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FROM THE EDITOR.

As educators, we deal with a special set of problems in our classrooms every day. From teaching methods that can keep up with the ever-changing learning styles of students, to new technologies that need to be integrated into the curriculum. This edition of the journal includes articles that speak to just a few those and some ways that they can be addressed specifically in the aviation technician education setting.

Don Morris from Southern Illinois University Carbondale reviews the use of streaming video recorded demonstrations in a sheet metal laboratory course. The results of their effectiveness and student perceptions are also discussed. While extenuating circumstances led to the development of this project, the outcomes may be useful to others who are looking for new ways to supplement or enhance content delivery.

William Russo from the University of the District of Columbia Community College takes us through a broader discussion on classroom demonstrations. Based on his experiences and other research, William highlights some questions that should be considered as educators contemplate adding live demonstrations into our daily lesson plans.

Anne Lomperis from Language Training Designs gives an extensive overview of the problems associated with non-native English language learners and helpful solutions for educators. Increases in international enrollment has been happening for some time now and as aviation technicians become more in demand due to the workforce shortage, the number of international students is certainly set to increase even more.

Thank you to all of the authors of these most interesting articles. I hope that everyone enjoys them, finding them to be useful in your future course and program development. I encourage your feedback addressing either specific content or the general theme of this edition of the ATEC Journal.

As always, please join me in thanking the editorial board for their efforts. Their work is imperative to the success of this journal.

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COMMITTEE UPDATES

DORETTA GUTIERREZ
MEMBERSHIP COMMITTEE CHAIR
DEAN, COLLEGE OF AERONAUTICS, HALLMARK UNIVERSITY

MEMBERSHIP COMMITTEE

The primary objective of the membership committee is to support recruitment and community engagement activities. While the ATEC membership roles have increased by 40% in the last three years, a quarter of certificated aviation maintenance technical schools are not council members (you can see a map of member and non-members schools here). Outreach to that segment of the community is something the committee will focus on in the coming months.

At the same time, we are leveraging our network of members to help spread the word about ATEC. We just released a new toolkit to support outreach at professional advisory committee meetings and industry events. The resource includes a PowerPoint presentation on the latest ATEC activities, membership brochures, and flyers outlining opportunities to get involved. All are welcome to download and utilize the materials; come back often as they are revised and updated to reflect current events and activities.

Finally, the committee is finalizing its 2019 outreach meeting calendar, with plans to hold events in three cities across the U.S. next year. Dates and locations will be announced soon.

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COMMUNICATIONS COMMITTEE CHAIR
ASSOCIATE PROFESSOR, DEPARTMENT OF AVIATION TECHNOLOGIES, SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

COMMUNICATIONS COMMITTEE

Currently, the communications committee is working alongside the Choose Aerospace working group in an effort to develop a workforce pipeline initiative. As we move towards the end of the year, the committee will be working with Crystal Maguire to review the results from the ATEC Annual Survey and develop a plan to market the subsequent report in a way that will best promote the current state and highlight future needs of the aviation technician education community. During 2019, the committee will begin looking into the addition of a member's portal to the new ATEC website and also at suitable options for marketing ATEC on different social media platforms.

REPLACING LIVE DEMONSTRATIONS WITH STREAMING VIDEO IN AN AIRCRAFT SHEET METAL LABORATORY

By **Don Morris**
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ABOUT THE AUTHOR

Normally this section is used to talk about qualifications and positions held by authors. However, to properly appreciate this paper, you need to know a bit more about me. I was born with an extremely rare hand condition known as Macrodactyly. With age, this condition led to increasing levels of disability. I eventually had to schedule finger amputation and reconstructive palm surgery. This made it temporarily impossible for me to conduct the hands-on demonstrations typically associated with sheet metal labs. The tutorial videos described in this paper allowed the class to function as normally as possible under the circumstances. Since the study, my rebuilt hand has healed and I am able to teach sheet metal in the conventional manner again. The video tutorials that we shot for this study are now used as class supplements. They are also available to the public on YouTube, where they have received over 150,000 views in the last 20 months.

In terms of my qualifications, I have an undergraduate degree in Physics Education from Illinois State University, and began my career as a Middle School and High School teacher. My interest in Aviation took me to Lincoln Land Community College where I earned an Airframe and Powerplant Certificate. I also attended Embry Riddle Aeronautical University, where I earned a Master of Aeronautical Science degree. After a few years maintaining aircraft, I combined my two careers as an A&P instructor. I have spent the last six years at Southern Illinois University, where I now teach the Sheet Metal portion of the Part 147 curriculum.

ABSTRACT

The purpose of this study was to determine if streaming videos could effectively replace live demonstrations in an aircraft sheet metal training lab. This was a two-year study. In the first year, I handled the lab in the traditional manner. When the lab met, I gave live demonstrations to teach students how to handle the equipment and how to perform the appropriate tasks. I then provided guidance as they completed their training in a largely self-paced manner. At the end of the year, I gave these students a series of questions to record their perceptions about the class.

Before the class was offered again, I created video tutorials that covered most of the common aspects of lab completion. When the class next met, everything was kept as identical as possible with the exception of the video tutorials. I encouraged the students to view these tutorials before and during lab times. I provided only very limited hands on demos, but I was still present in person to give guidance and to record performance. At the end of the second year, I administered the same questionnaire to the students.

After gathering the data, I used single factor ANOVA to determine if the differences between how the groups responded to each question on the questionnaire, how many hours each group spent in lab, and course grades for each group rose to the level of statistical significance. Since the data pool was relatively small, a probability level of 10 percent ($p < .10$) was chosen to indicate statistical significance. Based on this level of probability, the differences between the numbers of hours spent in lab and in the final grades between the two class groups did not rise to the level of statistical significance. This shows that streaming video can be used to replace live demonstration for effective learning. However, differences between how the two groups filled out the questionnaire did rise to the level of significant. These differences are detailed in the body of the report.

INTRODUCTION

A recent report from Cisco Systems indicates that streaming video made up 73 percent of internet traffic in 2016, and that number is projected to rise rapidly (2017). A large portion of that streaming video comes from YouTube. Many of the videos on YouTube are tutorials, and watching these tutorials has rapidly become a standard method of learning new skills. A 2015 Google survey of persons aged 18-34 found that 67 percent believed they could find a video on YouTube teaching them anything they wanted to learn (Mogensen, 2015). North American viewers watched 20 million hours of YouTube tutorials per month in early 2015 (Mogensen, 2015). It isn't just young people who are watching these video. In the past few years, I have personally used YouTube to identify which capacitor I needed to replace in order to restore audio on a 23 inch Polaroid LCD TV, how to change the front axle of a 2003 Subaru Outback Legacy, and how to diagnose print skew problems on a Da-Vinci 3D printer. Of course these are only a few random examples of the very detailed information that is readily available today.

As a teacher whose career predates the ready availability of streaming video, I can say that it has changed the way I teach. The availability of tutorial videos has obvious implications for education, and the educational impact of streaming video has been studied by many researchers (Greenburg & Zanetis, 2012). The general conclusion is that video tutorials work well in the classroom and in the lab. Even delicate medical procedures like catheterization can be taught successfully using streaming video (Croker, Andersson, Lush, Prince, & Gomez, 2010). The accessibility and past success of the format were part of what inspired this study. The other inspiration was the unusual event of a scheduled amputation of one finger and reconstruction of my hand (Goldfarb, 2016). I saw video tutorials as a way that the class could continue to function even while my hand could not. The fact that my surgery was scheduled in advance allowed time for the appropriate groundwork for a study to be established and for detailed data to be recorded. These details included a Human Subject Committee review. This study was classified as exempt and approved.

