# EVALUATION OF THE INTEGRATED AMT/AMT-T CURRICULUM: YEAR 2 ACTIVITIES

*Doyle Arnold*
*Aviation Maintenance Technology*
*111 Connecticut Court*
*Donaldson Center Industrial Air Park*

*Anand K. Gramopadhye, Reena Master,*
*Xiaochun Jiang, and Kartik Madhani,*
*Department of Industrial Engineering*
*Clemson University*
*Clemson, SC 29634-0920*

*Jean Watson*
*Federal Aviation Administration*
*Office of Aviation Medicine*

*May 2001*

## 2.1 INTRODUCTION

The report is divided into four major sections. The Background outlines the need for pursuing this research to implement and evaluate portions of the integrated Aviation Maintenance Technician Transport (AMT-T) curriculum while the second section describes the revised curriculum development effort and the third develops the methodology and assessment tools used in conducting the evaluation. Finally, the conclusion outlines the implications of this study for the evaluation of the use of advanced technology in implementing the curriculum and enhancing the learning experience. The final section outlines the directions for future work. This project is managed by the Aircraft Maintenance Technician Program at Greenville Technical College and conducted in collaboration with the Department of Industrial Engineering at Clemson University (CU). Other partners actively involved in this research include Lockheed Martin Aircraft Center (LMAC) and Stevens Aviation. Moreover, the research also directly supports undergraduate and graduate students.

## 2.2 BACKGROUND

For the Federal Aviation Administration (FAA) to provide the public with continuing safe, secure, efficient and reliable global air transportation, it is important to have undergraduate aircraft maintenance technology programs that encourage careers in the field and address the FAA technology requirements for the future.[1,2,3] This research effort will enable both the establishment of technician performance benchmarks relative to the Part 66 curriculum requirements and the evaluation of the relative merits/consequences of alternative training strategies. These results, then, will form the foundation of a comprehensive AMT/AMT-T training program that will ultimately result in improving the safety and reliability of aircraft maintenance technology and maintenance operations and as a consequence provide the aviation industry with ready access to licensed technicians, a more stable and reliable work force, increased safety performance, improved quality assurance, higher consumer satisfaction, and increased profitability and competitiveness.

Three new Advisory Circulars for aircraft maintenance technology under the FAA Research, Engineering, and Development Authorization Act of 1997, Section Three (Law 105-155) mandate research on future training requirements for projected changes in the regulatory requirements of aircraft maintenance and powerplant licensees. These mandates call for new/updated safety enhancements for AMT/AMT-T training programs and skill requirements for technicians. The introduction of the new Part 66, in particular, imparts future training requirements, both for training levels and objectives, for AMT/AMT-T personnel training procedures. Thus, applied research is needed to develop and implement an alternative methodology for a learner-focused curriculum that is integrated into laboratory experiences via interactive modules of skill mastery and evaluation/assessment. Since the general industry of aircraft maintenance technology requires more rapid training in appropriate skills while also enhancing quality and safety performance, the results of this research will serve as a model for changing training and continuing education certification for aircraft maintenance technology for general and transfer technician application. The alternative learning methodologies can be applied to improving safety standards that govern civil aircraft worthiness and operational performance.

### 2.1.1 Research Objectives

The general objective of this research was to develop, implement, and assess the newly integrated curriculum, using alternative training methodologies for technician technology skill transfer and application that demonstrate acceptable student performance through the various levels of the integrated curriculum. Specifically, a detailed assessment of portions of the integrated curriculum was conducted to test whether it meets educational objectives and student performance objectives, that is the desired learning outcomes, and then use these results to further enhance the effectiveness of the curriculum, the learning experience, and the educational delivery system.

Portions of the integrated curriculum included in this project were selected from the units of Ground Operations and Safety, Gas Turbine Engines, and Aircraft Structures and implemented in Year 1. This report outlines the development and evaluation work conducted in Year 2.

## 2.3 CURRICULUM DEVELOPMENT

The primary participants and their respective roles in the research were as follows: GTC AMT served as the test bed for implementing and testing the curriculum. The AMT program is developed the training material, the educational methods and the technology in cooperation with the CU research team. The CU research team was tasked with the development of the assessment methodology and is jointly conducting assessment with instructors from the GTC AMT program along with support from industry partners. The CU team was also actively involved in the development of the educational methods, the training material, and the identification of learning strategies. LMAC and Stevens Aviation have provided industry input on curriculum development and assessment activities. In addition to instructional material, a course related web site was developed to support distance learning. Results of Year 1 activities were used to enhance the functionality and the interface design features of the web-site. It is anticipated that the use of the Internet and multimedia in conjunction with classroom instruction will provide students with better orientation in the use of computers. In the future, this facility can be used to facilitate distance learning programs. Figures 2.1 through 2.4 show prototypical screens for the revised Gas Turbine Engine course. Figure 2.1 shows the homepage of the Gas Turbine Engines website. There are several features available on the website, which can easily be accessed from the homepage. These include course outline, calendar of course events, email, bulletin board, assignments, chat room, lectures, pictures, handouts and grades. Figure 2.2 depicts a sample picture that is used to supplement the lecture information. Pictures can be accessed two ways: by going to the Pictures link from the homepage or by going through the lecture notes and clicking on the appropriate link in the text. Figure 2.3 depicts the webpage, which provides lectures available for the course. A sample slide from the lecture notes is shown in Figure 2.4. Using this web-site students and course instructor can communicate without being constrained by geographical proximity. The students can access all information pertaining to the course, use the e-mail facility to contact the course instructor and interact with members on team projects using the chat room facility. Each student can logon to the website from any place he/she has access to the World Wide Web.

