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The following authors are recognized for their contributions to this volume:

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W. J. Haynie, III, Ph.D.
Executive Editor

Refereed Articles

Doing More with Less: Aligning Freeware Applications with the North Carolina "Exploring Technology Systems" Curriculum

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Introduction

In 2009, the United States is facing some of the worst economic conditions since the Great Depression, and many experts agree that we are experiencing a recession which will affect many sectors of our society (Wyss & Bovino, 2009), (Coy, 2009), (Bauer, & Shenk, 2009). Public school funding, resources and personnel are being reduced and state and federal support for Career and Technical Education (CTE) programs is uncertain as many school systems struggle with payroll and daily operations amid the national recession. The 2008 national budget for CTE included a $20 million decrease in funding due to across-the-board-budget cuts. The Perkins program has not received a substantial increase in funding since 2002, and since that year, funding has decreased by $42 million (http://www.acteonline.org). Recently, according to The Association for Career and Technical Education (ACTE) The American Recovery and Reinvestment Act has proposed $39 billion to local school districts and public colleges and universities but the Perkins Career and Technical Education Act is still the only funding designated in either chamber's bill for CTE programs (http://www.acteonline.org). Further, the ACTE states that these funds delivered through this route will primarily help to "patch" CTE programs in order to avoid program closures and reductions in force. This is difficult to understand when many technical programs have rising enrollments because of the obvious need for workforce development and job preparation. This economic climate is causing CTE teachers to hear the phrase "we will have to do more with less." However, students must still be prepared to enter college and the workforce during these difficult times. With these circumstances, it is imperative that CTE programs learn to adapt so that they may survive and continue to prepare students to compete and lead in the 21st century. According to North Carolina's Five-Year Plan for Career and Technical Education (section e, *Develop, Improve and Expand Access to Appropriate Technology in CTE Programs*) "State-of-the-art technology will be infused through courses as they are developed or revised throughout the North Carolina program (www.ncpublicschools.org). How can this proposition be achieved when CTE program resources are so limited? Decreased funding coupled with higher expectations creates a difficult challenge for educators in need of sophisticated technologies necessary to meet curricular needs.

Lev Gonick, Chief Information Officer at Case Western Reserve University recently stated in an article in *The Chronicle of Higher Education* that the use of open source and freeware technologies will be necessary in order to maintain operations at many academic institutions due to the national economic crisis. There are many technologically advanced freeware applications and operating systems which can be used for teaching and learning at zero cost. Given the current economic situation schools face, these options must be carefully examined and considered. Freeware solutions have the potential to help technology education programs develop and maintain high quality instruction. This paper specifically explains how freeware applications can be integrated and aligned with the North Carolina "Exploring Technology Systems" (ETS) curriculum. The goal of this paper is to provide technology teachers a series of freeware applications which may be used to effectively teach the ETS curriculum despite severe budgetary limitations. The synthesis of this information has the potential to help technology education teachers "do more with less" from an economic perspective, both figuratively and literally, and most importantly, help to better prepare technology students during these difficult times.

Exploring Technology Systems

The North Carolina Technology Education Curriculum provides a clear description of all technology education courses within the standard course of study. "Exploring Technology Systems" is a popular course which sets a solid foundation for further study within the Technology Education curriculum. ETS has no prerequisite and has its broad scope is intended to expose students to a variety of contemporary technologies and help them begin to develop ideas about their careers (North Carolina Standard Course of Study, 2009). This course is greatly influenced by information and communication technologies and relies heavily on computer concepts and applications as a vehicle to understanding the theoretical and philosophical concepts of technology systems on the macro level. Line two of the ETS course description states;

> *"Topics include design and problem solving, technology assessment, technology systems, technical sketching, CAD, graphic design, modeling skills, computer systems, electronics, and audio/visual production"* (North Carolina Standard Course of Study, CTE p 77*).*

This excerpt summarizes the wide array of instructional scenarios which are common in the ETS curriculum. In order to be effective, ETS teachers must have the resources necessary for designing and delivering lessons. Given the diverse nature of the ETS curriculum, technology teachers need suitable and appropriate software applications from which lessons and activities can be designed. Understanding the bleak funding outlook, purchasing commercial software is probably difficult or impossible for many technology teachers. With this in mind, freeware applications can be a viable solution for teachers who have limited or non-existing budgets. The main goal of this paper is to assist technology teachers who are struggling with limited resources to teach and help students achieve and learn despite the fact that they may not have the most popular commercial software in their classrooms.

In the following sections, key ETS course foci from the course description are listed and aligned with freeware applications. Further, these products could also easily be integrated into any technology education course focused around the Standards 11 and 17 in the Standards for Technological Literacy (International Technology Education Association, 2007). After the list found in Table 1, each application is briefly described and discussed. Websites are also provided for further reader investigation and download. The freeware applications listed are not an all-inclusive list of possiblities. Rather, these applications are those which the authors have installed and used for various projects and or experiments with success. Some of the freeware applications discussed in this paper may be used with various computer operating systems (Linux©, Windows© or Macintosh©) and others have specific operating system requirements. As a note of caution, end users should always examine the technical specifications and terms of use for all applications and understand that like commercial software, freeware is subject to various issues.

Table 1: Alignment of Course Foci with Freeware Applications

Course Foci	***Freeware Application***
Design and Problem Solving	Freemind© CmapTools©
Technical Sketching	Google SketchUp© K-Sketch©
CAD & Modeling	Q-CAD© LDraw©
Graphic Design	Gimp© Scribus© Fontforge©
Audio/Visual Production	Audacity© ZS4©

ETS Foci: *Design and Problem Solving*

Technologists value the skill of process and problem analysis. Various tools exist to help in outlining tasks, events, procedures, and other issues. The following freeware and open-source solutions can help teachers instruct students on graphically analyzing problems and processes as well as present brain-storming concepts which can be used in creative problem solving scenarios.

Suggested freeware applications:

1. Freemind© (http://freemind.sourceforge.net)
2. CmapTools© (http://cmap.ihmc.us)

FreeMind© is a freeware mind-mapping or concept-mapping application. It is written in Java and runs on many operating system platforms. FreeMind© is a freeware application which is comparable to Inspiration© concept mapping software. There are “lite” and full versions (noted as min and max versions) which are both free. As a knowledge organization tool, brainstorming tool, or idea support and creation tool it offers an easy to user interface and many useful built-in options, such as export to PDF format. Links to ideas can also be hyperlinked uniform resource locators. CmapTools© shares many of the features of FreeMind©, except that there is a stand-alone version and a client/server version for groups working together. As with FreeMind©, you can link to URL's on the Internet. The stand-alone version has very minimal memory requirements so that it can run on older computers and platforms such as the Intel©

Classmate and the OLPC XO (One Laptop Per Child PC). Projects may also be exported as a webpage.

ETS Foci: *Technical Sketching*

Depending on whether you are teaching a certain technical sketching application or generalized principles that apply you all technical drawing, you may find some value in free and open-source solutions related to this area. There are numerous commercial applications available on the market. However, the cost-savings which free and open-source software bring to the table demand that the applications at least be considered given the economic situations most schools face. In that light, consider the following solutions.

Suggested freeware applications:

1. K-Sketch© (http://www.k-sketch.org)
2. Google© SketchUp (http://sketchup.google.com)

K-Sketch© offers the user to easily make animations in Shockwave© Flash format which can be saved and used on a web site. The interface is simple and learning curve is not steep on this product. Setting options can be adjusted to enable advanced features. Commercial tools used for creating animation are often complex, so K-Sketch© offers a nice starting point for beginners. Google© SketchUp is a free application in basic form and has a low cost "professional" version with more features if needed. Basic features include templates, architectural and engineering aspects, Google© Earth integration and more. Additionally, Google© SketchUp has built-in video tutorials.

ETS Foci: *CAD & Modeling*

As commercial CAD software is typically not free, a freeware/open-source option for schools and colleges looking for a low-cost alternative to teach generalized concepts fits well with the current economic situation as of 2009. Again, it depends on whether or not you are teaching certain technical skills related to a particular application or if you are teaching generalized principals that apply to many CAD packages. As with other areas, certainly no one would argue that there are several commercial applications for this area, however the cost-savings that open-source software bring to the table demand that the applications listed at least be examined. Consider the following freeware and open-source solutions for teaching CAD and modeling.

Suggested freeware applications:

1. Q-CAD© (http://sourceforge.net/projects/qcadbin-win)
2. LDraw© (http://www.ldraw.org) *along with Lpub (http://lpub.sourceforge.net) & L3PAO (http://l3pao.malagraphixia.com)*

Commercial CAD programs can be very expensive and out of reach for educators on a budget. Q-CAD© may be a viable alternative to more popular programs if two dimension CAD is applicable for the concepts being taught. If 3D modeling is necessary then this package will not suffice. If 2D modeling, then Q-CAD© offers a free version, a path to a more powerful commercial version, and many training books and videos for instruction (not free). The company who developed Q-CAD© (Ribbonsoft.com) sells compiled, closed-source versions of the program for a variety of platforms, but also gives away the source code (a few versions old) so that you can compile your own copy for free (Note: A pre-compiled, ready to install version for Windows© is linked above at or you could use the factory pre-compiled version that comes with an Ubuntu© Linux© operating system install). LDraw© is a free 3D CAD modeling and rendering package, based on pre-defined and user-defined LEGO© bricks. If you are working with any robotics programming (such as with the LEGO© Mindstorms RCX bricks or the newer NXT LEGO© robots) then this is just the ticket for students. Students can design a construction (such as a robot), examine it in 3D, then render the final image, perhaps for import into a video! Add to this that if you have one of the Mindstorms© robotics kits that they could actually build what they prototyped on the computer and you have a very powerful (and free) end-to-end solution for future engineers. When you download the full package from www.ldraw.org, you actually get several applications. Most of the applications bundled in the installer are available also as separate Sourceforge© or other projects. The bundled applications include: MLCAD© (CAD), POV (point of view rendering), Lpub© (produces construction documentation from an MLCAD file, Ldview© (allows you to view and rotate 3D wireframe models from MLCAD), and L3P (command-line application which allows you to create a file from your MLCAD© construction that can be rendered in 3D with your POV application).

