of educational tests, survey procedures, interview procedures or observation of public behavior.

You will need to submit an end-of-project report to the Compliance Office upon completion of your research. Complete research means that you have finished collecting data and you are ready to submit your thesis and/or publish your findings. Should you not finish your research within the three (3) year period, you must submit a Progress Report and request a continuation prior to the expiration date. Please allow time for review and requested revisions. Your study expires on **July 10, 2016.**

Any change to the protocol must be submitted to the IRB before implementing this change. According to MTSU Policy, a researcher is defined as anyone who works with data or has contact with participants. Anyone meeting this definition needs to be listed on the protocol and needs to provide a certificate of training to the Office of Compliance. **If you add researchers to an approved project, please forward an updated list of researchers and their certificates of training to the Office of Compliance before they begin to work on the project.** Once your research is completed, please send us a copy of the final report questionnaire to the Office of Compliance. This form can be located at www.mtsu.edu/irb on the forms page.

Also, all research materials must be retained by the PI or **faculty advisor (if the PI is a student)** for at least three (3) years after study completion. Should you have any questions or need additional information, please do not hesitate to contact me.

Sincerely,

Andrew W. Jones

Compliance Office
615-494-8918
Compliance@mtsu.edu

Appendix B: IRB Consent Form

MTSU
IRB Approved
Date: 7/10/2013

Middle Tennessee State University Institutional Review Board
Informed Consent Document for Research
Principal Investigator: Dontae Jackson
Study Title: Learning Styles: The Learning Methods of Air Traffic Control Students
Institution: Middle Tennessee State University

Name of participant: _____ Age: _____

The following information is provided to inform you about the research project and your participation in it. Please read this form carefully and feel free to ask any questions you may have about this study and the information given below. You will be given an opportunity to ask questions, and your questions will be answered. Also, you will be given a copy of this consent form.

Your participation in this research study is voluntary. You are also free to withdraw from this study at any time. In the event new information becomes available that may affect the risks or benefits associated with this research study or your willingness to participate in it, you will be notified so that you can make an informed decision whether or not to continue your participation in this study.

For additional information about giving consent or your rights as a participant in this study, please feel free to contact the MTSU Office of Compliance at (615) 494-8918.

1. **Purpose of the study:**
   You are being asked to participate in a research study because you are a Middle Tennessee State University student that is currently enrolled in the Air Traffic –Collegiate Training Initiative (AT-CTI). This study will help you to determine your specific learning style and utilize that style to learn aircraft identification. This study will give you a better understanding of how to learn information.

2. **Description of procedures to be followed and approximate duration of the study:**
   All participants will take a short questionnaire that will determine their learning style. Upon learning their learning style, participants will receive a 55 minute lecture on aircraft identification. During the next class period, participants will be split into two groups. Each group will experience different methods of instruction regarding aircraft identification, designed to reach various learning styles. During the beginning of the third class period, the participants will have a twelve question quiz on aircraft identification that will last for 15 minutes. The entire study will take place over three class periods and will last a total of 2 hours and 35 minutes.

3. **Expected costs:**
   None

4. **Description of the discomforts, inconveniences, and/or risks that can be reasonably expected as a result of participation in this study:**
   None

5. **Compensation in case of study-related injury:**
   None

6. **Anticipated benefits from this study:**
   a) The potential benefits to science and humankind that may result from this study are determining if a person can learn information more easily by understanding their learning style and being taught in a way that benefits their way of learning.
   b) The potential benefits to you from this study are giving you a better understanding of the way that you learn information. This will help with further studying in the AT-CTI program and your college career.

7. **Alternative treatments available:**
   Students will participate in the two instructional periods and complete the aircraft identification quiz regardless of whether or not they choose to participate in the research study. However, the learning style

Appendix B: IRB Consent Form (Continued)

assessment will not be completed by those students who choose not to participate. In addition, no data will be recorded from the quiz results for the purposes of this study for those who choose not to participate.

8. **Compensation for participation:**
There will be no compensation for participation in this study.

9. **Circumstances under which the Principal Investigator may withdraw you from study participation:**
Participants will be withdrawn for the study if: a) they miss any of the three class periods; or b) if they are caught cheating during the quiz.

10. **What happens if you choose to withdraw from study participation:**
Participants will not be penalized if they choose not to participate in this study.

11. **Contact Information.** If you should have any questions about this research study or possible injury, please feel free to contact **Dontae Jackson** at **615-438-1236** or my Faculty Advisor, **Dr. Wendy Beckman** at **615-494-8755**.

12. **Confidentiality.** All efforts, within reason, will be made to keep the personal information in your research record private but total privacy cannot be promised. Your information may be shared with MTSU or the government, such as the Middle Tennessee State University Institutional Review Board, Federal Government Office for Human Research Protections, if you or someone else is in danger or if we are required to do so by law.

13. **STATEMENT BY PERSON AGREEING TO PARTICIPATE IN THIS STUDY**
I have read this informed consent document and the material contained in it has been explained to me verbally. I understand each part of the document, all my questions have been answered, and I freely and voluntarily choose to participate in this study.