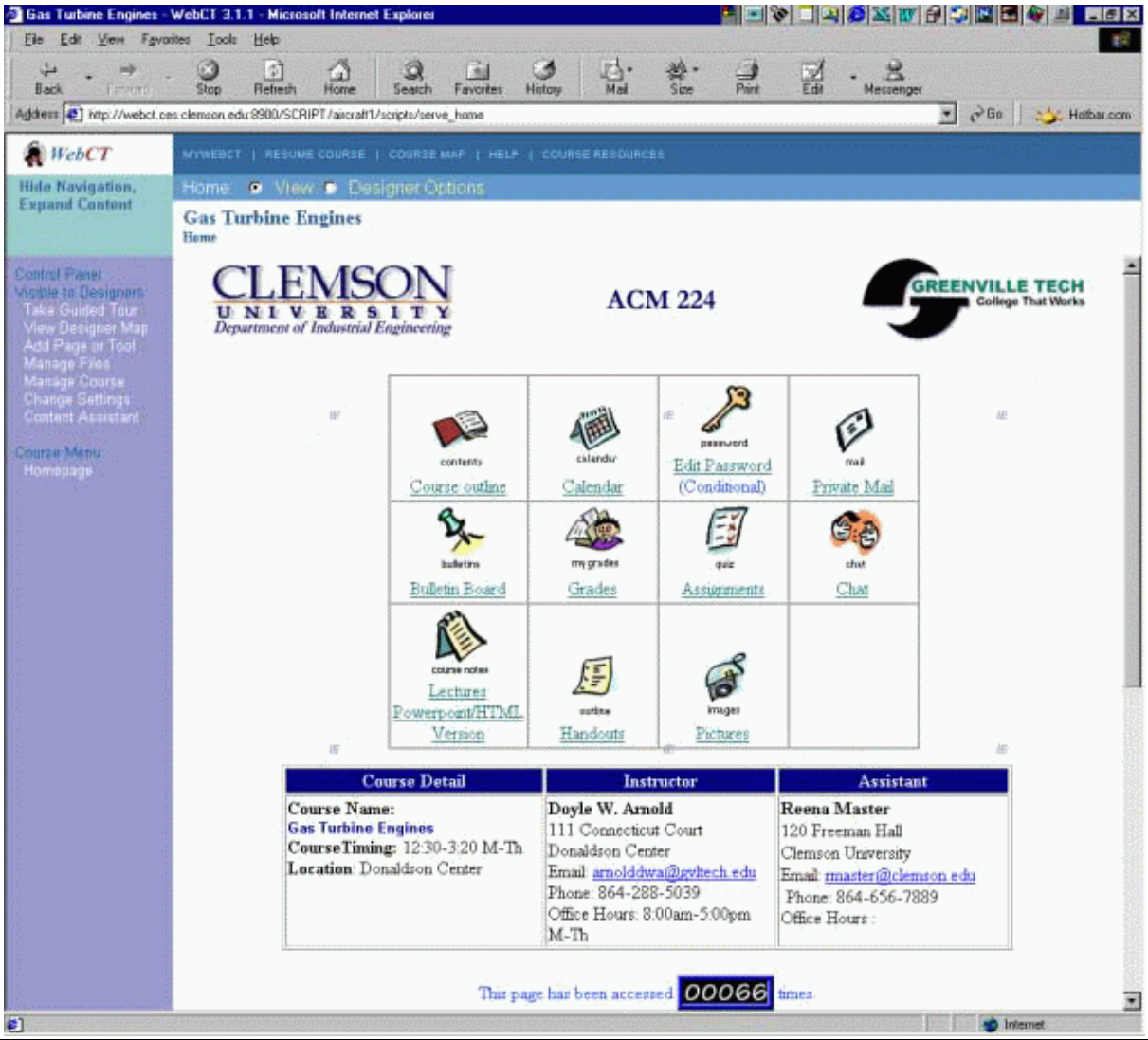



**Figure 2.1 Homepage of Gas Turbine Engines website**

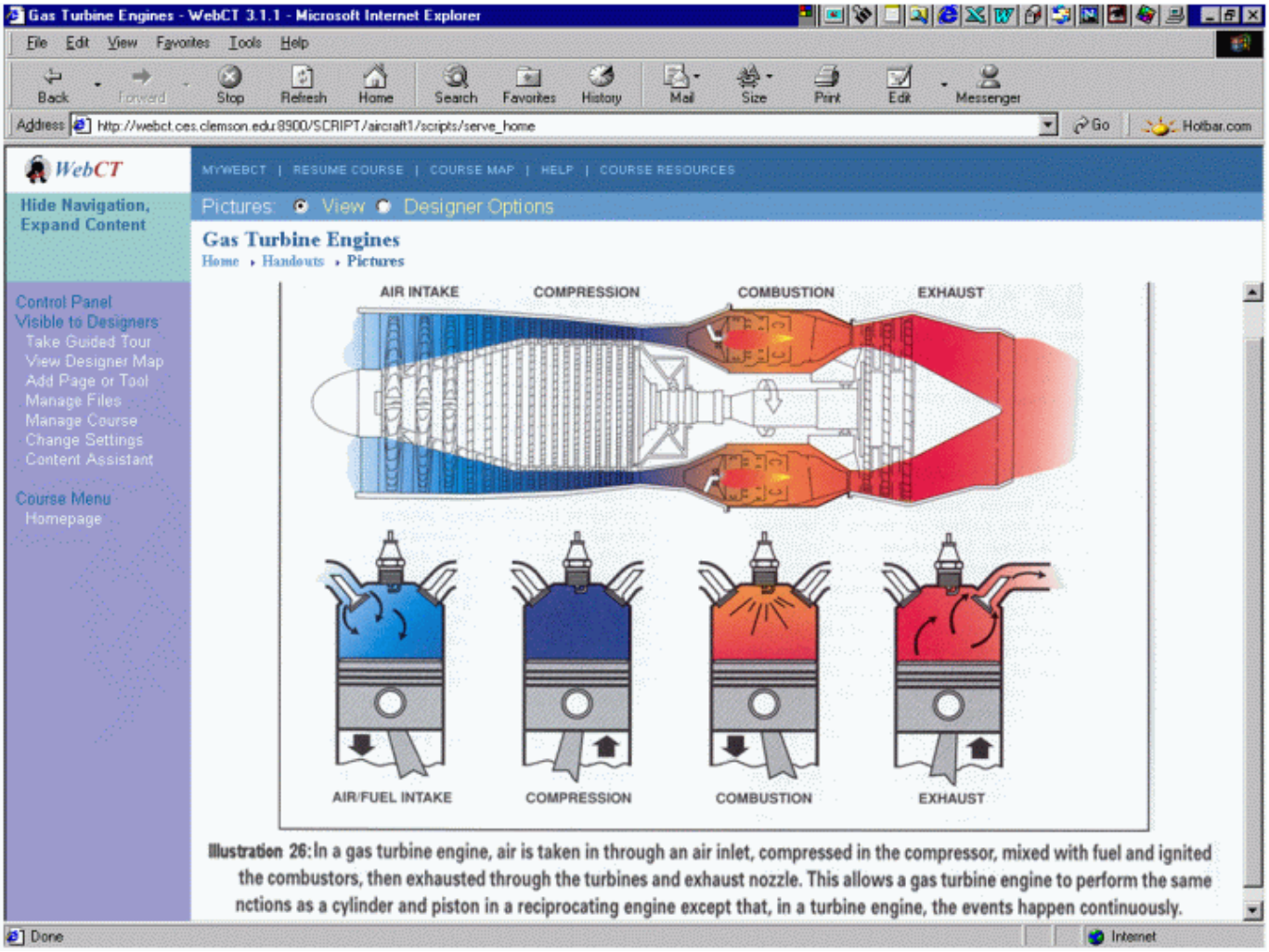



**Figure 2.2 Sample picture of the Brayton Cycle**

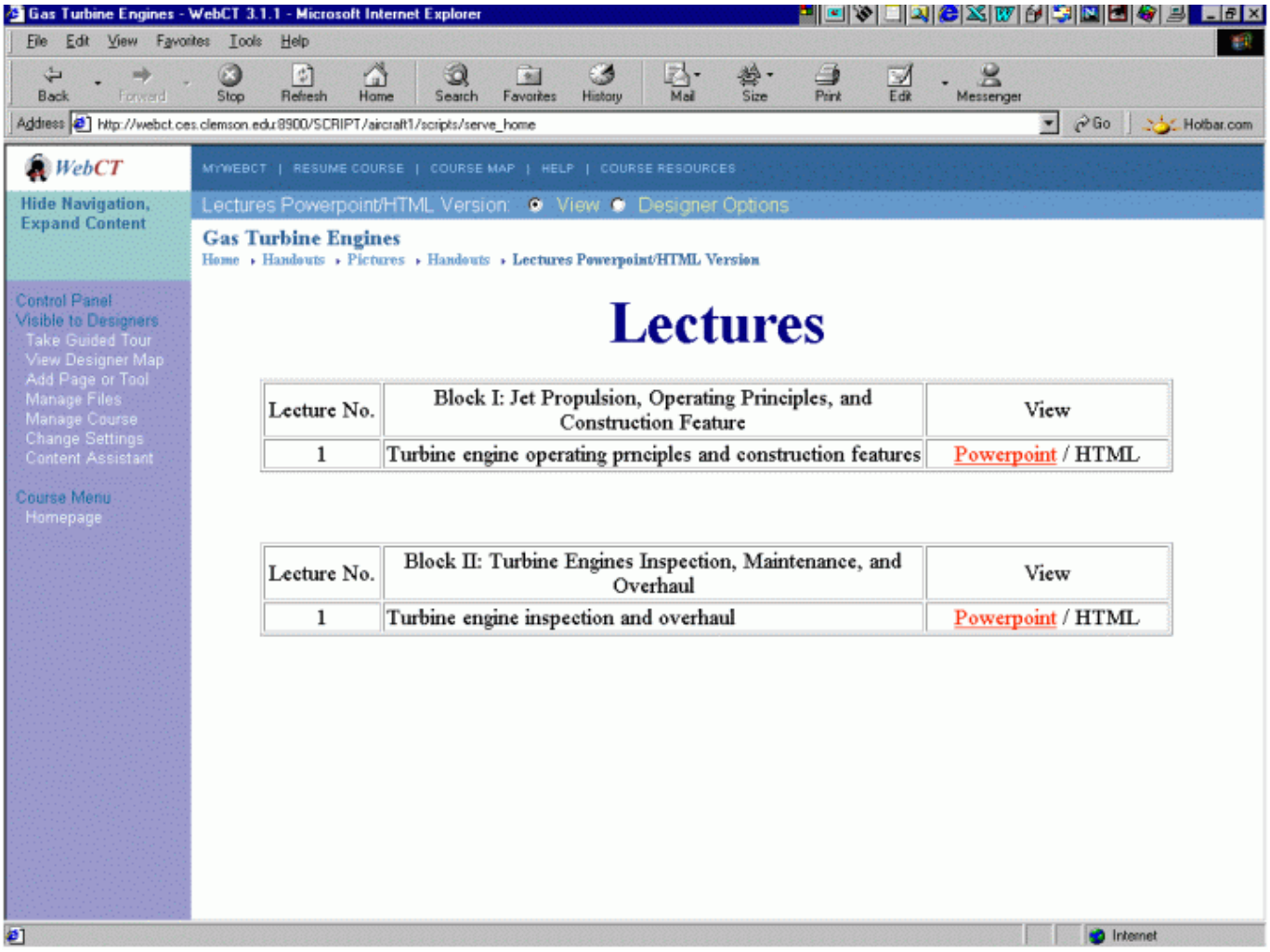
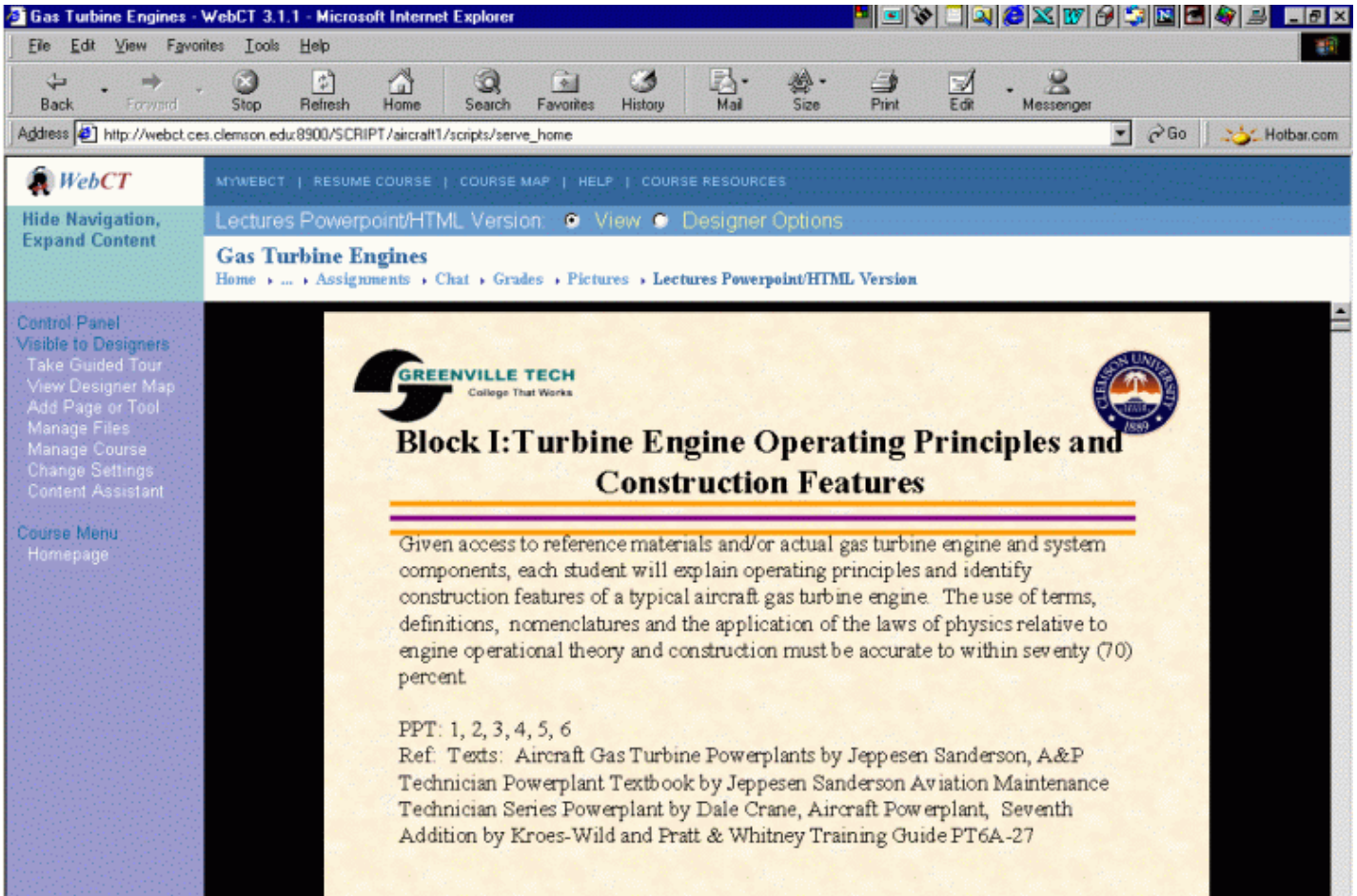