ETS Foci: *Graphic Design*

Common software applications for graphic design typically include one or more of the Adobe © suite of products. Being commercial applications, they do require the end user to purchase either individual products or a site license for use. Freeware and open-source alternatives offer similar features and capabilities. If the goal is teaching generalized concepts, then the following applications are strategically positioned to offer solutions in the areas of graphics manipulation, desktop publishing, and font creation.

Suggested freeware applications:

1. GIMP© (http://www.gimp.org)
2. Scribus© (http://www.scribus.net)
3. Fontforge© (http://fontforge.sourceforge.net)

GIMP© (GNU Image Manipulation Program) is a photo/image manipulation tool that in some ways rivals Adobe© Photoshop. Far more than a basic “Paint” package, GIMP© offers professional features to control all aspects of an image, such as color, shape, sharpness and hue. Images can be adjusted and exported to a wide array of file formats.
Scribus© is a freeware package similar to Adobe© Pagemaker and Microsoft© Publisher. Scribus© is an outstanding open-source desktop publishing application that has been released for

quite a few years as of 2009. Scribus© offers a professional set of features which could allow students to learn skills which are generalized to any desktop publishing application. Fontforge© allows you to create your own fonts. Most require a Linux©/Unix© or MacOS© system, but can be run on Windows versions either via virtual machine, via emulation with something like VirtualBox© from Sun©, or Microsoft© Virtual PC, or via and Linux© on a Windows© platform.

ETS Foci: *Audio/Visual Production*

Windows© and Macintosh© computers typically come with audio and video editing software, however often an instructor wants students to either be exposed to more feature-rich software or exposed to other tools to better prepare them for a diverse workplace. The following audio and video manipulation tools are very powerful and offer possible solutions for an instructor looking for more creative control or variety without the high associated costs of many commercial applications.

Suggested freeware applications:

1. ZS4© Video Editor (http://www.zs4.net/)
2. Audacity© (http://audacity.sourceforge.net/)

ZS4© is a freeware alternative to Windows© Movie Maker (which is free with Windows operating system). ZS4offers the ability to export to Windows© or Real Player© format, and is fairly straightforward in use. ZS4© is only a Windows© application, but does offer some interesting features and many online tutorials. One interesting feature is the "pan and zoom" ability which might allow the user to take a photo and apply motion graphics to older still photos. As needed, technologists might create an .avi clip in ZS4© and import it into another video editing package, as a clip such as Windows© Movie Maker and combine the effects and abilities of both packages to create a polished final product.

Audacity© is a free sound editing and recording package. This software is so popular that is often bundled and distributed with commercial recording equipment. Audacity offers the ability to use industry standard plug-ins which allow for technical effects, such as taking a recording and making it sound as if it was originally recorded on a vinyl LP album (see http://www.izotope.com/products/audio/vinyl/). Considering that this application allows the use of VST plug-ins, is multi-track, has a variety of export and import options, and is constantly updated, and you have a very powerful and well supported audio engineering tool.

Conclusion

Given the current economic conditions, it is wise for technology educators to make the most of the resources which they have available. Anyone who has visited schools throughout eastern North Carolina can attest that there are many classrooms which are using antiquated software. With antiquated software on one hand and budget shortfalls on the other, one is reminded of the preverbal "rock and a hard spot" for many technology educators. The material discussed above represents the author's attempts at helping to alleviate some of the problems classrooms are currently facing.

In his book, *Technological Change* (1970) Harvard University Professor of Technology E.G. Mesthene asked if the advancement of computers means the end of freedom or a new beginning. The short answer in this case is a new beginning. Advances in freeware applications have opened doors for people without the means to buy commercial software. The freeware titles discussed here are typically easily installed and will function well on older computers because they are lacking the “bloatware” that many commercial software programs contain for advertising and such. Unfortunately, freeware doesn’t come with instruction manuals, but most technology-savvy people will attest that you can find answers to any problems in the plethora of blogs, forums and community websites at any time. And like any software, freeware is not a utopia. There are problems which must be navigated. Perhaps the biggest challenge that educators face is the communication which must happen between the teacher and the school/district technology support personnel. Technical support personnel must be informed of the opportunities the freeware offer given the shortage of funds for buying new software. In these challenging times, everyone in the educational system must work together to solve problems caused by limited funding. Freeware applications are an opportunity to do “more with less” as we prepare students to be productive in a defining era in our economic history.

References

Association for Career and Technical Education. (2009). Retrieved February 22, 2009 from http://www.acteonline.org.

Bauer, P., & Shenk, M. (2009, February). Economic Activity: Dating a Recession and Predicting Its Demise. *Economic Trends (07482922)*, Retrieved April 7, 2009, from Academic Search Premier Database.

Coy, P. (2009, March 5). Job Data Expected to Point to a Deeper Recession. *Business Week Online*, Retrieved April 7, 2009, from Academic Search Premier Database.

Gonick L. (2009) How Technology Will Reshape Academe After the Economic Crisis. *The Chronicle of Higher Education*. Retrieved February 24, 2009 from http://chronicle.com.

International Technology Education Association. (2007/2002/2000). Standards for technological literacy: Content for the study of technology. Reston, VA: Author.

Mesthene E. (1970). *Technological change: Its impact on man and society*. New York: New American Library.

North Carolina's Five-Year Plan for Career and Technical Education (section e, *Develop, Improve, and Expand Access to Appropriate Technology in CTE Programs*). Retrieved February 20, 2009 from www.ncpublicschools.org.

North Carolina Technology Education Curriculum Area and Descriptions Retrieved February 20, 2009 from http://www.ncpublicschools.org/docs/cte/scos.pdf.

Wyss, D., & Bovino, B. (2009, January 26). A Deep and Long Recession. *Business Week Online*, Retrieved April 7, 2009, from Academic Search Premier Database.

Summer Youth Technology Programs
Improving Middle School Students Awareness of Technology and the Role of Technology in Their Lives

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Introduction

Two youth technology camps were offered at North Carolina A&T State University in the School of Technology in the summer of 2008 to increase the number of female students who pursue and succeed in careers related to science, technology, engineering, and math (STEM). The enrichment programs were geared to attract nontraditional students to the technology fields in grades six through eight. The need to increase the number of nontraditional students in fields related to STEM is apparent due to the underrepresentation of women and minorities among professionals in these careers.

Advertisement

Both programs were advertised through an Aggie Camp booklet produced by the North Carolina A&T State University Office of Summer Sessions & Outreach. The Summer Sessions Division also conducts a Summer Program Fair which advertised on the university radio station, local newspapers and the university website. This event attracts students and parents from the entire country to determine the summer program which best accommodates the individual child's needs.

Project Rational

Cornelia Ashby (2006) presented a study to the House of Representatives that stated there is a need for diversity to help offset workforce deficiencies in the United States. This report also stated that America's economic well being and ranking in the global community was contingent upon its science and technology industries. The study went on to say that there is uncertainty if the numbers of Science, Technology, Engineering, and Mathematics (STEM) graduates will be sufficient to meet the future needed needs of this country. There are a number of factors affecting this potential shortage of STEM workers in the country. First of all, during the past decade the percentage of American students receiving STEM degrees fell from 32% to 27% of all college graduates, despite increases in overall numbers of college enrollment. There has also been a Post 9/11 decrease in the numbers of foreign students seeking advanced degrees in the country. Additionally, the American workforce only experienced an insignificant increase from 38% to 39% over the past decade (Ashby, 2006).

CADD Summer Institute

The CADD Summer Institute served youth (n = 4; 2 females and 2 males) middle school students in grades six through eight. This age group was selected to provide these participants a clearer understanding of the profession by giving them information on the field coupled with concrete, hands-on, industry related activities (Carlson, 2004). The goal of this summer institute was to introduce students to career choices, such as the field of computer aided design and drafting (CADD) and potentially influence future career choices. The information presented in this institute provided students with an understanding of the purpose, principles and career prospects relative to the CADD industry. Students who completed this institute may develop an interest in this discipline that could develop into a career in the CADD Industry. The more students, young women in particular, who elect to pursue high-tech careers, could help this country maintain its position within the global community.

Young girls participating in this summer institute gained a greater understating of the CADD industry. Students learned the foundational principles relative to CADD, technical sketching principles and visualization strategies for viewing and describing objects, and gained an understanding of software utilized by CADD professionals. Learners engaged in an interactive lesson format. The instructor coordinated lectures in a hands-on lab environment to allow students the opportunity to apply the principles presented during the lecture.

Weekly Plan

Day 1: Introduction to CADD

1. The participants arrived to class the first day of camp. The teacher welcomed them to the university and asked each student to tell the class their name, grade, experience with CADD software, and their career goals.
2. Students were given an overview of CADD as a career path. Then the learners were given a basic introduction to engineering design graphics techniques which would be foundational for utilizing CADD to draw objects.
3. The first activity the campers were involved in was to construct a three dimensional object from building blocks. This approach was taken to give students a hands-on visual object from which to create both sketches and drawings.
4. Participants were then introduced to orthographic views of objects and principles of technical sketching. They also learned some principles for dimensioning sketches of orthographic projections.

Day 2: Introduction to computer generated drawings

1. The second day of class the students were given an overview of AutoCad 2008 software. They were taught how to input data into the computer and how to begin a new drawing.
2. Participants were instructed to retrieve the sketch of the object they had first constructed, and then sketch it onto grid paper. Then they created electronic drawings of the object utilizing AutoCad software.
3. The students also learned how to dimension and how to save drawings electronically. The campers were given a test at the end of this session. The students were presented with a three dimensional object to draw (toy auto). The teacher informed them that the first person finished would win the toy as a prize. The seventh grade male student won the prize.

Day 3: Explanation of geometric shapes

1. The third day of the camp the instructor explained how geometry affects the build world and how to draw geometric shapes electronically.

2. The students were also introduced to inserting text onto drawings and plotting drawings from model space. The participants learned how to create various layers and line types.
3. The campers also had an opportunity to experiment with textures included in hatch and gradient. The students were given another three dimensional object to draw at the end of class (toy airplane). The sixth grade male student finished first and won this prize.