METHOD

To measure the effectiveness of video tutorials in the lab, I attempted to teach the material the same way to two separate classes. The two classes were run over two consecutive school years, marking the fourth and fifth time that I presented this material in this setting. The same PowerPoint presentations were shown to both of the classes. Both classes were given the same tests, the same assignments, the same quizzes, and the same lab handouts. The same lab facilities, tools, and raw materials were used. In short, I held everything as constant as possible except for the method of lab demonstrations. For the first group in the study, I gave live demonstrations of tools and techniques at the beginning of each lab periods and again during the labs as questions arose. For the second group, I posted video tutorial demonstrations on YouTube, and provided links to these tutorials for the students. Except for rare occasions, students with difficulties were referred back to the tutorials. The students did not view this negatively, as it was obvious that I could give live demonstrations with my recently operated on hand. A still image from one of the tutorials is shown in figure 1.

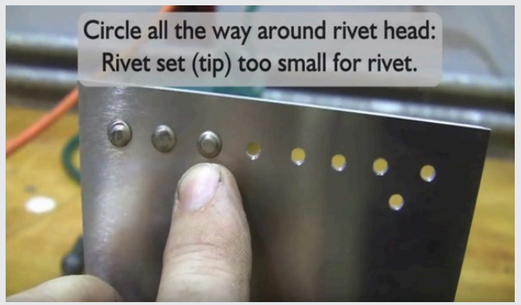


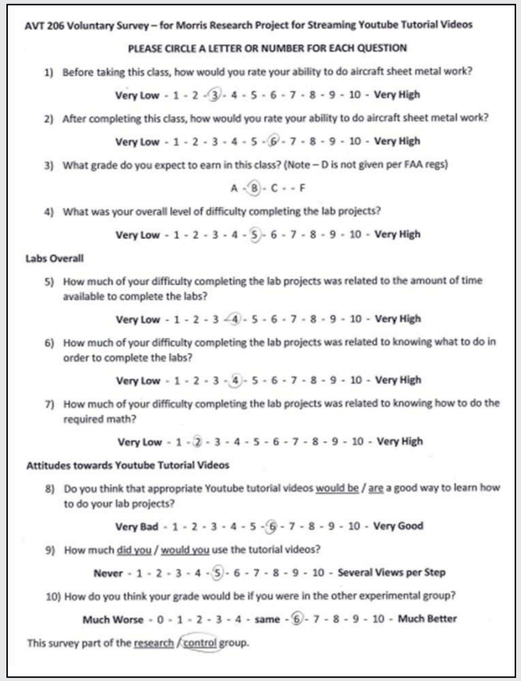
Figure 1: Still frame from one of the tutorial videos.

The tutorials were filmed in the lab during the off semester between course offerings. My teenage sons operated the camera, and the production quality was far from professional. None of the students complained about the lack of quality. This was consistent with what Croker et al. (2010) have reported – that the quality of videos is not something that Millennials tend to harshly criticize. Filming these projects resulted in many hours of raw footage. I edited the footage down until each of the five projects could be summarized in around an hour each. This footage can be seen on YouTube by searching for the terms "SIUC A&P 206 Sheet Metal."

At the conclusion of each course, I asked students to voluntarily answer questions related to the class. I did not attempt to assess their knowledge, but rather to quantify their perceptions of what was difficult in the sheet metal course they had just taken. I also wanted to measure their attitudes towards learning with tutorial videos. A completed questionnaire is shown in figure 2. All of the students filled out the surveys. The questions were self-scored on 10-point Likert scale with the exception of question 3, which was reported in letter grades.

After the data were gathered, I used an internal consistency test to validate the data. Three students reported that YouTube tutorials were a very good way to learn the material (question 8) but they also stated that they would have received a much better score had they not had the YouTube tutorials (question 10). These internally inconsistent questionnaires were removed from consideration. All three rejected questionnaires came from the research group. None of the students from the control group had similar inconsistencies (i.e. YouTube tutorials are a terrible way to learn, but I would have gotten better grades if I had them), so I was able to keep all of these data points.

Once the data were recorded, I used single factor analysis of variance (ANOVA) to determine if the differences between the control and research groups rose to levels of statistical significance. A probability level of 10 percent ($p < .10$) was used to determine statistical significance. I used the 10 percent number because of the small number of samples (n) available in the two groups: 33 in the control group, and 38 in the research group. The student overall grades from each group were also analyzed in a similar manner



AVT 206 Voluntary Survey – for Morris Research Project for Streaming Youtube Tutorial Videos

PLEASE CIRCLE A LETTER OR NUMBER FOR EACH QUESTION

1) Before taking this class, how would you rate your ability to do aircraft sheet metal work?

Very Low - 1 - 2 - (3) - 4 - 5 - 6 - 7 - 8 - 9 - 10 - **Very High**

2) After completing this class, how would you rate your ability to do aircraft sheet metal work?

Very Low - 1 - 2 - 3 - 4 - 5 - (6) - 7 - 8 - 9 - 10 - **Very High**

3) What grade do you expect to earn in this class? (Note – D is not given per FAA regs)

A - (B) - C - - F

4) What was your overall level of difficulty completing the lab projects?

Very Low - 1 - 2 - 3 - 4 - (5) - 6 - 7 - 8 - 9 - 10 - **Very High**

Labs Overall

5) How much of your difficulty completing the lab projects was related to the amount of time available to complete the labs?

Very Low - 1 - 2 - 3 - (4) - 5 - 6 - 7 - 8 - 9 - 10 - **Very High**

6) How much of your difficulty completing the lab projects was related to knowing what to do in order to complete the labs?

Very Low - 1 - 2 - 3 - (4) - 5 - 6 - 7 - 8 - 9 - 10 - **Very High**

7) How much of your difficulty completing the lab projects was related to knowing how to do the required math?

Very Low - 1 - (2) - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - **Very High**

Attitudes towards Youtube Tutorial Videos

8) Do you think that appropriate Youtube tutorial videos would be / are a good way to learn how to do your lab projects?

Very Bad - 1 - 2 - 3 - 4 - 5 - (6) - 7 - 8 - 9 - 10 - **Very Good**

9) How much did you / would you use the tutorial videos?

Never - 1 - 2 - 3 - 4 - (5) - 6 - 7 - 8 - 9 - 10 - **Several Views per Step**

10) How do you think your grade would be if you were in the other experimental group?

Much Worse - 0 - 1 - 2 - 3 - 4 - **same** - (6) - 7 - 8 - 9 - 10 - **Much Better**

This survey part of the research / (control) group.

Figure 2: A randomly chosen survey.

RESULTS

The results are shown in table 1. The columns that reached statistical significance are highlighted. Column 3 (anticipated grade) was calculated by the traditional academic scale with an A being four, and an F being zero. The last two columns are based on actual measured parameters and not on surveys. Because the surveys were anonymous, it was not possible to remove data corresponding to the invalidated surveys from these columns. The actual grades which are reported in the last column are the percentage grades students earned in the class.

Table 1: Data and Statistical Analysis by question.

	1) Ability before taking course	2) Ability after taking course	3) Expected grade in course	4) Overall difficulty completing labs	5) Difficulty getting done in time	6) Difficulty knowing what to do	7) Difficulty doing the math	8) Think tutorial videos are good?	9) How much you did or would use	10) Your grade in the other group	Number of recorded hours in lab*	Actual percentage grades earned*
Control Group (n=33)												
Average	1.88	7.67	2.86	6.21	6.67	5.00	4.27	8.85	7.55	7.42	62.1	80.7
Standard Deviation	1.48	1.42	0.96	1.98	2.67	1.87	2.37	1.85	2.55	1.69	6.81	15.4
Research Group (n=38)												
Average	2.59	7.22	2.95	4.88	5.68	3.61	3.05	8.59	8.15	3.27	62.0	84.2
Standard Deviation	2.26	1.34	0.78	1.89	2.88	1.96	2.06	1	1.41	1.75	8.37	8.8
p=	.030	.099	.024	.187	.798	.071	.156	.011	.001	.000	.941	.220
Statistically Significant?	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	No

** these columns did not have invalidated data points removed.*

DISCUSSION

As everyone knows, it is never possible to hold everything exactly the same. The biggest uncontrollable difference noted was section

This illustrates why video based classes are thought to be significantly less sensitive to section size than are more traditional live demonstration classes.