**Figure 2.3 List of the course topics posted on the site**



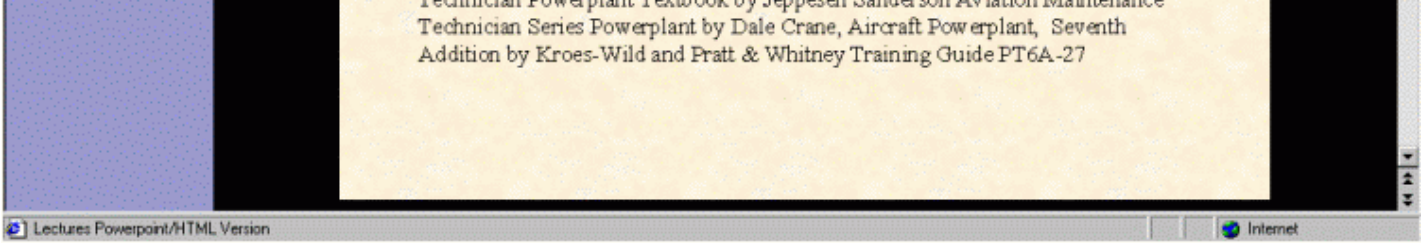



**Figure 2.4 First slide of one of the course lectures**

## 2.4 CURRICULUM ASSESSMENT

The classic closed-loop outcome based assessment methodology was used with the model for AMT/T and new FAR Part 66 curriculum (Figure 2.5) illustrating the paradigm.4