Day 4: Introduction to plotting drawing from paper space

1. Students learned how to insert a title block template, and then zoom into specific areas on the title block to fill in identifying information.
2. The campers then took a field trip to the university library to begin researching the career path of his/her choice.
3. Some of the questions students were asked to answer included: What career he/she wanted to pursue, what type of activities should they expect to be involved in on a daily basis, and how much money should he/she expect to earn in this career.
4. The participants were given time to write up summaries of their findings in the library and finish filling out title blocks.
5. This day ended with another test. A three dimensional object (slinky) was presented for the students to sketch electronically. The seventh grade male was the winner of this prize.

Day 5: Overview of CADD industry

1. Students spent time completing the career summaries they had begun at the library.
2. The campers also had to compile a portfolio of the report, sketches and drawings they had completed during the week. Each student was given an opportunity to present a report on the career path he/she was most interested in.
3. The seventh grade male presented CADD as his career choice. The sixth grade boy presented engineering. The eighth grade female did not complete this report. The sixth grade female presented on law as a career choice.
4. The three dimensional object presented for students to draw on the final day was a North Carolina A&T State University Tee shirt. The eighth grade girl won.

Youth Technology Institute

The Youth Technology Institute (YTI) served youths (n = 9; 3 females and 6 males). The YTI was a one week summer technology program for middle school students. It provided young learners an opportunity to visit North Carolina A&T State University technology programs and laboratories and participate in challenging hands-on technology and problem solving activities that were planned and directed by faculty. The major objectives of the program were to:

- Promote interest in technology programs through the development of summer camps by educating middle school students about technology careers.
- Help middle school students understand technology by engaging them in challenging technology activities to develop their problem solving skills and manipulative skills through hands-on activities.
- Improve middle school students' awareness of technology and the role of technology in their lives.
- Develop middle schools students' ability to communicate effectively in a technological world.

- Create a marketing strategy in order to promote the project and technology programs as vital sources of education, research, and service within the profession of technology.

Weekly Plan:
Day 1: Introductions and Technology defined

1. Participants were welcomed to the School of Technology by the camp director and asked to introduce themselves. Additionally, the students completed a questionnaire that included their demographics.
2. The director asked the students to write their definition of technology on a note card. R. Thomas Wright (2008) states that "technology is humans using objects (tools, machines, systems, and materials) to change the natural and human-made (built) environment (p. 17). Below are examples of the students' definitions:
    - Working with such things as electronics, computers, etc.
    - Using computers, microwave, tv, projectors, cell phone, etc.
    - Something that helps someone do something easier that is man made.
    - The use of something to fit your needs or the needs of society.
3. Problem Solving activity (wind car). Participants built a Huffer and Puffer car using the following material:
    - nonbendable, plastic drinking straws
    - 4 Lifesavers; Some students ate the lifesavers
    - 1 piece of paper
    - 2 paper clips
    - Tape
    - Scissors
4. Students were introduced to electrical components. Learners completed an electronics activity on a circuit board and drew schematic symbols (battery, transistor, switch, resistor, lamp, inductor and capacitor).

Day 2: Students completed other Technology activities

1. Campers created a powerpoint presentation on the following types of bridges: truss, cantilever, suspension, arch and beam.
2. Learners discussed the following Simple Machines: wheel and axle, level, pulley, inclined plan, and wedge and screw.
3. Students brainstormed ideas and created their own inventions/innovations. They also completed a worksheet on their solutions which described the purpose of the idea, physical structure, how idea operates/function, unique features, etc.

Day 3: Students went on a tour of the School of Technology and campus, and continued working on Technology activities

1. Participants visited the Printing, Manufacturing, and Construction Laboratories in the School of Technology
2. Students located technology books in the Teacher Resource center of the university library.
3. Teams of two students created their own 30 second Video Commercial. The following steps were followed:

- Brainstorm ideas about material going to film.
- Created a script and storyboard for the actors to go by.
- Rehearsed and timed (30 seconds) the sequence of events. Recorded and edited the footage.
- One student stated, "The video was a great experience to us all. We would love to do it again!!"

Day 4: Students were introduced to AutoCad software and continued working on Technology activities

1. Dr. Elinor Blackwell, CADD Summer Institute Director, introduced the participants to AutoCad drawings techniques.
2. Students researched African American Inventors on the internet and in books. Some examples of these great Americans that the campers located were:
   - Richard Spikes - Automatic Gear Shift
   - Virgie M. Ammons - Fireplace Damper
   - G. Cook May - Auto Fishing Device
   - Louise H. Andrews - Lens Holder Accessory
   - Frederick M. Jones - Air Conditioning Unit
   - Patricia Bath, M.D. - Apparatus for Ablating & Removing Cataract Lenses
   - Granville T. Woods - Auto Cut-Off Switch
   - Miriam E. Benjamin - Gong and Signal Chair for Hotels and the Like
   - Sarah Boone - Ironing Board
   - Benjamin Banneker – Almanac

Day 5: Students were introduced to Photobooth software and the conclusion of the camp.

1. Alex Uzokowe, a graphics instructor in the School of Technology, introduced the participants to the Photobooth program. Learners manipulated their pictures and images using the program.
2. Students were asked to list their pros/cons of the institute. Campers listed the following items:
   - Pros
     - Fun using the circuit board.
     - Like making friends.
     - I liked the cafeteria.
     - Using the computer.
     - Tours.
     - Doing research – Learning history.
     - Problem solving activity (wind car).
   - Cons
     - Walking up and down the stairs to get to classrooms. I was tired. So I managed it.
     - Walking to the cafeteria.
     - Cafeteria food.
     - Circuit activity.

3. Participants presented their activities for the week in a PowerPoint presentation to all summer campers, parents and directors.

Impact/Outreach

Students learned and understood technology principles, engaged in technology activities, and improved their awareness of technology and the role of technology in their lives. Participants visited laboratories and learned about the many technology programs at North Carolina A&T State University. Faculty and instructors coordinated lectures in a laboratory setting which allowed participants to improve their problem solving and manipulative skills through hands-on activities. Ultimately, the programs' goal was to provide a pipeline of diverse students participating in STEM school programs.

The concepts and experiences students gained from these two summer institutes could be the catalyst that sparks a life-long interest in CADD and other technology careers that these participants may have considered out of their reach. The interest generated in the programs may lead to students choosing technology fields as an individual career path. The young women who select technology professions in the future can be instrumental in helping this country maintain its competitive edge in the global economy.

References

Ashby, C. M. (2006). Science, technology, engineering, and mathematics trends and the role of federal program. Testimony before the Committee on Education and the Workforce, House of Representative. GAO-06-702T. Retrieved September 2, 2006, from http://www.gao.gov/cgi-bin/getrpt?GAO-06-702T

Carlson, B. (2004). Career Resources Network Project: Gender, Diversities & Technology Institute Education Development Center, Inc. Retrieved January 11, 2008, from http://www2.edc.org/gdi/publications_SR/CareerLitReviewSumm.pdf

Wright, R. T. (2008). *Technology.* Tinley Park, IL: The Goodheart-Willcox Company.

Design Without Make – A Pedogogy

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The American Society for Engineering Education (ASEE) describes how high school "students are required to invent a new product or design an improvement to an existing product" (2008). *Design-Without-Make* is a new pedagogical concept of engineering design that may address this need. Originating in London, this innovative methodology allows students to have creative design experiences without emphasis on building or project construction.

Barlex (2007) indicates that while still a hands-on project based approach, Design-Without-Make saves time, money, and allows for greater student design creativity. It places more emphasis on teaching and learning the design process rather than focusing on mechanistic prototyping outcomes. We believe this student-centered intuitive, inventive practice has potential to play an important role in moving technology and engineering education toward STEM education.

Introduction to the Literature

Throughout the years, technology educators have been bridging the gap between other core subjects in education. Often this is done using innovative projects, which are creatively designed and implemented to provide students with meaningful learning experiences (Banks & Jackson, 2007). However, with new standards, shortages in funding, and greater teacher accountability through state testing, teachers may be pressured for time and funds throughout the educational year. Therefore, teachers are forced to modify curricula to include fewer projects, discouraging creativity. The design-without-make pedagogy comes from David Barlex of England. In a design-without-make activity, students progress through the stages of the design process, much as they would in a design-with-make project, just without the prototyping stage. The construction skills they possess or the resources available to their particular school do not limit students, since no building is done. This allows for greater freedom in creative designing for technology students of all ages.

Social Learning Theories

Success in education can be directly linked to research done in social learning by Vygotsky (Davydov & Kerr, 1995), John-Steiner (2000), and Murphy & Hennessy (2001). Designing is a "social activity drawing on interaction between pupil/pupil and pupil/teacher" (Trebell, 2007, p. 2). Teaching tools such as scaffolding and group work are very important in the social learning classroom. Vygotsky encourages teachers to challenge students by designing lessons that kept students in their *zone of proximal development*, which is a level of performance just above what the student can achieve on their own, but not more than they can achieve with the teacher's help (1978). He concludes that students learn and reason verbally and that the teacher is only there to provide the social interaction that students need since students learn through social interactions with knowledgeable members of culture (Gredler, 2005).

The Case for Design and Creativity

With the prevalence of so many learning standards and standardized testing in the education system today, teachers spend more time teaching to the test than to the skills students really need to be successful in society. Sternberg, Reznitskaya, and Jarvin (2007) state that "[t]he memory and analytical skills that are so central to intelligence are certainly important for school and life success, but perhaps they are not sufficient" (p.144). They proposes the "purpose of education is to develop not only knowledge and skills, but also the ability to use one's knowledge and skills effectively" (p.144). This method of educating students to use knowledge and skills is called educating for wisdom. Wisdom is made up of a combination of intelligence, creativity, and wisdom, which is then influenced by one's personal value system on interpersonal, intrapersonal, and extrapersonal levels.

Each aspect of Sternberg, Reznitskaya, and Jarvin's (2007) personal value system applies to the International Technology Education Association's (ITEA) *Standards for Technological Literacy* (STL) and is closely tied to topics addressed in technology education. Learning standards and standardized testing intend to help teachers ensure students are gaining the knowledge base that the authors report, but how do teachers encourage their students to develop creativity? Why does it matter?