Before delving into the numerical results of this study, it is worthwhile to consider how the data would likely present itself if it were completely random in nature. At the chosen level of p, an average of 10 percent (one out of 10) sets of random numbers should indicate statistically significant differences. In this study, more than half of the columns show statistically significant differences. This sort of meta-analysis gives me a high level of confidence in my assertion that the questionnaires filled out by the two groups are different.

Before beginning the study, I expected students to have a strongly positive initial reaction to the video tutorials, but to gradually loose enthusiasm for the format. I thought that over time, the students would find that the videos were not as helpful as they thought they would be. The data is mixed in this regard. Students who had access to the videos relied on them even more heavily than their colleagues expected they would (question 9). However, the group with access to the videos was not quite as willing to say that the videos were a good way to learn the material in the end (question 8).

The students who learned from live demonstrations reported lower initial knowledge (question 1) and higher final knowledge (question 2) in the class. Putting these factors together, they believed that they learned more. This is in spite of the fact that their final grades were not significantly different, and were actually a bit lower. Viewed from the opposite perspective, this is quite intriguing. The students who learned with video tutorials did not feel that they had learned as much. It seems plausible that the video tutorials were better at mentally linking the new knowledge and skills they were learning to old knowledge and skills that they already had.

In spite of their belief that they had learned less, the students who learned with the tutorial videos expected to get higher grades (question 3) than the ones that learned traditionally. This may have been the result of seeing each project completed in its entirety, and thus having a clearer understanding of the published rubric. In fact, they did receive slightly higher grades, but the grade differences did not rise to the level of statistical significance.

The tutorial videos did not change the overall perceived difficulty of the labs (question 4). Both groups agree that the greatest difficulty lay in completing the labs in the amount of time given (questions 5, 6, and 7). They agree that the videos did not help with this aspect of the labs (question 5). They further agree that the next greatest difficulty lay in knowing what to do next. However, this difficulty is ranked much lower for the research group than the control group (question 6).

This is entirely logical, because a student who has watched the entire process has a far better idea of what to do next.

Across all of the results, the most statistically significant difference was for question 10, where I asked students to predict their grade if they had been in the other group. The group without the videos said that the videos would have raised their grades to about halfway between the "same" and "much better." The group with the videos indicated that without them, they would have done about a third between the "same" and "much worse." The probability that this variation was due to random chance was calculated to be about one out of 53 billion.

Qualitatively, the tutorial videos seemed to be extremely effective for students who were self-motivated. In my five years of instruction in this setting, I have never seen anyone complete the projects as quickly and effectively as several of the students with the videos were able to do. One student told me that he watched the portions of the video he expected to cover before coming to the lab, and was therefore able to work extremely efficiently. Students with less motivation did not do so well. In spite of my instructions, they came to lab sessions without having watched the videos. Because the lab periods did not begin with live demonstrations, these students often floundered aimlessly.

Instead of being the equalizer I had hoped they would be, I felt that the videos ended up causing a wider gap between those with skills and motivation, and those without. This is borne out by the numbers. The average number of hours to complete the projects is almost identical for each group, but the standard deviation is higher for the research group.

CONCLUSION

I completed this study to determine if streaming video can replace in person demonstrations in an aircraft sheet metal lab. The data show that it can. It is important to note that this was not distance education with streaming video taking the place of a qualified instructor. I was still present and engaged with the students. I could still interact with the students in person and in real time. I could still immediately identify unsafe practices and unsatisfactory results and deal with them accordingly. I could still encourage good habits and discourage bad ones. These are far more difficult to accomplish through distance education.

It is also important to note that these results do not suggest that streaming video should take the place of live demonstrations. This was a special case situation, necessitated by special circumstances. In spite of the students' enthusiasm for the videos, they did not produce a statistically significant difference in the amount of hours it took them to complete the labs, or in the grades that they received.

In the end, each student is an individual, and learns in his or her own way and at his or her own pace. Streaming video is an effective teaching tool, and it probably should get more attention than it does. It is almost certainly best used as a supplemental tool alongside traditional live demonstrations.

GOING FARTHER

If it had been practical, I would have conducted a third iteration of this study where the students were given both the YouTube tutorials and the live demonstrations. Unfortunately for this study, significant schedule and credit hour changes to SIUC's curriculum were made before the next class was run. These made it impossible for me to run the next class on anything that I could reasonably call an identical basis, so this is the end of this study. IF anyone else runs a similar study, I would like to see it include this third group as well as other two I included.

NOTES

1. My hand is one the two hands photographed and discussed in Goldfarb, 2016.
2. I had OSPA/HRC approval to run this study. I also had department approval and an agreement that if it became necessary, another instructor would be called in to conduct live demonstrations.

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CLASSROOM DEMONSTRATIONS: EDUCATION OR ENTERTAINMENT?

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ABOUT THE AUTHOR

Professor William Russo is the Aviation Maintenance Technology Program Director for the University of the District of Columbia Community College (UDC-CC), and an instructor teaching a full-course load of FAA-Approved General, Airframe and Powerplant courses. He holds a Bachelor of Science degree in Professional Aeronautics and a Master of Aeronautical Science degree (with Distinction) with dual specialization in Aviation Education and Human Factors from Embry-Riddle Aeronautical University. He is the 2018 winner of the UDC Executive Cabinet's Employee Recognition Award for outstanding service to the University, and is regularly quoted as a faculty expert from numerous aviation-based publications, most recently in AMT Magazine and MRO Management Magazine, which are considered by many as the aviation industry's leading online resources for aviation maintenance news, information, and analysis.

Professor Russo works tirelessly to promote the UDC Aviation Maintenance Technology Program as a presenter at numerous conferences, festivals, and career fairs, and is a regular attendee of industry related events. He serves as a technical expert and consultant to Gleim Publications, is a published co-author of the Gleim Inspection Authorization Training Course, and has written 18 FAA Accepted training modules published within Gleim's Inspection Authorization Renewal Course. Mr. Russo routinely initiates and coordinates community outreach activities appropriate for audiences within elementary school to adulthood settings, and is a champion for promoting aviation awareness and STEM educational opportunities; he also maintains currency as a practitioner and recently completed an American College and University Educator (ACUE) course on Effective Teaching Practices.

ABSTRACT

This article explored the effective use of classroom demonstrations as a tool for enhancing student learning, especially for basic science. The author presented four important lessons learned from many years of research and effort in developing techniques for successfully utilizing classroom demonstrations to engage with students in productive and meaningful ways. These lessons are: 1. There is tremendous need for classroom demonstrations in almost all academic programs, most especially in those involving an understanding of basic scientific principles. 2. Students learn better from participating in demonstrations than they do from simply observing them. 3. The teacher's attitude is one of the largest contributors to whether a classroom demonstration is successful. 4. The demonstrations must serve an academic goal described in the curriculum – otherwise, valuable class time is wasted. Supporting arguments were provided for each lesson, with the conclusions that Aviation Maintenance Technician Schools (AMTS) that do not use effective classroom demonstrations should explore the possibility of doing so, and that AMTS that do use classroom demonstrations should consider evaluating and possibly revising their existing demonstrations to improve effectiveness.