Methods of assessment were developed allowing the evaluators to determine whether or not the new curriculum has met program objectives and to test whether it has produced the desired learning outcomes and student behavior resulting in the desired performance levels. The assessment methodology evaluating the curriculum focuses on the following topics:

- Implementation issues
- Organizational issues
- Teaching issues
- Learning issues
- Workload issues
- Meeting FAA requirements
- Tracking student skills
- Tracking employer satisfaction
- Tracking student performance

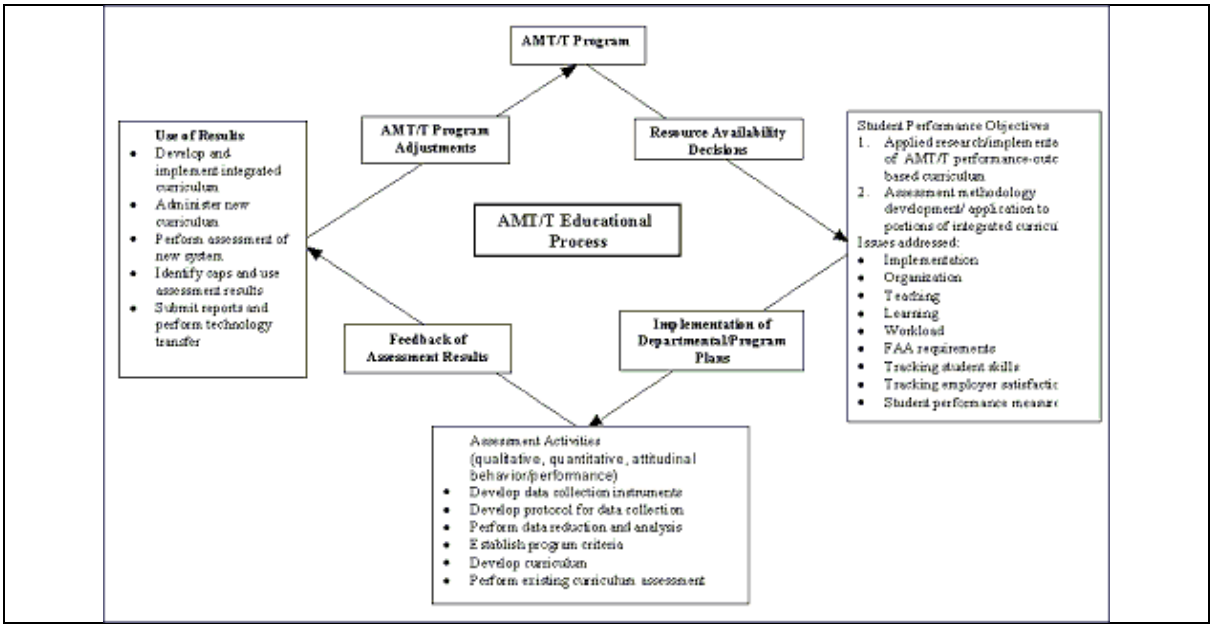



**Figure 2.5 Model for AMT/T and new FAR Part 66 curriculum**

Details on the assessment as they would potentially impact the above issues and their implications for use of technology and human factors in improving the AMT curriculum and course instruction will be forthcoming as part of the final report. In-class assessment was conducted on the old offerings of the three courses, Ground Operations and Safety, Gas Turbine Engines and Aircraft Structures. Data obtained from the teaching evaluations are summarized in Tables 2.1, 2.2, 2.4, 2.5, 2.7 and 2.8. The data for each question was also analyzed using the Wilcoxon test (Tables 2.3, 2.6 and 2.9). Student evaluations completed for the revised offering of Ground Operations and Safety course is summarized in Tables 2.10 - 2.12. Results of the alumni survey are also summarized in Tables 2.13 - 2.14.

**Table 2.1 Teaching evaluation: Ground Operations and Safety (old)**

| Question # | Responses | | | | |
|---|---|---|---|---|---|
| 1. I am satisfied with my accomplishments in this course. | Yes | | | No | |
| | 34 | | | 8 | |
| 2. I expect to receive the following grade on this course. | A | B | C | D | F |
| | 15 | 18 | 6 | 1 | 1 |

**Table 2.2 Student information: Ground Operations and Safety (old) (Continued)**

| Question # | | |
|---|---|---|
| 1. Please list the strengths of the course and/or instructor. | 2. Please list the strengths of the course and/or instructor. | 3. Please provide suggestions to improve the course. |
| Good material, up-to-date aircraft | Hard to understand | Have the instructor explain himself |
| I learn a lot about airplanes. The instructor seems enthusiastic about the things we do. He provides an in-depth explanation of the things we go over. | The instructor needs to be clearer when we are in the classroom. I tend to get confused until we are in the hangar. | I would like it if we could do more hands on projects. Like working with the engines or letting us figure out how things work. |
| Hands on get to know more. | | |
| It would lead you to knowing more about airplanes. | Not enough work in the labs | I suggest that we work on the engines a little more than we do. I think it would be easier to learn if it was a lot of hands-on-work. |
| The instructor is able to communicate with students in a calm and professional manner. | | |
| The instructor knows what he is doing, he's been in this longer than us. He explains all the material to us without making us confused. | I think he needs to let us do more hands on work, it helps me to do and understand better. | |
| Textbooks are very helpful and the hands on make it more fun and easier to learn. Being able to work in pairs and groups on project help greatly. The class being smaller also helped because we could all take turns working on projects. We were all able to do everything ourselves.<br>Comment: I have learned a lot in this course and I really enjoyed working with the planes. | Should have more studying, assignments to insure that the students know everything there is to know about this section of A.M. Needs to encourage the students to read the textbook. | Thorough explanations of each section (by the book) that was nothing is left out that may be important. Perhaps you could have two or three class dealing with different sections of A.M. so that the student can have a choice as to which course he/she wants to start with. (when you have more students of course). |

| | | |
|---|---|---|
| **The course had hands on experience** | **You have to sit there and wait if you are not involved in the activity** | |
| **Labs, Tests** | **Lecture** | **Living up the lectures** |
| | **None** | **Need help in lab. More instructors or qualified people to help start and taxi aircraft.** |

| **Table 2.2 Student information: Ground Operations and Safety (old) (Continued)** | | |
|---|---|---|
| **Question #** | | |
| **1. Please list the strengths of the course and/or instructor.** | **2. Please list the strengths of the course and/or instructor.** | **3. Please provide suggestions to improve the course.** |
| **Instructor is very good** | **The tests are very tricky** | **I like the course as it is** |
| **Mr.Webb's knowledge of the subject is highly respectable. He is the instructor, which I have most enjoyed thus far. I would recommend his class to anyone. Also quite pleasant to talk to outside the class.** | **The only complaint I have about the course is, due to the size of the class (amt. of students) some of the lab activities (towing, aircraft runs, etc.) seemed rushed or could only be performed one time. This is in no way a reflection upon Mr. Webb's presentation of the material. As previously stated, I feel he is a wonderful instructor with professional knowledge of the subject.** | |
| **This course helps people to get a better understanding of motors, towing, starting the aircraft.** | **We need more instructors so that we can get more accomplished during towing and engine runs so we won't have to sit around and wait.** | **More instructors to help us with motor runs and towing so that we don't have to sit around and wait.** |
| **Instructor is well organized, Highly skilled and has a vast encyclopedia of aircraft knowledge and wisdom inside his mind. He makes you really pull all the information out of your mind on his tests. But you know what you are doing.** | **The course was sort of fast paced, but given thoroughly. The weight and balance portion could be a little more detailed.** | **Suitable equipment for the lab. Field trips to real facilities as a lab course.** |
| **Exact detail and correctness of instructor requires you to know and remember the material.** | **Not enough time.** | **Make it a smaller class or have 2 instructors during lab exercises.** |
| **The instructor is knowledgeable and is still interested in the aircraft (after all these years) His enthusiasm is motivational.** | **Time restraints for the course.** | |
| **Class size made several tasks difficult to accomplish with any more than minimal familiarization. Instructor's real world experience made for invaluable insights.** | **Class size made several tasks difficult to accomplish with any more than minimal familiarization.** | **Teaching assistants to provide for availability to access lab equipment.** |