Creativity is becoming increasingly more important to the future of society, providing for ever-broadening, multidisciplinary creativity and innovation (Badran, 2007). For years experts have encouraged technology education teachers to take an interdisciplinary, if not multidisciplinary, approach in their teaching. Most teachers have tried to use projects of varying types as a means to an end of connecting the various disciplines into hands-on creative ventures where the children get to express themselves. As educational standards continue to become stricter from year to year, teachers are forced to remove creative projects from their curricula to improve test scores. Now other ways to encourage creativity might be better integrated into curricula than time consuming, tangible projects.

According to the literature, there are a few necessities to developing a creative classroom. First, creativity "involves departing from the facts (norms), finding new ways, making unusual association, or seeing unexpected solutions" (Badran, 2007, p.575). Therefore, creativity can be defined as a process, which must be viewed as an investment consisting of a commitment of time, effort, and resources (Badran). Second, the "Intrinsic Motivation Theory Principle of Creativity…defines that intrinsic, emotionally engaging activities are highly conducive to creative acts" (Spendlove, 2007, p. 52). Spendlove also lists five criterion sure to stifle creativity:

- expected reward
- expected evaluation
- surveillance
- time limits
- completion

Conversely, Badran lays out a more positive formula for creativity in the classroom:

Creativity = Function {Intelligence, Knowledge, Thinking, Personality, Imagination, Motivation, Environment} (p.576)

In order to cultivate a technology education learning environment that develops and encourages creativity in its students, a well-rounded technology educator must be present. This person should be "creative, well-experienced…capable of steering the interest of students in solving problems, finding new solutions, taking risk…[and have] a mix of academia, practice, art and imagination" (Badran, 2007, p. 581). Badran says that co-curricular activities, teamwork, diversified activities, and strong ties with industry are also important factors for developing creativity in the classroom.

Project Based Learning

Project-based learning is a method of teaching problem solving skills in which students work together as they progress through a series of steps to design, implement, and evaluate solutions to real world problems (Mills & Treagust, 2003). Technology education in North Carolina is built around this concept with its hands-on laboratory exercises that allow students to gain real-world experiences in developing, implementing, and evaluating technologies (North Carolina Department of Public Instruction, 2006). In their research, Banks and Jackson (2007), describe how many students are motivated to take classes in technology education because of its experiential, project-based approach.

Design-With-Make. Traditionally technology educators have used design-with-make projects to enhance, encourage, and allow for creativity among its students. For instance, when provided with LEGO™ robotics programming modules, students can easily create and develop interactive storylines and props to accompany any discipline; even literature (Berg, Pezalla-Granlund, Resnick, & Rusk, 2008). However, Spendlove's (2007) research has shown that

> "[p]oor practice with education is often focused for reasons of expediency on the product stages of the creative process and in doing so bypassing the essential creative (person) and learning (process) elements and resulting in embellished, rather than creative, novel and inspiring, outcomes with limited contextualized learning, emotional engagement or opportunities to engage in risk taking and uncertainty." (p. 53)

Kipperman and Sanders (2007) outline six basic steps in every technology education design-with-make activity:

- identify and clarify problems
- conduct research which might involve investigations
- generate one or more design proposals
- develop these so that they can be scrutinized for predicted performance and social/environmental impact
- construct a prototype of the most promising design, experimenting with subcomponent designs as necessary
- test/evaluate the constructed solution (p. 227).

They also recommend that students document all procedures throughout the design and building process.

In technology education, this is commonly referred to as a design log, design brief, engineering log, or design journal. Regardless of the name, portfolio assessments tend to be ineffective, as they are commonly not completed during the design and construction process, but rather after construction is finished (Barlex, 2007). A process Trebell thinks has "become far too mechanistic" (2007, p. 3).

Some easily integrated substitutes for projects that fit well into standards based technology education curricula and still encourage creativity are history of engineering, biographies of inventors, technical writing, and visits from professionals in technological fields (Badran, 2007). Nevertheless, many students enroll in technology education courses because in their other classes they say "there [is] too much note-taking in the classroom and not enough hands-on learning" (Schwartz, 2007, p. 94). Perhaps then, a middle-ground solution still exists allowing for a hands-on design project effect without the time consuming prototyping phase. This process is called *Design-Without-Make*.

Design-Without-Make. Barlex & Trebell (2008) describe a design-without-make activity as designed around six key concepts: pupils

- design, but not make
- design products and services for the future
- use new and emerging technologies in their design proposals
- write their own design briefs
- work in groups
- present their proposals to their peers, teachers and mentors and to adult audiences at innovation conferences (p. 124)

They define creative activities as "having four characteristics: (a), imaginative thought or behavior, (b) purpose, (c) originality (new to the creator) and (d) an outcome of value" (p.121). To develop creativity, "children must be actively involved in the learning process" (p.121) through activities involving group work and collaboration. Barlex and Trebell encourage teachers to challenge students using design-without-make activities that force them to design products based on conceptual (what it does), technical (how it works), aesthetic (what it looks like), constructional (how it fits together), and marketing (who it's for) criteria without actually having to manufacture a final product for grading.

Design-without-make activities work well in creative learning environments as defined by Isaksen (as cited in Peterson, 2001). Peterson concludes that the more challenge, freedom, support, trust, prestige-free discussions, humor, and risk-taking the individual perceives in the immediate social work environment the more opportunity the student has to be creative. This description is closely linked to the beliefs Barlex (2007) identifies as necessary for teachers who wish to host design-without-make activities in their classroom. He indicates teachers who believe

- students intellectual abilities are socially and culturally developed
- tasks need to be culturally authentic
- prior knowledge and cultural perspectives shape new learning
- learners construct rather than receive meaning
- pupils share responsibility for learning with teachers
- pupils are motivated by dilemmas to which they are emotionally committed

will be most successful at integrating design-without-make activities (p. 156).

Banks and Jackson (2007) point out that despite many students being motivated to take technology courses because of the hands-on process of physically making a product, physical artifacts often lack any creativity or innovation on the point of the student, due to teacher designed plans. While these projects are easy to implement and fun for students to construct, often evaluation is based on product completion and an accompanying portfolio activity. However, in a series of interviews with students in design and make classrooms, Barlex (2007) learned that students tend to develop design portfolios after the product has been completed, which undermines the entire portfolio activity. Atkinson (2000) asserts that in portfolio evaluation teachers tend to reward ‘thin’ evidence before rewarding students for exhibiting higher-order thinking skills. When an entire class of students’ products are identical in appearance and they are not performing the proper design and problem solving processes during the creation phases of said products, innovative thinking is not apparent in student work, and the study of technology is incomplete.

This is the case for implementing design-without-make activities into Technology Education classrooms. Barlex’s research has “revealed that pupils can be successfully engaged in designing without attendant making and that the current use of the portfolio for assessment purposes is for many pupils a highly demotivating experience” (2007, p.160). He attributes this demotivation to students not recognizing the value of the portfolio due to the way in which it is ineffectively implemented with the project. He also points out that the advantages of collaboration between pupils can be gained in the absence of an emphasis on making (Barlex, 2007).

Advantages of Design-Without-Make. The implementation of design-without-make activities in place of some design-with-make activities within the Technology Education classroom has many advantages. First, design-with-make is often approached as if the act of designing is a linear process, rather than an inter-connected, reflective, non-linear series of steps (Barlex & Trebell, 2008). Figure 1 shows Barlex’s design decision pentagon, which demonstrates the interconnectedness of the elements within the non-linear approach to designing taught in design-without-make activities. Second, group work, active involvement in the learning process, and risk-taking are all encouraged in design-without-make activities (Barlex& Trebell, 2008; Trebell, 2007). These important aspects of a creative learning environment are necessary for students to be innovative designers. A third major advantage of design-without-make in the classroom is the lack of large amounts of physical resources required in traditional design-with-make activities, such as tools, equipment, and consumable materials (Barlex, 2007).

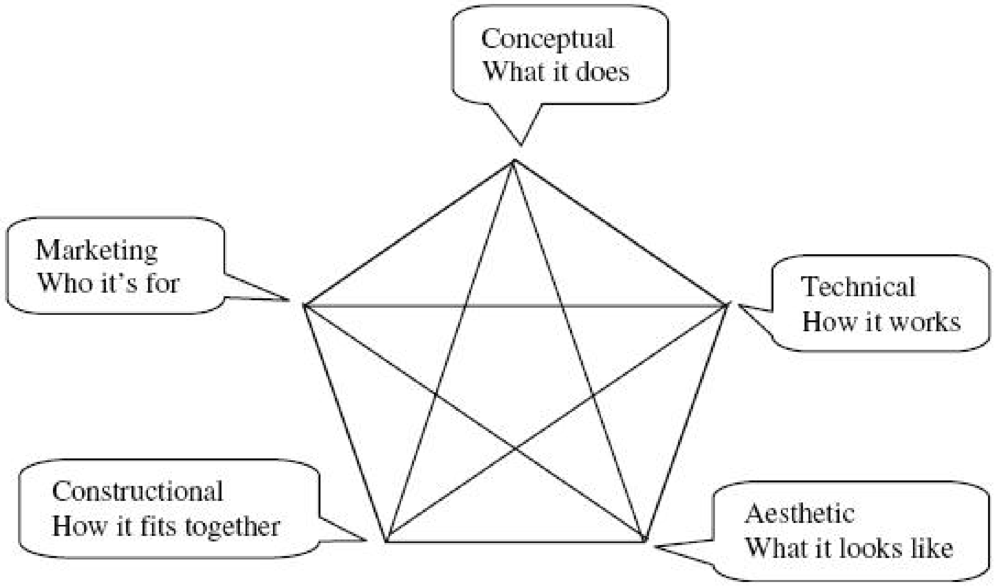

Figure 1. The design decision pentagon.

From "Design-without-make: Challenging the conventional approach to teaching and learning in a design and technology classroom," by D. M. Barlex and D. Trebell, 2007, *International Journal of Technology and Design Education, 18:* p. 122. Copyright 2007 by Springer Science + Business Media.