_____ _____
Date Signature of patient/volunteer

Consent obtained by:

_____ _____
Date Signature

_____
Printed Name and Title

Appendix C: EducationPlanner.org Learning Style Questionnaire

1. What kind of book would you like to read for fun?

- ☐ A book with lots of pictures in it
- ◉ A book with lots of words in it
- ☐ A book with word searches or crossword puzzles

2. When you are not sure how to spell a word, what are you most likely to do?

- ☐ Write it down to see if it looks right
- ☐ Spell it out loud to see if it sounds right
- ☐ Trace the letters in the air (finger spelling)

3. You're out shopping for clothes, and you're waiting in line to pay. What are you most likely to do while you are waiting?

- ☐ Look around at other clothes on the racks
- ☐ Talk to the person next to you in line
- ☐ Fidget or move back and forth

4. When you see the word "cat," what do you do first?

- ☐ Picture a cat in your mind
- ☐ Say the word "cat" to yourself
- ☐ Think about being with a cat (petting it or hearing it purr)

Appendix C: EducationPlanner.org Learning Style Questionnaire (Continued)

5. What's the best way for you to study for a test?

- ☐ Read the book or your notes and review pictures or charts
- ☐ Have someone ask you questions that you can answer out loud
- ☐ Make up index cards that you can review

6. What's the best way for you to learn about how something works (like a computer or a video game)?

- ☐ Get someone to show you
- ☐ Read about it or listen to someone explain it
- ☐ Figure it out on your own

7. If you went to a school dance, what would you be most likely to remember the next day?

- ☐ The faces of the people who were there
- ☐ The music that was played
- ☐ The dance moves you did and the food you ate

8. What do you find most distracting when you are trying to study?

- ☐ People walking past you
- ☐ Loud noises
- ☐ An uncomfortable chair

Appendix C: EducationPlanner.org Learning Style Questionnaire (Continued)

9. When you are angry, what are you most likely to do?

- ☐ Put on your "mad" face
- ☐ Yell and scream
- ☐ Slam doors

10. When you are happy, what are you most likely to do?

- ☐ Smile from ear to ear
- ☐ Talk up a storm
- ☐ Act really hyper

11. When in a new place, how do you find your way around?

- ☐ Look for a map or directory that shows you where everything is
- ☐ Ask someone for directions
- ☐ Just start walking around until you find what you're looking for

12. Of these three classes, which is your favorite?

- ☐ Art class
- ☐ Music class
- ☐ Gym class

Appendix C: EducationPlanner.org Learning Style Questionnaire (Continued)

13. When you hear a song on the radio, what are you most likely to do?

- Picture the video that goes along with it
- Sing or hum along with the music
- Start dancing or tapping your foot

14. What do you find most distracting when in class?

- Lights that are too bright or too dim
- Noises from the hallway or outside the building (like traffic or someone cutting the grass)
- The temperature being too hot or too cold

15. What do you like to do to relax?

- Read
- Listen to music
- Exercise (walk, run, play sports, etc.)

16. What is the best way for you to remember a friend's phone number?

- Picture the numbers on the phone as you would dial them
- Say it out loud over and over and over
- Write it down or store it in your phone contact list

Appendix C: EducationPlanner.org Learning Style Questionnaire (Continued)

17. If you won a game, which of these three prizes would you choose?

- A poster for the wall
- A music CD or mp3 download
- A game of some kind (or a football or soccer ball, etc.)

18. Which would you rather go to with a group of friends?

- A movie
- A concert
- An amusement park

19. What are you most likely to remember about new people you meet?

- Their face but not their name
- Their name but not their face
- What you talked about with them

20. When you give someone directions to your house, what are you most likely to tell them?

- A description of building and landmarks they will pass on the way
- The names of the roads or streets they will be on
- "Follow me—it will be easier if I just show you how to get there."

Appendix D: Aircraft Identification Quiz

Aircraft Quiz Name:_____

Name the aircraft below. Answers in Red

1.  _____ A321

2.  _____ F-22 Raptor

3.  _____ CRJ7

4.  _____ MD-80

5.  _____ B747

Appendix D: Aircraft Identification Quiz (Continued)

6.  _____ F-16

7.  _____ B757

8.  _____ F-117

9.  _____ DHC-8 (Dash 8)

10.  _____ C-17

Appendix E: Survey

Survey

1. How much of a benefit was the class presentation to your learning of aircraft identification?

   1=Very Negative 2=Negative 3=No Effect 4=Positively 5=Very Positively

2. How much of a benefit was the group session to your learning of aircraft identification?

   1=Very Negative 2=Negative 3=No Effect 4=Positively 5=Very Positively

3. How much of a benefit was simulator training to your learning of aircraft identification?

   1=Very Negative 2=Negative 3=No Effect 4=Positively 5=Very Positively

4. Estimate the amount of time that you spent outside of class studying aircraft identification before the quiz?

   0 to 2hrs 3 to 4hrs 5hrs plus

5. Was the extra classroom session beneficial to your learning of aircraft identification?

   1=Very Negative 2=Negative 3=No Effect 4=Positively 5=Very Positively