| **Table 2.2 Student information: Ground Operations and Safety (old)** |
|---|
| **Question #** |

| 1. Please list the strengths of the course and/or instructor. | 2. Please list the strengths of the course and/or instructor. | 3. Please provide suggestions to improve the course. |
|---|---|---|
| Instructor is very knowledgeable of the material. | Questions on the exams are vague. They are designed not to test a student's knowledge base, but to trick you into making a mistake. That is wrong! | |
| The instructor did very well managing the large number of students with the time available. | Not enough time. | Split the class in 2 batches. |
| Providing adequate information and learning opportunities in real world situation. Instructor explained material to the best of his knowledge. Labs well planned and all safety precautions taken. | Course:-none, Instructor at times seem nervous | Allow for more hand-on learning opportunities |
| Good communication skills and a great personality | Doesn't have the ability to instruct. Thinks because he's never taught anything. The whole class in general didn't learn anything | Gary should sit in James or Bills class and be trained how to instruct by the way they do. These guys have a military instructors background |
| Good background in the field of study and genuinely tries to help students learn | Lab equipment inadequate-some broken or unable to be used, schedule conflicts between the classes | More equipment, better pm |
| Access to actual aircraft and applying course knowledge | Not enough classes | More shop exercise |
| Does pretty good w/labs but has a hard time respecting students | None | More lab with equipment that works. No schedule conflicts between the classes and interference by the students of other classes |
| More organized instructor and class time utilized constructively | Moments during labs when safety procedures were not followed and activities disorganized. Some of lab equipment are outdated and doesn't work | Improve lab equipment, conduct safer lab experiments |
| None | Lacks in understanding the course | More equipment to work with |
| Time well used for most part | Not familiar with material he was teaching, not prepared for questions, could not answer his own question, seemed disinterested | Replace instructor with one Qualified to educate students |

**Table 2.3 Student responses: Ground Operations and Safety (old) (Continued)**

| Question # | Likert Scale | | Compared Mean | Mean(S.D.) | | Wilcoxon test |
|---|---|---|---|---|---|---|
| | 1 | 5 | | | | |
| 1. The course was well organized and outlined. | Very Strongly Disagree | Very Strongly Agree | 3 | 4.19 | (0.98) | ($p<0.05$) |
| 2. The syllabus was distributed and explained at the beginning of the course. | Very Strongly Disagree | Very Strongly Agree | 3 | 4.60 | (0.76) | ($p<0.05$) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **3. The textbook and course material supports teaming.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.42** | **(0.79)** | **(p<0.05)** |
| **4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.19** | **(1.03)** | **(p<0.05)** |
| **5. The lab assignments supported my understanding of the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.40** | **(0.79)** | **(p<0.05)** |
| **6. The equipment and supplies are adequate for completing lab exercises.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.09** | **(1.15)** | **(p<0.05)** |
| **7. The course projects were challenging and helped me in understanding the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.10** | **(0.90)** | **(p<0.05)** |
| **8. The course projects/lab assignments were based on real-world aircraft maintenance situations.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.31** | **(1.01)** | **(p<0.05)** |
| **11. The instructor treated students with respect** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.58** | **(0.82)** | **(p<0.05)** |
| **12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.39** | **(0.82)** | **(p<0.05)** |
| **13. The instructor used the time effectively and efficiently.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.41** | **(0.85)** | **(p<0.05)** |
| **14. The instructor's teaching methods helped me understand the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.17** | **(1.07)** | **(p<0.05)** |
| **15. The instructor presentation material and class notes are of high quality.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.03** | **(1.14)** | **(p<0.05)** |
| **16. It is possible to easily access the presentation material during after-class hours.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.79** | **(1.10)** | **(p<0.05)** |
| **17. The method of delivering instruction was highly effective.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.98** | **(1.01)** | **(p<0.05)** |

**Table 2.3 Student responses: Ground Operations and Safety (old)**

| **Question #** | **Likert Scale** | | **Compared Mean** | **Mean(S.D.)** | | **Wilcoxon test** |
|---|---|---|---|---|---|---|
| | **1** | **5** | | | | |
| **18. The instructor made adequate use of computers to support instruction.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **2.13** | **(1.07)** | **(p<0.05)** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 19. The instructor was enthusiastic about teaching. | Very Strongly Disagree | Very Strongly Agree | 3 | 4.19 | (0.93) | (p<0.05) |
| 20. The instructor's expectations were made clear to me. | Very Strongly Disagree | Very Strongly Agree | 3 | 4.26 | (0.98) | (p<0.05) |
| 21. The instructor motivated me. | Very Strongly Disagree | Very Strongly Agree | 3 | 3.91 | (1.11) | (p<0.05) |
| 22. I will recommend this course to another student. | Very Strongly Disagree | Very Strongly Agree | 3 | 4.19 | (1.14) | (p<0.05) |
| Question # | Responses | | | | | |
| 9. The course required the use of computers. | Yes | No | | | | |
| | 1 | 42 | | | | |

**Table 2.4 Teaching evaluation: Aircraft Structures (old)**

| Question # | Responses | | | | |
|---|---|---|---|---|---|
| 1. I am satisfied with my accomplishments in this course. | Yes | | | No | |
| | 9 | | | 6 | |
| 2. I expect to receive the following grade on this course. | A | B | C | D | F |
| | 1 | 8 | 3 | 3 | 0 |

**Table 2.5 Student information: Aircraft Structures (old) (Continued)**

| Question # | | |
|---|---|---|
| 1. Please list the strengths of the course and/or instructor. | 2. Please list the strengths of the course and/or instructor. | 3. Please provide suggestions to improve the course. |
| | The instructor has a very negative attitude towards the school and tries to make the students feel like failures. The instructor has nothing good to say about any work done in the Lab. Makes derogatory remarks to students when students do well on exams | |
| Very informative | | More Lab time. |

**Table 2.5 Student information: Aircraft Structures (old)**

| Question # | | |
|---|---|---|
| 1. Please list the strengths of the course and/or instructor. | 2. Please list the strengths of the course and/or instructor. | 3. Please provide suggestions to improve the course. |
| Promotes learning environment. Tries his best to help students understand and use what they learn | Lab equipment needs upgrading, needs to be a little more enthusiasm | Better equipment |

| | | |
|---|---|---|
| **Teaches enough material to understand sheet metal. Lab activities were fun and interesting.** | **Lack of up to date tools. Not enough Lab time. Instructor was not thorough enough when helping in Lab.** | **Larger facilities for Lab hours, better quality tools, longer class and Lab hours** |
| **Knowledgeable on material, but not enough time spent in Lab.** | **Knowledgeable on material, but not enough time spent in Lab.** | **More Lab time to apply classroom lessons** |
| **The course is tested too strongly in areas that are less important. For instance, in setting up rivet rows, pitches and patterns the # of rivets can vary, but on the test he grades too harshly if the # of rivets aren't exact.** | **The instructor does not motivate the class at all.** | **A new instructor** |
| **Well organized. Good notes** | **Instructor showed no enthusiasm. Was not supportive to us during labs. Only criticized performance.** | **Have an instructor that wants students to succeed not fail!** |
| **Knowledge of Course material** | **Negative Attitude towards A & P opportunities** | |