Yet another advantage is that design-without-make allows a teacher to bring the latest, newest, futuristic technologies into the classroom without any expense to the school. This gives students unrestricted access to innovative design decisions they may not have experienced otherwise. When students are limited by their own personal building skills, they cannot design solutions outside of their own abilities. With design-without-make activities however, they can design solutions to future problems, using future technologies and techniques without the limitation of personal ability (Barlex, 2007; Barlex & Trebell, 2008; Trebell, 2007). Design-without-make activities are not meant to replace all design-with-make activities. There is an inherent need for an understanding of how things are made (Banks, 2007). Design-without-make is useful in emphasizing the preconstruction phases of product development (Barlex, 2007; Barlex & Trebell, 2008; Trebell, 2007), which is often referred to as the design phase.

Introduction to Study

In a design-without-make activity, students progress through the stages of the design process, much as they would in a design-with-make project, just without the prototyping stage. Since students do not actually build the prototype, they are not limited by the construction skills they possess or the resources available to their particular school. This allows for greater freedom in creative designing for technology students of all ages. In an upcoming study, student learning objective achievement and attitudes using design-without-make will be compared to design-with-make.

Problem Statement

This study seeks to discover whether the design-without-make pedagogy is an effective alternative to design-with-make within the technology education project-based learning environment. Design-without-make by nature resolves the issues of time, expense, and over-emphasis of product construction associated with design-with-make activities, while also encouraging creative and innovative design among students. The hypothesis in this study is that students in a design-without-make environment will have as good as, if not better, learning objective achievement than students in a design-with-make classroom.

Purposes of the Study

The purposes of this study are: 1) to assess whether students who participate in design-without-make activities achieve learning outcomes as successfully as or better than students of traditional design-with-make activities, and 2) to determine student and teacher attitudes towards design-without-make activities within technology education.

Basic Methodology

This is a blended study consisting of both quantitative and qualitative components. The quantitative component will use a non-equivalent quasi-experimental design. The control group will be the traditional design-with-make class, while the treatment group will consist of a design-without-make class. Both groups will be presented with pre- and post-tests, which will then be compared statistically using an ANOVA test. Qualitative data will be collected in semi-structured teacher and student interviews.

Using quantitative and qualitative methods, this study seeks to determine whether design-without-make is as effective in student learning as the traditional design-with-make approach to technology education. Data will be gathered from pre- and post-assessments and interviews in which information about teacher and student attitudes will be gathered. This study seeks to discern whether design-without-make is a more feasible approach to teaching design within the project-based learning environment of technology education.

Summary

Design-without-make is a new tool for America’s technology education teachers, which allows for more creativity while increasing the student focus on the design process rather than building a product. This fresh approach to teaching design will develop student knowledge and skills while straying away from the mechanistic, product driven design-with-make projects, allowing for broader thinking and greater innovation. With more research and practice, this tool may prove to be a feasible direction for the future of technology education.

References

ASEE. (2008). PLTW Certified High School South Carolina District's First To Offer College Engineering Credits. *First Bell*.

Atkinson, S. (2000). Does the Need for High Levels of Performance Curtail the Development of Creativity in Design and Technology Project Work? *International Journal of Technology and Design Education, 10*, 255-281.

Badran, I. (2007). Enhancing creativity and innovation in engineering education. *European Journal of Engineering Education, 32*(5), 573-585.

Banks, F. & Jackson, G. O. (2007). The role of making in design & technology. In Barlex, D. (Ed.), *Design & technology for the next generation* (pp. 186-197). Shropshire, England: Cliffe & Company Ltd.

Barlex, D. (2007). Creativity in school design & technology in England: a discussion of influences. *International Journal of Technology and Design Education*, *17,* 149-162.

Barlex, D. M. & Trebell, D. (2008). Design-without-make: Challenging the conventional approach to teaching and learning in a design and technology classroom. *The International Journal of Technology and Design Education*, *18*, 119-138.

Berg, R., Pezalla-Granlund, M., Resnick, M., & Rusk, N. (2008). New pathways into robotics: Strategies for broadening participation. *Journal of Science Education and Technology, 17*, 59-69.

Davydov, V. V. & Kerr, S. T. (1995). The influence of L. S. Vygotsky on education theory, research, and practice. *Educational Researcher, 24*(3), 12-21.

Gredler, M.E. (2005). *Learning and instruction: Theory into practice.* Upper Saddle River, NJ: Pearson, Merrill, Prentice Hall.

International Technology Education Association (ITEA). (2000). *Standards for technological literacy.* Reston, VA: ITEA.

John-Steiner, V. (2000) *Creative Collaboration*. Oxford, Oxford University Press

Kipperman, D. & Sanders, M. (2007). Mind (not) the gap…Take a risk. In Barlex, D. (Ed.), *Design & technology for the next generation* (pp. 186-197). Shropshire, England: Cliffe & Company Ltd.

Mills, J.E. & Treagust, D.F. (2003). Engineering education-Is problem-based or project-based learning the answer? *Australian Journal of Engineering Education*.

Murphy, P. and Hennessy, S. (2001). Realising the potential –and lost opportunities – for peer collaboration in a D and T setting. *The International Journal of Technology and Design Education*, *11*, 203-237

North Carolina Department of Public Instruction (NCDPI). (2006). *Technology Education.* Retrieved Oct. 31, 2008, from http://www.dpi.state.nc.us/cte/technology/index.html

Peterson, R. E. (2001). Establishing the creative environment in Technology Education. *The Technology Teacher, 61,* 7-9.

Schwartz, J. (2007, September 30). Re-engineering engineering. *The New York Times,* pp.6, 94.

Spendlove, D. (2007). The locating of emotion within a creative, learning and product oriented design and technology experience: Person, process, product. *The International Journal of Technology and Design Education*, *18,* 45-57.

Sternberg, R. J., Reznitskaya, A., & Jarvin, L. (2007). Teaching for wisdom: What matters is not just what students know, but how they use it. *London Review of Education*, *5*(2), 143-158.

Schwartz, J. (2007, September 30). Re-engineering engineering. *The New York Times*, pp.6, 94.

Trebell, D. (2007, July). *A literature review in search of an appropriate theoretical perspective to frame a study of designerly activity in secondary design and technology.* Paper presented at the meeting of The Design and Technology Association Education & International Research Conference, Telford, England.

Vygotsky, L. (1978). Interaction between learning and development. In Gauvain & Cole (Eds.) *Readings on the development of children.* New York: Scientific American Books. pp. 34-40.

On the Brink of a Teaching Career: Aspirations and Perceptions of Senior Technology Education (TED) Student-Teachers

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Introduction

After four years of personal sacrifice and study, student-teachers in the industrial technology education disciplines at the University of Technology, Jamaica (UTech) have the choice of a career in education or industry. Technical teacher-education lecturers pride themselves in producing graduates who can perform with equal competence in the industrial field as well as in the classroom. UTech (2005) stated in the accreditation application that the B.Ed. Technical Vocational Education & Training (TVET) degree was created out of a need to:

> . . . prepare competent, professional teachers of technical subjects for the upper levels of the secondary and lower levels of the tertiary education system and instructors for training in the industrial and business sectors . . . facilitating the mastery of the requisite knowledge, skills and professional attitudes . . . provide the appropriate environment for graduates to learn independently, reason clearly and think critically . . . communicate effectively and apply their knowledge and skills to meet the needs of a rapidly changing society. (p. 7)

Teaching is one of those stable professions and vacancies do not always exist for newly qualified graduates emerging from teacher preparation programs in Jamaica each year; and undoubtedly, students have exercised their options and have chosen careers outside of teaching. In the past, pre-service student-teachers were bonded to serve in the Government's education system as repayment for highly subsidized tuition and monthly stipend. This stipend and bonding requirements were phased out in the 1980s and the level of subsidy has been reduced in real terms and is no longer above any other non-teaching program at the university. The current subsidy is approximately 38% of costs for all university students (Personal communication, Dr. K. Nkrumah-Young, V.P. Business & Finance).

The International Technology Education Association's (ITEA) Advancing Excellence in Technological Literacy (AETL) details Student Assessment, Professional Development, and Program Standards for each *Standards for Technological Literacy* (STL). A comparison of AETL objectives and B.Ed. TVET Industrial technology goals show a vast overlapping of concepts and philosophies, albeit geared to different societies. Therefore for the purpose of this paper, and unless otherwise differentiated, Technology Education (TED) and industrial technology education are being used synonymously (See Appendix A).

The logical link between Engineering and Technology Education is recognised by many leaders in TE and has been a recent theme of ITEA's Science Technology Engineering and Mathematics (STEM) philosophy. . Roman (2006) also put the idea before the classroom teachers in *Tech Directions*. This connection is even more pronounced with Industrial Technology Education as practiced within the population in this survey, as few graduates are known to branch into the teaching of Mathematics, Physics and Chemistry at the secondary school level.

The author was invited to speak to final year industrial technology student-teachers at one of their capstone seminars. From a study on industrial technology teachers' leadership perceptions (Johnson, 2004) and observations as a technology teacher educator, the author wanted to get a better understanding of student-teacher's dispositions after leaving the Faculty of Education and Liberal Studies - a 36 year-old teacher training Faculty of UTech. That opportunity of the seminar presentation was seized to capture data on the expectations and thinking of these student-teachers before their venture into the real world beyond graduation. This paper captures the results from this survey over a two year period. The questions were modified slightly to refine and enhance the data collected in the second year. This survey will again be repeated in March 2009.

Review of Related Literature

Choice of Major and Career

Students entering UTech select their major at the time of application to the university. The students that gain admission are not all happy at their choice and they usually end up selecting the B.Ed. TVET in Industrial Technology option as a second choice for various reasons: The applicant could not get into their school/program of choice or the tuition fees were more affordable. During the Faculty's interview process, applicants are told that it is a teacher-education program and sometimes sold on the advantages of teaching as a career. They are also told they do not have to teach on completion. There were applicants who would unabashedly state to the author during the interview session that they did not want to teach, but would consider it. It is relatively easy to identify past graduates of the program that have careers in various fields that are industry or technology related; so using a teaching program as a stepping stone to other careers is not a new phenomenon (Jarvis & Woodrow, 2005).