While attending a recent conference for college and university educators, I listened and observed as colleagues from across the country discussed various initiatives that they were exploring in an effort to bring experiential learning practices into their educational programs. Both external programs, such as internships and industry partnerships, and internal techniques, such as leveraging simulation technology and using classroom demonstrations were discussed with equal vigor. Upon my return home, I struck up a conversation with a group of colleagues during a professional development session and relayed some of what I had observed in the conference presentations. I was somewhat surprised by their response, because several of them said that classroom demonstrations are a waste of time and are more akin to entertainment than education. Several others thought that my academic program (aviation maintenance) has no need for classroom demonstrations because we have a physical, hands-on portion of our program and could present all demonstrations in the maintenance hangar during that portion of the course, rather than trying to do them in the classroom.

My colleagues' responses should not have surprised me too much, because I had heard these same thoughts expressed by many Aviation Maintenance Technician School (AMTS) instructors. However, I have a differing opinion and feel that my colleagues were not as well-informed as they could be on this topic. For instance, if I teach theory in the classroom without providing demonstrations and then later take my students out to the hangar for a demonstration after the theory portion of the class has ended, the sequence of instruction is disjointed and largely ineffective. Theory must be reinforced and explained while the discussion is active, not at some later time. I have put substantial effort into developing techniques for successfully utilizing classroom demonstrations as a tool for engaging with students in productive and meaningful ways, and I feel that it is important for me to share the four most important lessons that I have learned.

- There is a tremendous need for classroom demonstrations in almost all academic programs, but most especially in those involving an understanding of basic scientific principles.
- Students learn better from participating in demonstrations than they do from simply observing them.
- Teacher's attitude is one of the largest contributors to whether a classroom demonstration is successful.
- The demonstrations must serve an academic goal described in the curriculum - otherwise valuable class is wasted.

I discuss each of these lessons in the following paragraphs.

As a teacher in a community college, my experience has been that many of the students entering college have very little understanding of the basic scientific theories and principles that form the core of aviation and aerospace science, and unfortunately, my experience is not unique. Wieman & Perkins (2006) state that, "There is considerable evidence that science classes from elementary school through to university are generally failing to provide most students with an understanding of science. Sadly, these classes are also frequently suppressing whatever interest students may have in the subject" (p. 290). So, not only are students failing to achieve an understanding of basic science, but their interest in science has waned as a result of ineffective instructional practices. This could possibly explain why many students entering my AMTS programs have no quantifiable understanding of the science of electricity and magnetism or other topics of physics, such as the laws of force and motion. Even those who have taken and passed courses on these subjects in the past tend to have little understanding because they never actually learned them - they just memorized enough to pass their assessments. Classroom demonstrations that explain these scientific principles are crucial to helping students cross the line between memorization and understanding.

While there is substantial need for teachers to use classroom demonstrations to promote an understanding of basic science, it is extremely important to note that students who simply observe demonstrations do not typically learn anything from them. In fact, students who observe classroom demonstrations but do not actively participate in them may misinterpret the results, creating barriers to learning, rather than knocking them down. During a study of the effective use of classroom presentations, Milner-Bolotin, Kotlicki, and Rieger (2007) made the following observations:

> *Our experience confirms what other instructors have discovered— that students don't gain thorough conceptual understanding just from observing a demonstration. On the other hand, students who had a chance to predict an outcome of a demonstration prior to seeing the demonstration achieved a significantly higher success rate of 25%–35%. Furthermore, students who had the opportunity to make a prediction, discuss it with peers, and only then observe the demonstration, were found to be getting the most out of this learning experience - their rate of correct responses was higher than 50%. (p. 46)*

Dazzling displays of science in action are not enough by themselves, there has to be active student participation. For example, if I were to set up a Van de Graaf generator and then just play around, making students' hair stand on end and shooting big bolts of static electricity into the grounding sphere, my students might have fun, but they probably

will not learn anything, and we will lose valuable class time. The results would be quite different if we were to have a discussion on static electricity generation, electrical potential differences, and electrostatic discharge before I set up the Van de Graaf generator - especially if I were to ask questions such as, “What will happen if I step up on a plastic stool, place my hand on the sphere and then turn it on? What will happen if I do the same thing while standing on the ground instead of standing on the stool? Will the outcome between the two scenarios be different or the same? Why?” If I allow my students to have this discussion and then use what they have learned to develop a theory, they will be invested in the demonstration and will absolutely learn from the outcome, regardless of whether their theory was correct.

Like so many other aspects of teaching and learning, the attitude of the teacher is one of the biggest factors in determining whether a classroom demonstration is successful. Research has found that the personal beliefs and dispositions of teachers may relate to or predict successful technology integration (Vannatta & Fordham, 2004). As a program director or curriculum developer, you can write a lesson plan that effectively explains the course material, but if the teacher cannot present the lesson effectively in the classroom, failure is almost certain. Honey and Moeller (1990) assert that teacher philosophy (student-centered versus teacher-centered) affected one’s ability to effectively use technology in the classroom, in that student-centered teachers were more successful. Albion (1999) states that teachers’ beliefs, specifically self-efficacy beliefs, “are an important, and measurable, component of the beliefs that influence technology integration” (p. 2). All too often, instructors balk at introducing new techniques and new technologies in their classrooms, especially if they began teaching long before these techniques and technologies were developed; they assume that because they never needed them before, they do not need them now. I have made substantial investment in new technologies for my community college’s AMTS program only to see them fail initially as a result of faculty’s unwillingness to change or their lack of confidence in trying new techniques. This is an issue that must be dealt with head-on, as it speaks to the heart of student education. Faculty must be able to adapt, grow, and develop continually, embracing the introduction of new techniques and technologies; otherwise, their students’ learning experience will suffer as a result. A positive attitude is key to motivating students and fostering an effective learning environment.

Now that we have discussed the need for classroom demonstrations to support an understanding of basic science, the need for student participation in the demonstration to promote active learning, and the need for teachers to display the right attitude, we can discuss the last piece of the puzzle, choosing a demonstration that effectively supports the curriculum. If you are to truly make a distinction between education and entertainment, choosing a demonstration must be the result of serious thought and planning. What do you hope to accomplish with this demonstration? What do you intend for the students to learn? What learning outcome is supported by attainment of this knowledge? In studying the use of demonstrations in a high school physics classroom, Gross (2002) came to the following conclusion:

> *Demonstrations serve serious educational purposes. They should not be presented as mere entertainment. This is not to suggest, however, that teachers should not be enthusiastic and engaging. Rather, avoid demonstrations that detract from the class; for example, avoid performing demonstrations of physical principles that will not be taught at some time during the semester. Do not try to fool the students with tricks in the demonstration. The material in a physics class is challenging enough without resorting to tricks, which can result in student misconceptions as well as mistrust of the teacher. Whenever possible, use demonstrations to obtain some kind of quantitative results, even if they are rough. Always allow sufficient time to analyze and discuss the results of a demonstration. Again, a demonstration without an adequate explanation of the physics is simply entertainment. (p. 5)*

Earlier, I gave the example of using a Van de Graaf generator to support a lesson on static electricity; but is such a demonstration actually helpful? Could I not just describe something that everyone can relate to, like walking across a thick carpet on a cold winter day and shocking myself on a doorknob, and then move on to the next subject? Of course, I could, and many teachers do just that. But when teaching basic electricity, the next topic after discussing static electricity is usually electron theory and electromotive force (voltage), and if you truly want your students to understand electron theory and electromotive force, a little bit of time with a Van de Graaf generator demonstrating electrical potential difference will be time well spent. Not only will your students be more engaged in the discussion, but when you later place a multimeter in their hands and ask them to measure voltage across a component in a circuit, they will have a much better understanding of what they are trying to accomplish. Instead of just learning the minimum necessary to pass a test, your students will be laying the groundwork for a fundamental understanding that will serve as the foundation on which true understanding is built, and from which troubleshooting techniques will eventually rise.