**Table 2.6 Student responses: Aircraft Structures (old) (Continued)**

| Question # | Likert Scale | | Compared Mean | Mean(S.D.) | | Wilcoxon test |
|---|---|---|---|---|---|---|
| | 1 | 5 | | | | |
| 1. The course was well organized and outlined. | Very Strongly Disagree | Very Strongly Agree | 3 | 3.87 | (0.74) | (p<0.05) |
| 2. The syllabus was distributed and explained at the beginning of the course. | Very Strongly Disagree | Very Strongly Agree | 3 | 3.93 | (0.88) | (p<0.05) |
| 3. The textbook and course material supports teaming. | Very Strongly Disagree | Very Strongly Agree | 3 | 3.87 | (0.74) | (p<0.05) |
| 4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course. | Very Strongly Disagree | Very Strongly Agree | 3 | 3.87 | (0.83) | (p<0.05) |

**Table 2.6 Student responses: Aircraft Structures (old) (Continued)**

| Question # | Likert Scale | | Compared Mean | Mean(S.D.) | | Wilcoxon test |
|---|---|---|---|---|---|---|
| | 1 | 5 | | | | |
| 5. The lab assignments supported my understanding of the course material. | Very Strongly Disagree | Very Strongly Agree | 3 | 3.87 | (0.83) | (p<0.05) |
| 6. The equipment and supplies are adequate for completing lab exercises. | Very Strongly Disagree | Very Strongly Agree | 3 | 3.53 | (1.06) | (p>0.05) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **7. The course projects were challenging and helped me in understanding the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.00** | **(0.93)** | **(p<0.05)** |
| **8. The course projects/lab assignments were based on real-world aircraft maintenance situations.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.67** | **(0.98)** | **(p<0.05)** |
| **11. The instructor treated students with respect** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.20** | **(1.32)** | **(p>0.05)** |
| **12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.60** | **(1.06)** | **(p>0.05)** |
| **13. The instructor used the time effectively and efficiently.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.93** | **(0.80)** | **(p<0.05)** |
| **14. The instructor's teaching methods helped me understand the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.53** | **(0.99)** | **(p>0.05)** |
| **15. The instructor presentation material and class notes are of high quality.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.40** | **(0.99)** | **(p>0.05)** |
| **16. It is possible to easily access the presentation material during after-class hours.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.00** | **(1.20)** | **(p>0.05)** |
| **17. The method of delivering instruction was highly effective.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.40** | **(0.83)** | **(p>0.05)** |
| **18. The instructor made adequate use of computers to support instruction.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **2.29** | **(1.03)** | **(p<0.05)** |
| **19. The instructor was enthusiastic about teaching.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.13** | **(1.13)** | **(p>0.05)** |

**Table 2.6 Student responses: Aircraft Structures (old)**

| **Question #** | **Likert Scale** | | **Compared Mean** | **Mean(S.D.)** | | **Wilcoxon test** |
|---|---|---|---|---|---|---|
| | **1** | **5** | | | | |
| **20. The instructor's expectations were made clear to me.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.73** | **(1.16)** | **(p<0.05)** |
| **21. The instructor motivated me.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **2.73** | **(1.10)** | **(p>0.05)** |
| **22. I will recommend this course to another student.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.07** | **(1.39)** | **(p>0.05)** |
| **Question #** | **Responses** | | | | | |

| 9. The course required the use of computers. | Yes | No | | | | |
|---|---|---|---|---|---|---|
| | 0 | 14 | | | | |

| Table 2.7 Teaching evaluation: Gas Turbine Engines (old) | | | | | |
|---|---|---|---|---|---|
| Question # | Responses | | | | |
| 1. I am satisfied with my accomplishments in this course. | Yes | | | No | |
| | 14 | | | 1 | |
| 2. I expect to receive the following grade on this course. | A | B | C | D | F |
| | 7 | 5 | 2 | 0 | 0 |

| Table 2.8 Student information: Gas Turbine Engines (old) (Continued) | | |
|---|---|---|
| Question # | | |
| 1. Please list the strengths of the course and/or instructor. | 2. Please list the strengths of the course and/or instructor. | 3. Please provide suggestions to improve the course. |
| | More turbines to work on more updated lab work | |
| Material & AC is outdated | Old airplanes, worn out tools and equipment. | Teach what student will do in reality, break up class time and labtime |
| Experience level of the instructor | Need to cover more real time jet engines &split 50/50 with general aviation | |
| | Need to update technology, to equal the way these fbo operate | Stop teaching in depth functions |
| Instructor was fair | Lab project were unacceptable, tooling was not good, learning aids were old | Get up to date materials, provide proper tools |
| Very informative course about general light aircraft maintenance. | Course needs to cover more on large commercial aircraft maintenance | |

| Table 2.8 Student information: Gas Turbine Engines (old) | | |
|---|---|---|
| Question # | | |
| 1. Please list the strengths of the course and/or instructor. | 2. Please list the strengths of the course and/or instructor. | 3. Please provide suggestions to improve the course. |
| Instructor well prepared and willing to teach | Instructors text book and prescribed text book are different | Change Powerplant books, better lab equipment |
| Good instructor | | Update equipment/special tools |
| Promoted good hands on general aviation A/C | Need to work in section and hands on maintenance for AC | One particular text book and not multiple books |
| Instructor is thorough and effective | Powerplant book not adequate | Better tooling in lab, better vending area at the satellite location at Donaldson center. |
| Material in text book along with lab was put to good use | Different text book used by instructor made the course confusing | Instructor needs to control class cut ups better |
| Clear concise instruction, demonstration of hands on techniques | | Improve lab equipment |

| Table 2.9 Student responses: Gas Turbine Engines (old) (Continued) | | | | | | |
|---|---|---|---|---|---|---|
| **Question #** | **Likert Scale** | | **Compared Mean** | **Mean(S.D.)** | | **Wilcoxon test** |
| | **1** | **5** | | | | |
| **1. The course was well organized and outlined.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.67** | **(0.82)** | **(p<0.05)** |
| **2. The syllabus was distributed and explained at the beginning of the course.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.27** | **(0.70)** | **(p<0.05)** |
| **3. The textbook and course material supports teaming.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.33** | **(1.18)** | **(p>0.05)** |
| **4. The test assignments and examination questions measure skills, concepts, and objectives that are relevant to the course.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.93** | **(1.03)** | **(p<0.05)** |
| **5. The lab assignments supported my understanding of the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.60** | **(0.74)** | **(p<0.05)** |
| **6. The equipment and supplies are adequate for completing lab exercises.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **2.40** | **(0.98)** | **(p>0.05)** |
| **7. The course projects were challenging and helped me in understanding the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.47** | **(0.83)** | **(p>0.05)** |