The choice of major is a critical phase of a student's university life. From a small scale qualitative study conducted among TED students at a North Carolina university, the students selecting the TED teacher certification option found that they chose this major because it gave them a sense of purpose and direction (Johnson, 2002). The influence of peers, parents and spouse are all intertwined in this phase of a student's determination of a major as it impacts career and lifestyle.

It is expected that the external environmental changes (economic, political and social) will influence the choices graduates make on exiting a program (Tien, Lin & Chen, 2005). Prior to the current worldwide economic situation, the expectation was that some newly trained teachers would migrate to North America, the United Kingdom, and other Caribbean countries. The World Bank estimates that 80% of tertiary graduates from Jamaica eventually migrate. At the time of data collection the potential for migration was an option but this has been greatly reduced.

The B.Ed. TVET in Industrial Technology is a 135.5 credit course of study with the following components: Education/Professional Core of 39.5 credits (29.2%); General Education Core of 22 credits (16.3%); and Specialisation Core of 74 credits (54.6 %). A feature of the program includes a Teaching Practicum in the final year totalling 320 hours (See Appendix B).

In the USA, the university curriculum for TED appears to have a higher proportion of general education courses (approx. 44%) in comparison to 16.3% for UTech (See Appendix C for program structures). This arrangement allows TED students in the USA to complete the general education courses while exploring the majors before finalizing their choice in their sophomore or junior years (Johnson, 2002). Malgwi, Howe & Bunaby (2005) found the following factors influenced men's choice of college major: potential for career advancement, job opportunities, and compensation. At UTech the selection of a specialisation (major) begins at the time of application to the institution and without the benefit of an exploration of majors. Generally, once in a major, there is limited opportunity for switching and this may increase the level of uncertainty that students have with regards to their future career choices at the end of their program.

The desire to seek non-teaching jobs or to not enter the teaching profession was recognised in a survey of 1991-92 teaching graduates (Alt & Henke, 2007). Of those who considered teaching but had not entered the profession, 30% were in another job and 25% sought higher paying jobs (Alt & Henke, 2007). From a small accreditation self-study survey of 2003-04 graduates, 50% entered the teaching profession while the remainder entered other fields (UTech, 2005). Career paths chosen by the UTech graduates contrasts with Walter and Pellock (2004) findings where 74.1% Career and Technical Education (CTE) beginning teachers entered the profession after training.

Teacher Initiation/induction into the TED Profession

Johnson (2007) found that during teaching practicum, the TED student-teachers were given better-behaved students to teach, adequate resources, and direction from the class teacher. Despite this, the nature of induction for new TED teachers into the profession is at the 'deep end' – new teachers are treated as seasoned veterans; they have to engage in self orientation, confront apathy and disrespect, and forced to rely on mentors from outside the discipline (Johnson, 2007). This supports an earlier finding that a vast majority of TED teachers did not have a mentor at any time during their career (Johnson, 2004). Johnson also found that at the 10-year point of their career, there is a noticeable attrition of experienced teachers from the TED profession. Johnson (2007) noted that new TED teachers had to be flexible and adapt to their new environment in order to survive the early years. As Bastick (2002) posited, it is the intrinsic rewards that out shadow the struggles and challenges within the environment that influence teachers to remain in their posts.

Method

Two cohorts of senior TED student-teachers attending a Final Year seminar presentation (2007 and 2008) were surveyed to determine their present career perception, future career goals, income expectations, graduate study interests, and in 2008, the extent to which the seven stated goals of the TED program are perceived to have been met. The researcher-developed questionnaire consisted of 7 items on one page and was reviewed by the Final Year Seminar Coordinator for face validity and usefulness.

Before the presentation commenced, the students were introduced to the purpose of the questionnaire and informed that they were not obligated to answer the questionnaire or any item if they did not want to. No names or ID numbers were required. The questionnaires were completed in 10 and 12 minutes in respective years. Once completed, they were collected by the Seminar Coordinator. Data from the questionnaires was entered into Excel software for analysis to obtain measures of central tendency.

Results

Expected Annual Incomes and confidence level in achieving

Seventy one students completed the questionnaires: 46 from the 2007 cohort and 25 in 2008. The mean expected salary for the 2007 cohort was $13,209 and increased by 51.7% to $20, 039 for the 2008 cohort. After removing outliers, the upper range of salary expectations remained almost identical over two cohorts. Mean salary expectation over the two cohorts was $15,584 with a standard deviation of $10,293 (See Table 1).

Table 1

Mean, Standard Deviation and Range of Expected Annual Incomes for 2007 and 2008 cohorts

Cohort	n	Mean (US$)	SD	Range (US$)
2007	45	13,209	8,050	7,366 - 51,561
2008	24	20,039	12,552	10,134 - 50,669
2007 & 2008	69	15,584	10,293	

Note: Two outliers were removed from the data set: US$110, 489 and $281, 492 for 2007 and 2008 respectively.

Eighty-three percent of the respondents indicated their level of confidence in achieving their stated salary in the first year of employment. The distribution was almost equal between very high, high and medium ranging from 26.1% to 30.4%. The largest group (30.4%) had a high confidence that their stated income would be realised. Not student had a low level of confidence in their income expectations (See Table 2 and Figure 1).

Table 2

Student-teachers' Level of Confidence to attain Salary Projections

Level	n	%
Very high	18	26.1
High	21	30.4
Medium	20	29
No response	12	16.9

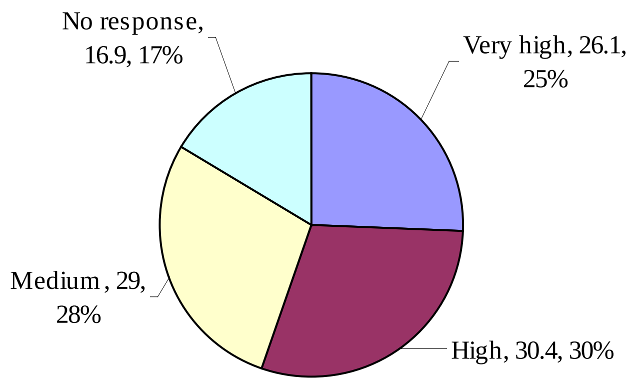

Figure 1: Confidence in achieving entry salary projection

Academic Pursuits after degree completion

Table 3 identifies the next academic pursuits for TED student-teachers after graduation. Sixty eight respondents indicated their next study interests after completing the bachelor's degree. Of the 52 respondents who stated their intention to pursue a Masters degree, 38 were unspecific as to the area of concentration, seven student-teachers wanted a technical masters degree in areas such as Construction Management, Manufacturing Systems, Engineering, and Information Technology, four respondents indicated a business/management focus, while three specified an education degree emphasis. Ten respondents identified another Bachelors degree or short courses in areas such as Computing and Information Technology, Electrical Engineering, and Media/Broadcasting as their next academic pursuit. Six respondents indicted a doctorate as their next academic pursuit, while three respondents did not specify any further academic interests.

Table 3
Anticipated Academic Pursuits after completing Bachelors Degree

Next academic pursuit	N	%
Masters degree	52	73.1
A second Bachelors degree/short course	10	14.1
Doctorate	6	8.5
No response	3	4.2
Total	71	

Knowledge of Faculty Offerings

Twenty-one students had knowledge of Masters Degree opportunities at UTech and in particular their own faculty. Student were interested in Workforce Education and Development (N=14), M.Ed. in Educational Leadership and Management (N= 11). Seven were interested in a TVET Masters that is still in development.

Career identity

Table 4 presents the career perceptions of the TED student-teachers at the completion of the B.Ed. TVET degree. Thirty-four respondents (37 %) saw themselves primarily as an Industrial Technologist, 17 saw themselves primarily as an industrial technology educator, while 16 saw themselves as Engineers. By contrast, only three respondents perceived themselves primarily as a teacher or a vocational instructor. There were 13 respondents who indicated multiple primary career identities and those responses were included, resulting in N = 92.

After removing the multiple responses, N= 50; Industrial Technologist was still ranked 1st with 44%, Engineering was 2nd with 20% and Industrial Technology Educator was a close 3rd with 18%. The top four career perceptions remained the same except for one change in position. The last ranked career identity was that of Vocational Instructor and Trainer with 0%.

Table 4
Primary Career Identity of TED Student-teachers

	With multiple choice			Without multiple choice		
Primary career perception	n	%	Rank	n	%	Rank
Industrial technologist	34	37	1	22	44	1
Industrial technology educator	17	18.5	2	9	18	3
Engineer	16	17.4	3	10	20	2
TVET instructor	7	7.6	4	5	10	4
Technology Educator	6	6.5	5	1	2	6
Trainer	5	5.4	6	1	2	6
TVET teacher	4	4.3	7	2	4	5
Vocational Instructor and Trainer	3	3.3	8	0	0	8
Total	92			50		

Career Goals

Despite completing a technical teaching degree, the career goals for the 58 respondents (82.8%) were centered on Engineering, Management or Industry. Education was the fourth popular career choice with 10 respondents (17.2%) which was half the number of respondents who saw their career in Engineering. No student considered a career in Training (See Table 5).

Table 5
Career Goals of 2007 and 2008 cohorts

Career Areas	2007 n	2007 %	2008 n	2008 %	2007 & 2008 n	2007 & 2008 %
Engineering	14	33.3	6	37.5	20	34.5
Management	11	26.2	4	25	15	25.9
Industry	9	21.4	4	25	13	22.4
Education	8	19	2	12.5	10	17.2
Training	0	0	0	0	0	0
Total	42		16		58	

B.Ed. TVET Program goals

Respondents were asked to indicate on a scale of 1 to 10, the extent to which they believed the goals of the B.Ed. TVET degree program were achieved. The ratings were categorized as 9-10, 7-8, 5-6, 3-4 and 1-2 as High, Above Average, Average, Below Average, and Low respectively. Thirty-nine respondents completed the questionnaire and results are shown in Table 6. The goal of independent learner, attitudes and values for citizenship was rated in the High range by 84.6% of the respondents. The goal with the largest Average and Above Average rating was curriculum planning, development, implementation and evaluation with 15.4 % and 61.5% respectively. This goal was also the least ranked High rating with 20.5%.