This article only scratches the surface of a complex and much debated topic. However, it should help to provide an understanding of some of the points to be considered regarding whether a classroom demonstration is appropri-

ate for a given curriculum subject, and how demonstrations could be used effectively to enhance student learning. The decision of using such techniques and investing time and resources into developing classroom demonstrations largely depends on the goals and objectives of each AMTS. Some AMTS programs place their students in class for the maximum number of weekly hours allowed by the FAA, with the goal of moving students through the program in the shortest time and have little interest in moving beyond the minimum effort required in the classroom. Some AMTS programs are at the opposite end of the spectrum, taking as long as they want and enhancing their curriculum with a host of additional and supplemental instruction. Most AMTS programs find themselves somewhere in-between and have room for including classroom demonstrations in some areas of their curriculum, but not in others. Wherever your AMTS falls on this spectrum, I urge you to evaluate your use of classroom demonstrations. If you do not use them, perhaps you should consider exploring the idea. If you do use them, consider reviewing your presentations for effectiveness and evaluating your faculty members' presentation skills.

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THE "ENGLISH ISSUE"—AND SOLUTION—IN AMT TRAINING

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Anne received her MA in Teaching English as a Second Language (TESL) from the University of Illinois, Champaign-Urbana, USA. Her childhood, from birth through high school graduation, was spent in South India, with periodic travel back and forth to the US. She remembers the momentous shift from taking ships around the globe to flying these distances by gleaming airplane!

ABSTRACT

Amid the worldwide labor shortage in aviation maintenance, the trend toward greater engagement by international populations in training for aviation maintenance technology (AMT) is encouraging. As these trainees complete certification and become employed, they will add to the labor force and help alleviate the shortage. However, many need special support in English language training to reach a high enough level of proficiency to understand the technical content of AMT training. Unfortunately, many with low proficiency are now being sent to English training programs that are not designed to meet their needs. Some are not receiving English language support of any kind.

This article sorts out various purposes for language training, then clarifies the approach needed to acquire customized AMT English in an efficient and productive way. Because this specialization in customized workplace language training is still relatively new, this article also discusses the components that yet need to be developed to provide such training: customized curricula, customized tests, and customized teacher training. The article closes with a blueprint for advancing the development of AMT English. This support can hasten the entrance of this population into the labor force and help address the shortage.

WORLDWIDE SHORTAGE, EXPANDED INTERNATIONAL TRAINEE/WORKFORCE POOL, AND THE ENGLISH LANGUAGE GAP

The worldwide shortage in aviation maintenance is well established. Figures vary, but Boeing's Technician Outlook for 2018–2037 puts the total world demand for new technicians at 754,000 (Boeing, "n.d."). The breakdown per world region is presented in the table below:

New Technician Demand: 2018–2037 by World Region	
World Region	**Demand**
North America	189,000
Latin America	55,000
Europe	132,000
Africa	28,000
Middle East	66,000
Russia, Central Asia	27,000
Asia-Pacific	257,000
Total	**754,000**

Table 1

The forecast for U.S. commercial MRO (Maintenance-Repair-Overhaul) Technicians is that demand is to exceed supply as soon as 2022 (Oliver Wyman, "n.d.").

One U.S. Aviation Maintenance Technology (AMT) program adds the further observation that "the new generation of students [will be] tomorrow's cross-cultural, cross-generational workforce" (Rock Valley College, "n.d."). This same program's website also cites Boeing who analyzes that, "The overall global fleet growth—and with an increasing trend in outsourcing maintenance, repair, and overhaul activities to third-party providers in emerging markets—will drive an increased overall need for qualified technicians sourced from an expanded number of [international] locations" (Boeing, 2014, within Rock Valley College, "n.d.").

This identification of a "cross-cultural workforce" from an "expanded number of [international] locations," including "emerging markets," captures the trend toward a more multilingual AMT profile. The U.S. Federal Aviation Administration (FAA) itself informed attendees at the ATEC 2018 Washington Fly-In in September that it is setting up an AMT school in the Philippines (Shaver, 2018). Other Fly-In attendees representing U.S. AMT programs provided updates that they are receiving students from Korea and China, among other countries. Notably, these students are also requesting English language support.

This need for English support is also borne out at another U.S. AMT program. It reports a roster of current English as a Second Language (ESL) students coming from El Salvador, Peru, the Curaçao Islands, South Korea, and South Sudan. These ESL students total 35 out of an overall student body of 46, or 76% ESL. Within this total of 35 ESL students, 30 are refugees from South Sudan. And of these 30 South Sudanese, there are 65%, or 19, who need a higher proficiency in English in order to understand AMT technical content and succeed in their studies (Brauhn, 2018).

Note that with refugee populations, one may also need to take into account the effect of conditions and the length of stay in the refugee camps from which they came. In a dire conflict situation such as South Sudan, schooling may have been suspended or could never have been offered, so "grade level" achievement or even literacy development in native language (i.e., Arabic) may have been compromised.

It is likely that almost any AMT program in the U.S., and certainly in overseas settings, may include international students who may well need some extent of English language support. AMT programs are encouraged to review their own student body profiles in terms of any trainees who need to bridge this gap and achieve a higher level of English proficiency in order to succeed in their studies and reach their career goal of becoming an AMT.

This expansion of the AMT trainee pool to international students, who may then become part of the future labor force, represents one way in which the labor shortage can be alleviated. It is imperative, then, that these trainees receive the English language support they need in order to graduate, become certified, and obtain jobs in the industry. The industry, in fact, is depending on this outcome. It needs this outcome—as does the flying public.

And this outcome of employable AMTs is urgent. As observed by the Professor of Aviation Maintenance and Avionics at the AMT program above with a 76% population of ESL trainees,

> *"Airlines are currently cancelling flights and parking aircraft due to a short of [mechanics]. If the AMT shortage is not corrected, this will only increase. If AMT training facilities are to provide for the industry, ATEC members must take a hard look at their institutions, as well as at their potential student population[s], to help solve the English issue before it reaches a cris[i]s level. [We have a] responsibility and duty… to the AMT/MRO industry [for which] we provide skilled work[er]s."*
>
> *(R.D. Brauhn II, personal email communication, October 1, 2018, 5:36 pm, ET)*

Currently, however, there appears to be little awareness about the most efficient and productive approach to providing this English language training support. This article, then, presents essential background information about English language training overall. It provides a rationale for the preferred approach—and solution—of customized English language training for the workforce context. It identifies the areas in which this relatively new, customized approach still needs to be developed. And it lays out what individual AMT programs and related stakeholders can do now to address this "English Issue."

THE BASICS OF ENGLISH LANGUAGE TRAINING

Language Skills and Language Systems

First, just for a little refresher about language itself, any language involves four skills and four systems. This will likely make sense if we think about our own engagement with language—our own native language or any other languages we might know. These four skills are Listening, Speaking, Reading, and Writing—or LSRW. (The last two skills are relevant in literate societies and contexts; but not so, if one is pre-literate.) Any language also has four systems—a system of sounds which need to be pronounced (if one is not mute); a system of meaning that can be represented by the term "vocabulary"; a system of structure and order that is usually referred to as grammar; and a system of cultural usage, whether that is corporate/industry culture, national culture, the culture of social subset groups, even sometimes religious culture, and any other classification of culture. In shorthand form, these systems can be labeled as Pronunciation, Vocabulary, Grammar, and Culture—or PVGC. See the summary table below.