| Table 2.9 Student responses: Gas Turbine Engines (old) | | | | | | |
|---|---|---|---|---|---|---|
| **Question #** | **Likert Scale** | | **Compared Mean** | **Mean(S.D.)** | | **Wilcoxon test** |
| | **1** | **5** | | | | |
| **8. The course projects/lab assignments were based on real-world aircraft maintenance situations.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.27** | **(0.88)** | **(p>0.05)** |
| **11. The instructor treated students with respect** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.47** | **(0.74)** | **(p<0.05)** |
| **12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.27** | **(0.80)** | **(p<0.05)** |
| **13. The instructor used the time effectively and efficiently.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.07** | **(0.80)** | **(p<0.05)** |
| **14. The instructor's teaching methods helped me understand the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.00** | **(0.65)** | **(p<0.05)** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **15. The instructor presentation material and class notes are of high quality.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.67** | **(0.62)** | **(p<0.05)** |
| **16. It is possible to easily access the presentation material during after-class hours.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.93** | **(0.59)** | **(p<0.05)** |
| **17. The method of delivering instruction was highly effective.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.73** | **(0.88)** | **(p<0.05)** |
| **18. The instructor made adequate use of computers to support instruction.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **2.29** | **(1.03)** | **(p<0.05)** |
| **19. The instructor was enthusiastic about teaching.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.33** | **(0.62)** | **(p<0.05)** |
| **20. The instructor's expectations were made clear to me.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.33** | **(0.62)** | **(p<0.05)** |
| **21. The instructor motivated me.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.07** | **(0.70)** | **(p<0.05)** |
| **22. I will recommend this course to another student.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.80** | **(1.15)** | **(p>0.05)** |
| **Question #** | **Responses** | | | | | |
| **9. The course required the use of computers.** | **Yes** | **No** | | | | |
| | **0** | **15** | | | | |

**Table 2.10 Student Information: Ground Operations and Safety (revised)**

| **Question #** | **Responses** | | | | |
|---|---|---|---|---|---|
| **1. I am satisfied with my accomplishments in this course.** | **Yes** | | | **No** | |
| | **14** | | | **1** | |
| **2. I expect to receive the following grade on this course.** | **A** | **B** | **C** | **D** | **F** |
| | **8** | **7** | **0** | **0** | **0** |

**Table 2.11 Teaching evaluation: Ground Operations and Safety (revised) (Continued)**

| **Question #** | | |
|---|---|---|
| **1. Please list the strengths of the course and/or instructor.** | **2. Please list the strengths of the course and/or instructor.** | **3. Please provide suggestions to improve the course.** |
| **Lab was well related to the computer slides/lectures** | **Some information is somewhat different** | **Slides should be more than just short outline, should be more specific** |
| **Able to communicate well, good knowledge of material covered, good relationship with students** | **None** | **More working with aircraft** |
| **Good knowledge** | **None** | **Course is fine, there should be no changes** |

| | | |
|---|---|---|
| Willingness to help, good overall knowledge | Limitations | |
| Student has a lot of hands-on material | In Computer lab students do browsing other than that related to the course | None |
| Course helped to learn everything about the airplanes, when they are on the ground, how to fuel, how to jack a airplane, and trouble shooting. Instructor explains everything | None | More time in the hangar, less time in the class room |
| All is good what he teaches. | Sometimes it is not clear what is expected for quizzes and exams | none |
| Practical experience of instructor/ Fair and Impartial / Kept class interest up. Good hands on experience | Too much emphasis on computer skills to the detriment of hands on skills | Less dependant on computer information and more hands on experience in hangar |
| Real life aviation maintenance experiences. More doing and less lip service. Good to access the materials at home | Instructor depends too much on the computer screens for lecture | Instructor could use a lab assistant |

**Table 2.11 Teaching evaluation: Ground Operations and Safety (revised)**

| Question # | | |
|---|---|---|
| 1. Please list the strengths of the course and/or instructor. | 2. Please list the strengths of the course and/or instructor. | 3. Please provide suggestions to improve the course. |
| Good teacher, labs were good due to hands on experience | Content on the internet, studying became difficult as I don't have a internet | Put the course back on the paper, since I couldn't study as I didn't have a computer |
| Good material | Needs handouts on some sections | More handouts and papers are required for lab |
| Hands on training | Not having time to take notes or obtain them without computer yet | More time for course |
| Computers, Good instructor, labs | | |
| Instructor has lots of experience in the field | Computer program is not easily accessible at home due to high price of software | Get rid of computers and get html online version working |
| Lot of hands on projects | High cost of software for accessing | Get rid of computers |

**Table 2.12 Student responses: Ground Operations and Safety (revised) (Continued)**

| Question # | Likert Scale | | Compared Mean | Mean(S.D.) | | Wilcoxon test |
|---|---|---|---|---|---|---|
| | 1 | 5 | | | | |
| 1. The course was well organized and outlined. | Very Strongly Disagree | Very Strongly Agree | 3 | 4.07 | (0.70) | (p<0.05) |
| 2. The syllabus was distributed and explained at the beginning of the course. | Very Strongly Disagree | Very Strongly Agree | 3 | 4.60 | (0.63) | (p<0.05) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **3. The textbook and course material supports teaming.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.07** | **(0.59)** | **(p<0.05)** |
| **4. The test assignments and examination questions measures skills, concepts, and objectives that are relevant to the course.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.07** | **(0.70)** | **(p<0.05)** |
| **5. The lab assignments supported my understanding of the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.47** | **(0.74)** | **(p<0.05)** |
| **6. The equipment and supplies are adequate for completing lab exercises.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.27** | **(0.80)** | **(p<0.05)** |
| **7. The course projects were challenging and helped me in understanding the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.47** | **(0.64)** | **(p<0.05)** |

**Table 2.12 Student responses: Ground Operations and Safety (revised) (Continued)**

| **Question #** | **Likert Scale** | | **Compared Mean** | **Mean(S.D.)** | | **Wilcoxon test** |
|---|---|---|---|---|---|---|
| | **1** | **5** | | | | |
| **8. The course projects/lab assignments were based on real-world aircraft maintenance situations.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.79** | **(0.43)** | **(p<0.05)** |
| **11. The instructor treated students with respect** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.80** | **(0.41)** | **(p<0.05)** |
| **12. The instructor's grading procedures provided me with a fair evaluation of my understanding of the material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.47** | **(0.52)** | **(p<0.05)** |
| **13. The instructor used the time effectively and efficiently.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.47** | **(0.64)** | **(p<0.05)** |
| **14. The instructor's teaching methods helped me understand the course material.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.27** | **(0.80)** | **(p<0.05)** |
| **15. The instructor presentation material and class notes are of high quality.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.67** | **(0.98)** | **(p<0.05)** |
| **16. It is possible to easily access the presentation material during after-class hours.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.53** | **(1.81)** | **(p<0.05)** |
| **17. The method of delivering instruction was highly effective.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **3.87** | **(1.06)** | **(p<0.05)** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **18. The instructor made adequate use of computers to support instruction.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.47** | **(0.64)** | **(p<0.05)** |
| **19. The instructor was enthusiastic about teaching.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.47** | **(0.52)** | **(p<0.05)** |
| **20. The instructor's expectations were made clear to me.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.40** | **(0.51)** | **(p<0.05)** |
| **21. The instructor motivated me.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.00** | **(0.76)** | **(p<0.05)** |
| **22. I will recommend this course to another student.** | **Very Strongly Disagree** | **Very Strongly Agree** | **3** | **4.07** | **(0.88)** | **(p<0.05)** |
| **Question #** | **Responses** | | | | | |
| **9. The course required the use of computers.** | **Yes** | **No** | | | | |
| | **14** | **1** | | | | |