Table 6
The extent to which the goals of the TED program are perceived to have been met.

	Ratings (%)			
Goals	Below Average	Average	Above Average	High
Independent learner, attitudes and values for citizenship	0	0.0	15.4	84.6
Leadership, administration, supervision	2.6	2.6	35.9	59.0
Awareness of importance of technical education in development	2.6	5.1	35.9	56.4
Use technology to enhance teaching and learning	0	5.1	41.0	53.8
Knowledge, skills and attitudes for teaching subject area	0	5.1	48.7	46.2
Research, apply technical knowledge to problem solving	0	12.8	53.8	33.3
Curriculum planning, development, implementation and evaluation	2.6	15.4	61.5	20.5

Discussion, Analysis & Implications

There is always fear in taking on a serious responsibility such as teaching and immersing oneself in it. From experience, a love for teaching is acquired, and it is not always an initial desire or passion (Johnson, 2002).

The entry salary for a trained teacher with a Bachelors Degree in Jamaica is the equivalent of approximately US$17,800 in 2008. For comparison, the beginning teacher salary in North Carolina in 2006-07 was US$31,478 with a median of US$46,137. (American Federation of Teachers, 2007). In the USA, new engineers out of college have starting salaries of US$40-60,000 per year (Roman, 2006). The mean salary expectation for the 2008 cohort was $2, 239 above the actual starting teaching salary. The teaching salary is $7,666 more than the expected salary in the low range. This suggests that TED student-teachers need more exposure in the TED program to the actual salaries and benefits of a teaching career.

Since 2003, in-service vocational instructors were given advanced placement in the B.Ed. TVET program so as to upgrade to the degree level. These teachers had both industrial and teaching experience and were bonded to return to their teaching posts on completion. The data collection instrument did not differentiate between respondents who were advanced placed (in-service) from those who were pre-service. Despite this, the majority of respondents 32 of 50 (64 %) did not identify themselves as educators, trainers or instructors. A strong career identifier was that of industrial technologist and engineer. These TED student-teachers were aptly described as reluctant educators and frustrated engineers (Johnson, 2008). Interestingly, the occupational title of Technology Educator is not a familiar or known term in the Jamaican lexicon, and yet it fared better or no worst as a career identifier than known terms such as Trainer, TVET Teacher and Vocational Instructor and Trainer. Further research would help to determine whether these vocational instructors are distancing themselves from what they were doing prior to entering the program. Additionally, this finding suggests that these terms may no longer find favour or status and should be revisited from the program marketing and career counselling perspectives.

The finding that training was not seen as a possible career is also surprising as this a the career that bridges both education and technology within the industrial environment. The B.Ed. TVET curriculum has not seriously recognised this career option and this may have to be rectified with a curriculum change so as to prepare graduates at the undergraduate or graduate levels.

A review of results in Table 6 shows students, with limited working experience, believing that the program has met the leadership, administration and supervision goals. The researcher questions whether this perception is premature, as these competencies are truly tested in the real-world and not necessarily developed in a simulated environment. For students who saw themselves as engineers and technologists, it is surprising that the goal concerning research and applying technical knowledge for problem solving ranked second to last. The main education-related goal pertaining to curriculum development, implementation and evaluation was the lowest ranked while the skill, knowledge and attitudes to teach the subject area was ranked in the lower half of the seven goals. This appears to reflect the respondents' overall non-teacher perception of themselves.

TED teacher-educators need to be aware of the student's perceptions and thus be able to shape their thinking and expectations with regards to real world scenarios. TED teacher-educators must continue to sell the advantages of teaching as a career. Also, where it is shown that the program does allow graduates to function in a para-engineering environment we should review and revise the program to better fit and market it as such. This approach may model the TED format as practiced at NC State where there is a non-teaching or industry option for the students enrolled. The perceived challenge to this approach would be from the Engineering-educators who believe TED graduates do not have a place in what they consider an exclusive environment.

It is evident that these student-teachers aspire to be engineers – in casual conversation they often express that they perceive engineering as a higher status career than teaching. Understanding the TED student-teachers' perception of their contextual reality (career, personal, economic) will help TED teacher educators to fashion interventions that may help these student-teachers arrive at career decisions that are congruent with their initial choice of major.

References

Alt, M.N., & Henke, R. R. (2007). *To teach or not to teach? Teaching experience and preparation among 1992-93 Bachelor's degree recipients 10 years after college (NCES 2007-163)*. U. S. Department of Education. Washington, DC: National Centre for Education Statistics.

American Federation of Teachers (2007). *AFT Salary Survey: North Carolina*. Accessed on February 18, 2009 from http://www.aft.org/presscenter/releases/2007/statereleases/SalarySurvey-NC.pdf

Bastick, T. (2002, January). *Materialist culture and teacher attrition in the Caribbean: Motivational differences between novice and experienced Jamaican teacher trainees*. Paper presented at the Conference on Caribbean Culture 2, University of the West Indies.

Jarvis, J. & Woodrow, D. (2005). Reasons for choosing a teacher training course. *Research in Education , 73, 29-35*.

Johnson, H. L. (2002). *Thank God for Technology Education: The decision making process of students selecting technology education as their major*. Unpublished paper, North Carolina State University. December 2002.

Johnson, H. L. (2004). *Individual Perceptions of Leadership Attributes by Industrial Technology Teachers in Selected Public High and Technical High Schools in Jamaica*. Unpublished doctoral dissertation, North Carolina State University.

Johnson, H.L. (2007, March). *Induction of Industrial Technology Teachers in Jamaica*. Paper presented at International Technology Education Association Conference, San Antonio, TX.

Johnson, H.L. (2008, February). *Technology teachers' perception of professionalism: preparation versus practice*. Paper presented at International Technology Education Association Conference, Salt Lake City, UT.

Malgwi, C. A., Howe, M. A. & Burnaby, P. A. (2005, May/June). Influences on students' choice of college major. *Journal of Education for Business, 275 – 282*.

Roman, H.T. (2006). The Undeniable Link between Engineering and Technology Education. *Tech Directions, 66*(4), 16-19.

Ritz, J. M., Deal, W.F., Ndahi, H. B., Reed, P. A., (2002) *Program Restructuring: Delivering Standards for Technological Literacy and ITEA/CTTE/NCATE Standards Through*

Technology Education Teachers Preparation. Presentation at SE Technology Education Conference, Raleigh, NC.

Tien, H. S., Lin, C., & Chen, S. (2005). A grounded analysis of career uncertainty perceived by college students in Taiwan. *The Career Development Quarterly, 54, 162-174.*

University of Technology, Jamaica (2005). A submission for accreditation of the Bachelor of Education degree in Technical Education and the Bachelor of Education degree in Technical and Vocational Education and Training (TVET).

Walter, R. A. & Pellock, C. (2004). Career Paths of career and technical teacher education graduates. *Journal of Industrial Teacher Education*. Accessed from http://scholar.lib.vt.edu/ejournals/JITE/v41n1/walter.html

APPENDIX A

Comparison between UTech program aims and AETL standards

AETL	UTECH
Program Standards	The 4-year B.Ed. degree program aims
Technology program development will be consistent with Standards for Technological Literacy: Content for the Study of Technology (STL).	Provide prospective teachers with skills in curriculum planning, development, implementation, and evaluation of technical programmes
Technology program implementation will facilitate technological literacy for all students.	
Technology program evaluation will ensure and facilitate technological literacy for all students.	
Technology program learning environments will facilitate technological literacy for all students.	
Technology program management will be provided by designated personnel at the school, school district, and state/provincial/regional levels.	Prepare teachers of technical subjects who will provide quality leadership, administration and supervision of technical programmes in the TVET system.
	Assist student-teachers in developing an awareness and understanding of the importance of technical education in national development
	To provide for the development of competent trainers for various industries.
Professional development standards	
provide teachers with knowledge, abilities, and understanding consistent with Standards for Technological Literacy: Content for the Student of Technology (STL).	Facilitate the student-teacher's acquisition of the requisite knowledge, skills and attitudes for the effective teaching of technical subjects.

provide teachers with educational perspectives on students as learners of technology.	
prepare teachers to use instructional strategies that enhance technology teaching, student learning, and student assessment.	Train student -teachers to appreciate and use technology that will enhance the teaching and learning process
prepare teachers to design and evaluate technology curricula and programs.	Provide prospective teachers with skills in curriculum planning, development, implementation, and evaluation of technical programmes
prepare teachers to design and manage learning environments that promote technological literacy.	
prepare teachers to be responsible for their own continued growth.	Provide opportunities for student-teachers to grow in confidence as independent learners and develop the attitudes and behavioural standards essential for good citizenship.
provide teachers with knowledge, abilities, and understanding consistent with Standards for Technological Literacy: Content for the Student of Technology (STL).	Facilitate the student-teacher's acquisition of the requisite knowledge, skills and attitudes for the effective teaching of technical subjects.
Student Assessment Standards	
be consistent with Standards for Technological Literacy: Content for the Study of Technology (STL).	
be explicitly matched to the intended purpose.	
be systematic and derived from research-based assessment principles.	Help student-teachers conduct research and apply technical knowledge and skills to the solution of problems of production and service in their areas of specialization.
reflect practical contexts consistent with the nature of technology.	
incorporate data collection for accountability, professional development, and program enhancement.	