Language Skills and Language Systems	
Language Skills LSRW	**Language Systems PVGC**
L – Listening	P – Pronunciation (sounds)
S – Speaking	V – Vocabulary (meaning)
R – Reading	G – Grammar (structure, order)
W – Writing	C – Culture (cultural usage)

Table 2

The Purposes for Which We Use—or Learn—Language

Next, it is helpful to think about the reasons, or purposes, for which we use language. This is especially relevant when identifying the reasons, or purposes, for which we want to learn another language. It is also important to identify the setting for any language learning. We need to distinguish whether we are learning a new language in our native country, such as a native English speaker in the U.S. wanting to learn Spanish or Swahili to converse with a new-found, local friend or associate. Or is the setting that of a native Spanish speaker in El Salvador who wants to (needs to) learn English for a job with a multinational corporation (MNC)? This MNC may use English as the common, international language of doing business. Or at least English may be required when relating to English-speaking customers. It may also be necessary to read and comply with documentation written in English that is not reliably rendered into local language through translation. Or is the setting in another country where you are visiting and want to learn a new, non-native language to get by as a tourist? Or have you taken up residence in another country and need to learn a new, non-native language to fully participate in that society and in that labor force? All these factors need to be considered as we think about the most appropriate ways to approach language learning for the various purposes involved.

Moving on, in an overview sense, people tend to learn languages either for fairly general or for more specific reasons. In terms of teaching English for these different purposes, see the breakdown in Figure 1., the English Language Teaching "Tree." Under General English, our students may want to learn English for everyday consumer functioning. This is typically the case with newly arrived immigrants or refugees who need to integrate into society for general consumer purposes. If these same immigrants or refugees—or foreign students—want to pursue studies in an educational or vocational setting, they may need to improve their basic English language skills and language systems, as well as learn about test preparation and study skills. All of this is oriented toward passing a gateway exam that qualifies them to enter an educational or vocational program of study in their field or discipline of choice.

From this point forward, one's purpose for learning a language typically becomes more specific. In the case of English, we call this "branch of the tree" English for Specific Purposes, or ESP. This broad division itself subdivides into academic or occupational purposes. English for Academic Purposes (EAP) refers to "those studying to enter the professions, focusing on the language of academic performance." English for Occupational Purposes (EOP) refers to "those already employed in industry, focusing on the language of job performance." (Note that EOP is often just referred to as Workplace or Workforce English, which is a little less of a mouthful! To reduce acronyms in this article, Workplace English will be used for EOP and Academic English will be used for EAP, except when referring to pre-existing titles and terms in graphics.)

In the case of AMT trainees, they could actually fall some-

where in between Academic and Workplace English. Yes, they are still students, learning the content of a field in which they look forward to becoming employed. They are not yet employed and engaged in all the dynamics of time pressures, personnel structures with "real" bosses and co-workers, and full accountability for their job performance. However, the hands-on nature of their training brings them very close to this occupational context. Be this as it may, there are two more points to be made about Academic English and Workplace English.

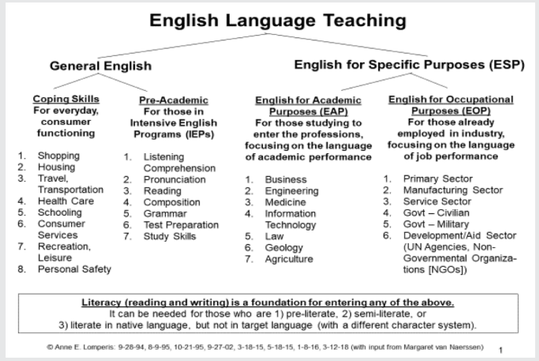

Figure 1: English language teaching tree. This figure shows the branching subdivisions of the purposes for which we teach (or learn) English (Lomperis, 2018).

MORE DISCUSSION ABOUT ACADEMIC ENGLISH AND WORKPLACE ENGLISH

Academic English and Workplace English Contexts

First, Academic English and Workplace English are distinguished by their different contexts. See Table 3 entitled, "EAP Language Tasks and Functions by Context" and Table 4 "EOP Language Tasks and Functions by Context." In EAP/academics, these contexts are:

- In Class (in person, online)
- Immediate, Short-Term Homework Assignments
- Research and Long-Term Assignments
- Tests, Exams

In EOP/industry, these contexts are:

- Administration
- Operations
- Social Responsibility
- Human Resources

These tables then go on to provide examples of language tasks and functions under each context. Note that these subpoints offer only a few, representative examples for each context. Many more can be added for the given circumstances of an academic course or program, and even more can be added for all four contexts of an occupational job with its multiple responsibilities. However, by looking at these examples, one will likely find that AMT training draws from both EAP and EOP contexts.

EAP Language Tasks and Functions by Context (EAP – English for Academic Purposes)

Context	Language Tasks and Functions
I. In Class (In Person, Online)	1. Understanding lectures, multimedia presentations, a variety of delivery formats 2. Taking notes 3. Answering professor's questions 4. Participating in class discussions, or laboratory or workshop activities
II. Immediate, Short-Term Homework Assignments	1. Reading textbooks, workbooks, journal articles; viewing multimedia formats 2. Writing outlines, summaries, essays, laboratory exercises
III. Research and Long-Term Assignments	1. Conducting print-based and online research 2. Writing papers, projects, laboratory reports
IV. Tests, Exams (Institution-Created or Standardized)	1. Answering multiple-choice; short-answer questions (may be written or oral) 2. Answering essay and long-answer questions 3. Demonstrating skills through completing tasks, including oral responses or presentations 4. Answering formal doctoral oral comprehensives or dissertation defenses

Table 3: EAP Language Tasks and Functions by Context. Needed in Any Discipline (e.g., medicine, business, law, computer science, engineering, architecture, journalism). © Anne E. Lomperis, 12-1-03, 1-5-12, 4-20-15, 10-1-18

EOP Language Tasks and Functions by Context (EOP – English for Occupational Purposes)

Context	Language Tasks and Functions
I. Administration	1. Writing documentation for ISO certification 2. Developing a proposal for project funding 3. Preparing a departmental budget 4. Submitting an expense report
II. Operations	1. Making a marketing presentation 2. Negotiating a client contract 3. Closing a sale 4. Writing correspondence and reports 5. Keeping records 6. Answering the telephone; taking a message 7. Ordering supplies and equipment 8. Reading manuals to maintain or repair equipment 9. Interacting with coworkers and superiors related to a specific issue or process 10. Participating in and/or leading meetings 11. Attending international conferences: presenting, handling Q&A, socializing
III. Social Responsibility	1. Warning others about a safety hazard 2. Documenting compliance with an environmental protection standard
IV. Human Resources	1. Interacting in a hiring or exit interview 2. Interacting in a performance appraisal 3. Participating in training

Table 4: EOP Language Tasks and Functions by Context. Needed in Any Industry Sector (e.g., primary, manufacturing, service, government–civilian, government–military, UN-NGO-CBO). © Anne E. Lomperis, 12-1-03, 1-5-12, 4-20-15, 10-1-18

Historic Lack of Familiarity with Academic English and Workplace English—Both Within Language Training and With Industry

Secondly, it is important to understand a little historic background about Academic English and Workplace English: how they compare to each other and how they compare to General English. General English is certainly the older, more established, and more traditional approach to English language teaching. Its topics are fairly standard, so that many commercial textbooks have been published and are widely available in both the coping skills, consumer functioning domain, as well as in the domain of pre-academic Intensive English Programs.

In addition, most ESL teachers of adults have been trained in how to teach General English—and they are used to teaching from its standard, commercial texts. (Many other ESL teachers are trained/endorsed to teach in the K-12 primary and secondary school systems, but we will focus our discussion here on teachers of the adult learner.) For those outside the field of language training, such as in industry, if they have heard about any language training at all, it is likely to be General English.