| **Table 2.12 Student responses: Ground Operations and Safety (revised)** | |
|---|---|
| **10. If the answer to the above question is Yes, explain how computers were used in the course.** | **They contained the info about this course and were used for the majority of the lecture part of the class.** |
| | **ATP navigator program to use the maintenance manual. Powerpoint to present lectures. Internet Explorer to check MSDS.** |
| | **Powerpoint, ATP Navigator, C-172 CDT, Internet Explorer, C90** |
| | **The computers make the info we need as well as illustrated pictures available at any time, so assignments and class demonstrations can be finished quickly and easily.** |
| | **To look up important info.** |
| | **The computers were used to look up answers, show diagrams of airplanes, and help learn everything about the course.** |
| | **For lectures and ATP's.** |
| | **Look up text materials and maintenance info on specific aircraft.** |
| | **Used to present lecture materials and research.** |
| | **The whole course was on computer.** |
| | **For text and diagrams to learn on.** |
| | **Very helpful as a guide with pictures, presentations, as well as instructor guiding.** |
| | **The material on the slides of the computers was given on test and quizzes and also to reference maintenance manuals.** |
| | **Information for the course came from an online program called Powerpoint.** |

| **Table 2.13 Alumni survey results** | |
|---|---|
| **Question** | **Mean (Std. Dev.)*** |
| | |

| | |
|---|---|
| **1. The AMT program prepared me well for the practice of aircraft maintenance related work** | **1.67 (0.52)** |
| **2. In comparison with my co-workers who graduated from other programs, I rate my education superior to their** | **2.33 (1.03)** |
| **3. My program prepared me well in the use of computers and computational techniques** | **3.50 (1.05)** |
| **4. My preparation in communication skills (written/oral) was excellent.** | **3.00 (0.89)** |
| **5. The overall quality of my department was excellent (compared with the rest of the college/University)** | **2.33 (1.51)** |
| **6. The departmental laboratory experience/projects prepared me well for the practice if my discipline** | **2.50 (1.64)** |
| **7. The overall departmental environment enhanced me education** | **1.67 (0.52)** |

*** 1- strongly agree, 5- strongly disagree**

**Table 2.14 Alumni survey responses**

| **Question** | **Response / Comments** |
|---|---|
| **8. Which of the following general categories best describes your current work assignment?** | 1. Maintenance<br>2. Continuing Education |
| 9. What type of continuing education programs have you participated in? | 1. Selected from courses<br>2. Non-credited short courses<br>3. Formal Graduate program |
| 10. What do you consider to be the greatest strength of your Aircraft Maintenance and Technology program? | 1. Hands-on project, experienced staff.<br>2. All courses are offered in one centralized location, not spread over a large campus.<br>3. Power plant inspection and repair power plant throttle rigging.<br>4. The teachers and their knowledge.<br>5. Hands on experience (but there wasn't enough of it).<br>6. The personnel performing the training. |
| 11. What do you consider to be the greatest weakness of your Aircraft Maintenance and Technology program? | 1. Some of the curriculum is outdated (wood, dope, fabric) Add more advanced technology (electronics, computers etc.)<br>2. Some courses are offered only once every two years. You must take every course when it is first offered or you will take 4 years to complete a 2-year program.<br>3. Avionics Maintenance<br>4. It was a new program, (at the time) not enough equipment.<br>5. Scheduling of classes for graduation completion |

| | |
|---|---|
| 12. What one or two specific curriculum changes would you recommend? Why? | 1. Add more electronics or avionics. Industry seems to be moving that direction. More and more advanced electronics are appearing on the aircraft of today! The technicians of today need to be very familiar with computers of same sort.<br>2. Let summer school be optional- see above, if you don't go to summer school it will take 4 years to finish.<br>3. More in-depth study of Avionics and electronic systems.<br>4. Higher elective courses, higher level English, math, etc.<br>5. More hands on work ( especially on commercial aircraft)<br>6. Offer obsolete classes like wood, dope and fabric as extras or electives and incorporate more relative courses as required. |
| 13. Please provide any additional comments/ suggestions concerning your department. | 1. A technical / community college is supposed to serve students and employees in the local area; however, there are not enough local jobs for all the graduates. To get a good job, graduates must leave the area. Therefore tech is serving employees outside the local area.<br>2. More support is needed from the commercial sector in Greenville county.<br>3. The AMT program needs updated training aids such as aircraft and engines that are in service. These updated training aids would give the students the required experience to be hired by the airlines. It would also attract more in and out of state students. |

Analysis of the student evaluations clearly revealed that the revised courses showed a high level of integration with computers and advanced technology compared to the older courses (responses to Questions 17 and 18 of Tables 2.3 and 2.12). Although the revised course scored high on most issues (e.g., use of computers, out of class assignments, use of class time, instructor's teaching methods), the course did not score high on issues related to course organization and links with textbook material. Follow-up interviews with course instructors and subjective evaluation from students revealed the various shortcomings leading to the lack of organization. The major reasons for these are as follows (1) student's and instructor's limited familiarity with using the Webct software for instruction delivery, (2) non-availability of lecture material on Webct before a particular class, and (3) problems associated with Webct software access. The above mentioned problems are being addressed as part of the next offering of the revised courses. These include the following: (1) introductory course material on using the internet and specifically Webct, (2) better coordination between presentation of material, hands on projects and exams, (3) improved access to lecture material to students. These and other changes will be forthcoming during the next offering of the course to be implemented in the summer of 2001.

In addition to the above teaching evaluation, other indicators and sources of data will be used to provide information outside the scope of the formal assessment, to be used primarily in assessing the quality and in seeking improvements in departmental processes, course content and delivery, facilities and student services. These include anecdotal information, which may be used by the Chair or discussed by the faculty leading to actions for improvement.

## 2.5 CONCLUSIONS

The focus of this research is the implementation and assessment of the integrated AMT/AMT-T curriculum on aircraft maintenance technology learning, aircraft maintenance technology performance (the ability to meet performance objectives and demonstrate acceptable performance), and on-the-job performance as demanded by the aircraft maintenance industry and the FAA. The curriculum development and assessment methodology developed as part of Year 2 activities was used to develop the revised courses for Ground Handling and Services, Turbine Engine and Overhaul and the Structures course. Detailed evaluations were conducted on the old offerings and new offerings of the same courses. Results from these evaluations were used to make changes and modifications to be implemented in the next offering of the courses. The assessment methodology developed in Year 1 and deployed in Years 2 and 3 will lead to the evaluation of the relative merits/consequences of the integrated curriculum and an evaluation of the use of advanced technology and alternative learning strategies (e.g., classroom, multimedia based, etc.) in implementing the curriculum and enhancing the learning experience. Results forthcoming from this evaluation will be included in the Final Report. The use of results obtained from the assessment will form the foundation for further enhancement of the training process for the integrated AMT/AMT-T curriculum.

## 2.6 REFERENCES

1. FAA (1997) Aviation Maintenance Technician Training: AMT/AMT-T Curriculum (An alternative method of compliance with Federal Aviation Regulation Part 66) Technical Report prepared for the Office of Aviation Medicine (AAM-240) and Flight Standards Service under Contract #DTFA01-94-C-01013.

2. FAA (1995) Human Factors Issues in Aircraft Maintenance and Inspection'95 CDROM Published by Galaxy Scientific Corporation.

3. FAA (1993) Human Factors in Aviation Maintenance – Phase Three Volume 1 Progress Report. DOT/FAA/AM-93/15.

4. Nichols, J. (1995) The Departmental Guide and Record Book for Student Outcomes Assessment and Institutional Effectiveness. Agathon Press. New York.