ESP, by contrast, is a much more recent specialization within English language teaching. Most significantly, it is characterized by customization to a given academic discipline or occupational job. Primarily, this means that the materials to teach Academic English or Workplace English have to be developed as original efforts for any given discipline or job. However, of the two, Academic English has been around longer, and specialized textbooks have actually been developed for some disciplines, such as English for Business, Medicine, Law, Engineering, and Information Technology. Workplace English, on the other hand, is the "newest kid on the block," and also, because of its wide variety of industry sectors and the wide variety of jobs within any of these sectors, virtually all materials have to be developed as new originals to be effective for each instance of training. Yet, it is this very customization that produces results—which General English cannot. It is also this targeted customization for job-specific improvement that yields compelling return on investment (ROI), as high as 531% (Martin and Lomperis, 2002).

Further, there is very little teacher training available in ESP. Hence, most ESL teachers are not very familiar with ESP, if at all. If they have heard anything about it, though, it is likely to be Academic English. In fact, until Workplace English was recognized and developed as its own specialty much more recently, ESP has almost exclusively been equated with Academic English. Thus, while ESP—both Academic English and more so Workplace English—are not well known and are often not accurately understood within the field of English Language Teaching itself, they are even more so unheard of in industry circles. It is hoped that articles like this one begin to provide such information and raise awareness in the AMT sector.

BEST PRACTICES IN WORKPLACE LANGUAGE TRAINING—THE CRITICAL ROLE OF CUSTOMIZATION DERIVED FROM NEEDS ASSESSMENT AND COLLABORATION

One can legitimately ask how English teachers can actually provide language training in academic disciplines or industry sectors with which they, in turn, have very little internal familiarity or knowledge. Point well taken! The key distinction to understand here, though, is that the English teacher does not and cannot make any claim to be a content specialist. However, as professional applied linguists, once trained in Academic English or Workplace English, they are knowledgeable of the process one goes through to identify the language needed to communicate effectively in a given academic discipline or industry sector job. (Remember the focus above on language skills [LSRW] and language systems [PVGC], as well as on the four contexts of Academic English and Workplace English.) In Workplace English, we essentially ask two questions:

- What tasks do you have to do in your job?
  (Input from target learner and industry experts)
- And what language do you need to do these tasks?
  (Industry input largely analyzed by language trainer)

This collaborative process for Workplace English involving industry and linguist is reflected in the development of international standards, or best practices, in workplace language training. This initiative involved six co-authors and review teams from 45 countries working for nine years before they eventually went to publication in 2003, with a technology update in 2014 (Friedenberg, Kennedy, Lomperis, Martin, and Westerfield, with contributions from van Naerssen, 2003, 2014). The key to this process is that the language trainer conducts a thorough and systematic needs assessment in collaboration with industry experts. Through this process, the language trainer gains knowledge of communication needs specific to given jobs within the industry sector and the given workplace. Thus, these Best Practices can essentially be expressed in a summary statement of this process: needs assessment (NA) in collaboration (COLL) with industry experts leads to customization (CUS) that produces results (RESULTS) and high ROI (HI ROI). In a shorthand formula: NA + COLL → CUS → RESULTS + HI ROI.

It is also important to add that, in this process, needs assessment occurs at different times, with different audiences, and for different purposes. Organizational Needs Assessment, or ONA, is conducted first with upper management to learn about corporate level goals, priorities, and trends; to understand operations; to explain and obtain buy-in for the customized approach of EOP; and, in practical terms, to end up with a sound program design. Put succinctly, one purpose of the ONA is to inform program design.

A quick example can be drawn from a land-based oil exploration and production worksite.

ONA revealed that all staff worked on shifts based on 7-day schedules:

Drill hands worked	7 days on / 7 days off
Supervisors worked	14 days on / 14 days off
Managers worked	21 days on / 21 days off
The General Manager worked	28 days on / 28 days off

Thus, the program design needed to be based on this 7-day schedule. One could not automatically assume and transfer a typical academic semester schedule to this worksite. Further, this program design must precede, then inform, curriculum design. Again, materials could not be developed on a semester basis, but needed to be organized in 7-day modules.

Similarly, AMT programs, though basically following an academic schedule, may have variations in the day and week that accommodate both classroom and workshop modes of instruction. A Workplace English curriculum design would then need to follow these accommodations for program design.

The second major type of needs assessment is Instructional Needs Assessment, or INA. In this part of the process, the language trainer, again in collaboration with industry experts (including now the target learner and appropriate others at different levels within the worksite), determine the actual needs for language training itself. Here, INA informs curriculum design, as originally shaped by program design.

One final point to make about the customized curriculum derived from this process of needs assessment and collaboration is that lessons are driven by job tasks. These job tasks are correlated to language tasks and functions as found in the EOP contexts of Administration, Operations, Social Responsibility, or Human Resources – or the EAP contexts of Class, Short-Term Assignments, Long-Term Assignments, and Tests/Exams. Language skills and language systems are still addressed, but they are only brought into the lesson in ways that support job tasks.

Conversely and in an upside-down kind of way, General English curricula and materials are typically driven primarily and only by language skills and language systems. These General English textbooks will focus on Grammar or Reading, or the teaching of Vocabulary lists and terminology alone that are not integrated into overall usage on the job. Or these General English texts may teach Listening and Speaking and Pronunciation. Or they may teach Writing and Composition.

It is unfortunate that what may be billed as Academic English or Workplace English courses may never really break out of the mold of General English. This is also more likely to happen if General English teachers are not trained well—or at all—in Academic English or Workplace English. They tend to "back-slide" into General English, which is their strength and comfort zone. But the serious consequence is that job-specific results are lost. It is the customization of Academic English and Workplace English that maintains this standard of achieving job-specific results. Customization is the "solution" to the "English issue" in workplace language training.

DEVELOPMENT NEEDS IN CUSTOMIZED ACADEMIC ENGLISH/WORKPLACE ENGLISH—WITH A FOCUS ON TESTING

So, what needs to be put in place to move forward with this customized Academic English/Workplace English "solution?" In summary:

- A customized AMT curriculum, shaped by a customized AMT program design
- Teacher training customized to Academic English/Workplace English
- A customized AMT test

The discussion above has largely covered curriculum, program design, and teacher training. To discuss a customized AMT test, it may be enlightening to trace what currently happens with ESL AMT trainees.

- They may be enrolled directly into the AMT program with no placement or diagnostic testing done of their level of English proficiency. If it is high enough, they will manage. If it is too low, they will struggle. Clearly, the latter situation places an unfair burden on the given trainee, the proficient classmates, and the instructor—all of whom are trying to accommodate and cope with an untenable situation. It is a completely reasonable, expected, and even mandated best practice to conduct placement and diagnostic testing of all ESL students before they are admitted into an AMT program.
- Some AMT programs may indeed administer tests to prospective AMT trainees and, as a result, those with low scores may be directed into the Intensive English Program (IEP) on campus. However, this may also not produce the best outcome. As discussed above, the IEP will very typically only provide a General English treatment of language skills and language systems—with no customization to AMT content at all. At the end of one or two semesters, for example, these trainees may well pass the gateway exam out of the Intensive English Program. But they will still not be prepared to understand and move seamlessly into the technical content of the AMT program.

The important issue here is that appropriate testing and appropriate placement into relevant preparatory instruction is needed. Currently, though, no AMT English test—for placement, diagnostic, or achievement purposes—has yet been developed. This is an agenda that must be undertaken. However, such an undertaking really is dependent on first developing a customized AMT English curriculum—so we know what content to assess. This curriculum development is also an agenda that needs to be undertaken. Research is ongoing to determine what truly customized AMT English curricula may already be "out there." However, to date, not much has been found. Some of what is available may indeed incorporate AMT terminology (vocabulary), but it still tends to be grammar driven—not job-task driven.

So, in the interim, some clarity is proposed. If a General English test must be given, consider the most appropriate placement, given the scores. For those with truly low scores, it may be appropriate for them to be placed into General English Coping Skills classes, especially if the individual is a new arrival into the country and truly does need this kind of consumer support first. As proficiency increases, these individuals may also benefit from the General English Pre-Academic language skills and language systems treated in IEP courses. But this content may still be better addressed as integrated within a customized AMT English program.

Thus, care should be taken to analyze these individuals' level of proficiency in case they could, indeed, benefit from the more efficient and productive approach of being placed in an AMT English program, even for Pre-Academic purposes. True, such an AMT English program would have to be developed, but it could even be developed to allow for different levels of incoming English proficiency. To develop this customized curriculum would require some initial, upfront time, but this delay would not be as long as being placed into a full semester course that was irrelevant in focus. Customized Academic English/Workplace English curricula are always being revised and tightened because needs are always becoming clearer. So, instruction can begin, even as the curriculum "emerges."

A note should be added here about the tests that are being developed worldwide according to the guidelines of the United Nation's International Civil Aviation Organization (ICAO) proficiency standards: a minimum score of 4 out of 6. These test guidelines were developed for pilots and air traffic controllers (ATCs). Considering the primary job tasks of pilots and ATCs, they must use listening and speaking skills to communicate and confirm landing and take-off instructions. By contrast, the primary job tasks of AMTs are to read

and comply with manuals published by civil aviation authorities (such as the FAA) and with manufacturers' service bulletin updates. AMTs must also write log entries of MRO work completed. So, the current ICAO-based tests for pilot-ATC listening and speaking do not even test for the reading and writing job tasks of AMTs. And if AMTs were to take an ICAO listening-speaking test, these scores would not be relevant to their own, different job tasks requiring reading-writing language skills. So, this ICAO test is a mismatch for AMTs.

Further, when this issue was explicitly raised at the last annual conference of the International Civil Aviation English Association (ICAEA) in May 2018, the emphatic response was that the ICAO test should not be used with AMTs. Clearly, we need to develop our own. Once we have our curriculum developed, we will have content from which to create test items.

Unfortunately, though, many language training program administrators, or academic program administrators above them, the world over push for the use of international standardized tests. They feel they "should" use these standardized tests because they are more widely recognized than tests customized to the given industry sectors of their individual programs. Some of these tests used as "gateways" into academic study or to cross other thresholds are the:

TOEFL – Test of English as a Foreign Language (traditionally academic in orientation)

TOEIC – Test of English for International Communication (intended to be more business oriented)

IELTS – International English Language Testing System (billed for international study, migration, and work)

These tests don't serve our purposes at all, though. They are not customized to any particular industry sector and certainly not to AMT. Thankfully, a compromise strategy has been developed to still use content from a customized curriculum for the test items, but score these test items against an internationally recognized framework of levels of proficiency. This framework of proficiency levels has been developed by the Common European Framework of Reference for Languages (known as the CEFR, for short). Although the CEFR originated in Europe, it is spreading in usage around the world. One program that implemented this strategy was in the Kingdom of Saudi Arabia with a curriculum of English for Elastomer (synthetic rubber) Technology.[1] This program prepares graduates to work in the tire manufacturing sector. But the same principle of using internationally recognized levels of proficiency with customized content would still apply as a model for an AMT English test.

INITIATIVES TO PURSUE NOW TO ADVANCE AMT ENGLISH TRAINING

So, what can be done now to move the field forward for AMT English training?

1. Recognize that a customized approach provides a more efficient and productive "solution" for AMT English training than the approach of General English. (General English may be appropriate for learners with needs for Coping Skills English – but not for technical English.)
2. Make this case with institutional administrators and decision makers. (Draw from the rationales laid out in this article.)
3. Seek funding for this initiative from sources such as the recently passed U.S. Congressional budget for the FAA (U.S., H.R. 302, FAA Reauthorization Act of 2018).
    a. Included in the budget is $5 Million for workforce development as part of addressing work shortage strategies
    b. Eligible projects to support the education of aviation maintenance technical workers and the development of the aviation maintenance workforce include:
        i. New educational programs that teach technical skills used in aviation maintenance, ... or to improve existing such programs
        ii. To support outreach about careers in the aviation maintenance industry to..... communities underrepresented in the industry
        iii. To support educational opportunities related to aviation maintenance in economically disadvantaged geographic areas
        iv. To support transition to careers in aviation maintenance, including for members of the Armed Forces
        v. To otherwise enhance aviation maintenance technical education or the aviation maintenance industry workforce

AMT English training programs could be developed under eligible projects, as above, specifically to:

- Improve existing programs – to enable ESL stu-

[1] The University of Akron, Ohio, USA under contract with the High Institute for Elastomer Industries, Yanbu, Kingdom of Saudi Arabia, subcontracted this development of a customized test, scored against the CEFR proficiency levels, to Northern Arizona University, Flagstaff, Arizona, USA, across 2015-2016.

dents to gain the necessary proficiency to grasp/access technical training

- Support outreach to communities underrepresented in the industry – such as ESL students who will not be able to grasp/access technical training without customized AMT English training first
- Support transition to careers in aviation maintenance – through preparatory customized AMT English training that will allow trainees to grasp/access technical training
- Otherwise enhance aviation maintenance technical education – with the addition of preparatory customized AMT English training that will allow trainees to grasp/access technical training

4. Engage Academic English/Workplace English specialists in initiatives to develop customized AMT English curricula.

   Contact professional associations with internal ESP specialty groups for Academic English/Workplace English professionals who can provide a record of proven experience in such curriculum development—and correlated teacher training.

   Two such professional associations are:

   a. Teachers of English to Speakers of Other Languages (TESOL), Inc. www.tesol.org.

      ESP Interest Section

      Affiliates around the world, with headquarters in Alexandria, VA, USA

   b. International Association of Teachers of English as a Foreign Language (IATEFL) www.iatefl.org.

      Business English Special Interest Group (BE SIG)

      ESP Special Interest Group (ESP SIG)

      Also with affiliates around the world, with headquarters in Faversham, Kent, UK

5. ESP professionals from these associations can also build in the training of General English teachers in Academic English/Workplace English content as part of the process of developing the curriculum. This is best done in partnership with the TESOL training program of a university (or similar entity), so teachers can receive credit for their training.

   A very effective model for such teacher training for Workplace English is based on conducting the teacher training while working with a client who wants such a curriculum (and program).

   - Thus, all needs assessment and collaboration is carried out in real-time at an active worksite, with the Workplace English specialist modeling the process, while also maintaining quality control.
   - Upon completing the training, the teachers are essentially guaranteed a job with the given workplace client. The client, in turn, is also guaranteed a high-quality curriculum, with teachers already in relationship with the target learners and other staff at the workplace. This is a win-win situation.

6. Once the customized curriculum is developed, a customized test can be developed. It can follow the model of scoring test items, drawn from the customized curriculum, against the internationally recognized CEFR levels of proficiency.

7. Look for the completion of the formation of a Special Interest Group (SIG) for Aviation English within the International Language Testing Association (ILTA). See www.ilta.org.

   (Plans to form this SIG were just announced in the September 2018 Newsletter of ILTA.)

8. Become a member of the ICAEA (the International Civil Aviation English Association). See www.icaea.org. Membership is free, and leadership is intentionally expanding its focus from pilots and air traffic controllers to also include aviation maintenance technicians. The next annual international conference will be held in Tokyo, Japan, May 8–10, 2019.

So, to summarize, AMT English training can be advanced through the development of a customized curriculum, a customized test, and teacher training customized to Academic English/Workplace English. By spreading the word to educate about and encourage these initiatives, more AMT trainees can be served well around the world and can more likely take their place in the AMT labor force. This can only help alleviate the urgent worldwide shortage.

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