References:

http://www.iteawww.org/TAA/Publications/AETL/AETLListingPage.htm

http://www.ncsu.edu/ced/mste/tech_programs/ted.html

http://www.utechjamaica.edu.jm/Faculty2/ED&Lib/IndTechProg/index.html

APPENDIX B

Program Structure - B. Ed. TVET Program, (2001-present)

Common Core Courses/Requirement	Codes	
Education Courses:		
Foundations of Education	EDU1005	
Adolescent and Adult Psychology	PSY1003	
Learning Theories & Practice	EDU1004	
Assessment in Education	EDU2001	
Instructional Methods	EDU2002	
Classroom and Behaviour Management	EDU2004	
Special Methods	EDU4011	4
Instructional Technology	EDU2008	3
Teaching Practice:		
- School Observation	EDU1002	
- Teaching Practice 1	EDU2006	
- Teaching Practice 2	EDU3004	
Curriculum Planning and Development in Technical and Vocational Education	EDU4002	
Introduction to Counselling	EDU4004	
Introduction to Psychology	PSY1002	
General Education Core:		
Pre-Calculus Mathematics	MAT1001	
Information Technology	INT1001	
Fundamentals of Communication	COM1001	
Oral Communication	COM1002	
Business Communication	COM2002	
Advanced Communication	COM2001	
Integrative Study	EDU4005	
Research Methodologies	RES3001	
Community Service Project	CSP1010	
Total		

APPENDIX B (cont'd)

UTech Bachelor of Education TVET Program Structure

PROFESSIONAL & GENERAL EDUCATION MODULES (61.5 Credits)

+

Program Core Modules: (24 Credits)

Graphic Communication I & II, Material Science, Cost Estimating, Industrial Organizations and Function, Laboratory Organization and Management, Special Methods, Occupational/ Environmental Health and Safety

Electrical Technology Option:

- Electrical Principles I &II
- Electrical Installation I & II
- Network Analysis I & II
- Electrical Machines & Controls,
- Electrical Blueprint Reading and Drawing,
- Electrical/Electronics Drafting,
- Solid State Electronics I &II,
- Applied Electronics,
- Digital Electronics,
- Electrical Communication Systems

50 CREDITS

OR

Mechanical Technology Option:

- Mechanical Technology I, II, III, IV & V
- Material Fabrication
- Engineering Drawing
- Plant Management I & II
- Applied Mechanics
- Engineering Drawing & Design
- Manufacturing Processing

OR

Construction Technology Option:

- Construction Technology I, II, III & IV
- Advanced Construction Technology
- Building Services
- Land Surveying
- Architectural Drawing I & II
- Building Measurement
- Construction Management

4-YR BACHELOR OF EDUCATION TVET -INDUSTRIAL TECHNOLOGY EDUCATION (135.5 CREDITS)

APPENDIX C

OLD DOMINION UNIVERSITY PROGRAM STRUCTURE

General, Elective, Professional and Field Based Experience courses:

(81- 90 credits)

+

Design and Technology

- Communication Design
- Industrial Design

Technology and Culture

- Technology & Society
- Exploring Tech & Mod Industry

Technological Foundations

- Industrial Materials,
- Materials & Processes Tech
- Basic Energy Systems
- Technological systems control
- Graphic Communication Processes

Technological Systems

- Energy & Power Tech
- Manufacturing & Construction Technology
- Production Technology
- Plant Management I & II
- Agricultural, Biological & Medical Technology

(45 Credits)

↓

BACHELOR OF SCIENCE DEGREE
-OCCUPATIONAL AND TECHNICAL STUDIES
(120 Credits)

Reference: (Ritz et al, 2002)

APPENDIX C (cont'd)

NC STATE UNIVERSITY PROGRAM STRUCTURE

General and Elective courses:

(53 credits)

+

Technology Major

- Wood Processing,
- Communication Technology
- Electrical Technology
- Construction Technology
- Manufacturing Technology
- Metal Technology
- Graphic Arts Technology
- Transportation Technology: Energy and Power

Education

- Into To Occupational Ed
- Into. To teaching Occ. Ed
- Tutoring adolescents
- School and Society
- Improving Reading in Sec. Schools
- Student Teaching in Technology Ed

(33 + 27 CREDITS)

↓

BACHELOR OF SCIENCE DEGREE
- TECHNOLOGY EDUCATION
(121 CREDITS)

Non-Refereed Section

The Conversion of Non-TED/TVET Leaders to Embrace TED/TVET

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Background

Jamaica is the largest English-speaking island immediately south of the U.S.A with a population of approximately 2.7 million inhabiting 4,400 square miles. Jamaica is widely known for its tourism, culture, music and sports. The Government of Jamaica has a 25 year development plan with a vision for Jamaica to achieve developed country status by 2030 (Planning Institute of Jamaica [PIOJ], 2009). The education and training sector has a key role in this vision with Technical Vocational Education and Training (TVET) taking a prominent position (Maragh, 2008).

In Jamaica, Technology Education (TED) and TVET serve as two ends of the secondary educational system continuum. Resource and Technology (R&T) which parallels TED, is at the grade 7-9 level, while TVET is primarily at the Grade 10-13 levels. R&T serves the pre-vocational and pre-technical preparation of students for the TVET offerings at grades 10-13. R&T provides a broad based orientation to occupational areas such as Home and Family Management, Resource Management, Product Design and Development Agriculture and the Environment, and Visual Arts (Ministry of Education and Culture,1992)

At the grade 10 and 11 stages, students complete Caribbean Examination Council (CXC) Caribbean Secondary Examination Certificate (CSEC) in subjects such as Technical Drawing, Electrical and Electronic Technology, Building Technology, and Mechanical Engineering Technology (CXC, 2009a). Successful completion of one or more of these courses along with general education and science courses such as English Language, Geography, Physics, Chemistry, Biology and Mathematics provide the basis for entry to college and university programmes. At grades 12 and 13 some students complete select CXC Caribbean Advanced Proficiency Examinations (CAPE) towards advanced placement in the university or for employment (CXC, 2009b). In addition to CXC-CSEC, some students also have the option to pursue National Vocational Qualifications of Jamaica subjects (NVQ-J) at grade 11, in preparation for entry-level employment.

Of the approximately 50,000 students who now leave high school at grade 11 each year, 15,000 are engaged in further education or training while 35,000 are unattached or seek employment. The government intends to extend the school leaving age by two years though evening TVET programmes (Johnson, L., 2008). To reasonably effect this major policy shift requires school leaders that are aware of the history, nature, role and function of TED/ TVET .

Few school leaders in the technical high schools in Jamaica have a TED or TVET orientation (Johnson, 2004). This absence of TED/TVET leadership is even more pronounced in the traditional high schools, and therefore a M. Ed. degree course such as *Leadership in Technical & Vocational Education* provided an opportunity to prepare non-TVET school leaders to embrace TVET as part of the secondary school system.
Leadership in Technical & Vocational Education is a 2-credit elective course that was selected by 10 M.Ed. Educational Leadership and Management students in Summer 2008. This was described as "an interactive course [that] provides the participant with an understanding of the history, nature and context of Technical & Vocational Education (TVET) for personal and economic development; enables the measurement of leadership potential and attributes through self and group assessments; and culminates with a personal or institutional leadership development plan using research and reflective-based methodologies" (Johnson, H.L., 2008).
The approach used in assignments and activities included:

- TVET practitioner Interviews
- Online forums and glossary of TVET terminologies
- Guest presentations from TVET leaders and government directors
- Leadership Development Plan: to relate plan for growth and development to TVET.

The online forum explored topics such as:

- Technical Vocational Education vs. academic subjects
- Where does vocational training belong?
- At what level should vocational training begin in schools?

Participants

The participants in the class were four (4) Primary school educators, two (2) High or Technical High School teachers, One (1) Vice Principal and One (1) teacher with an industrial technology (TED/TVET) background. The academic background of the other members of the class was the Sciences, Geography, English, Social Studies and Business Education.

Purpose & Method

This paper seeks to encapsulate the lessons learned in the transformation process of non-TED/TVET teacher-leaders in embracing TED/TVET. Approximately six months after completing the module, the members of the class were contacted to participate in the study. This exercise did not constitute the formal course evaluation that is conducted for all modules taught at the University of Technology, Jamaica. After obtaining the necessary ethical clearances and permission from the respondents, six of the ten students consented to be interviewed.

Interviews were recorded and transcripts written from which common themes and issues related to TVET perceptions, advocacy and leadership were identified.

Findings

<u>The perception of TED/TVET prior to and after completing the course</u>

One respondent had a negative entering belief about those who pursued TVET: "I thought TVET was for drop outs … normally the weaker students did it". Ironically, this respondent is a Technical High School graduate and appears to confirm the researcher's observation that a stigma existed even within the bastion of TVET - in the Technical High Schools,

Since taking the course, respondents were more aware and observant of opportunities to make a change in community as well as how to profit financially from TVET. Respondents were thinking of setting up training schools in agriculture, business, and hospitality.
There was expression of increased appreciation for TVET and the engendered pride and respect gained especially by the TVET-trained respondent. One respondent summarised thus: "To be honest, it was eye opening"

<u>Factors that contributed to the change of perception</u>
Exposure to TED/TVET concepts, roles and principles helped in expanding the respondents' understanding. One Arts-based teacher's perception was changed due to the observation and interaction with a fellow class member. "I was impressed with how intelligent [class member] was" This fellow class member was a TVET-trained person.

There was also a case of personal discovery. An academic teacher's father was an electrician, spouse an engineer and yet they did not realise both father and spouse's career fell under the broad umbrella of TED/TVET. This respondent however made the connection with Technical Drawing (TD) and map reading in the study of Geography and is currently encouraging the introduction of TD into the curriculum. As the respondent aptly stated, this was happening all along "Right under mi [my] nose". This discovery about the value of TED/TVET may appear incredulous to colleagues in our profession, but the intense stigma of TED/TVET in the society prevented the respondent from alternative interpretations of the scope of TED/TVET.

<u>TED/TVET Advocacy and Projects</u>
One respondent described using TED/TVET to attract wayward students (especially boys) at the Primary (Elementary) school level. Another respondent's understanding of her own role as a leader, has started to encourage and influence a young TVET teacher to take a more active role in their field: "I recognise that there are no leaders [in TVET]". This has also led her to seek the assistance of a successful technically-trained individual from the community to mentor a technical high school engineering class. She emphatically stated: "I am now an advocate … unless you have both [TVET and academic] .. you will not be marketable".

Summary and Conclusion

The conversion or attempted conversion of non-TVET teacher-leaders to embrace TED/TVET has lessons for TED/TVET educators and leaders. The following approaches supported the conversion process:

- Within a training or educational setting, include a course, module, unit or topic on TED/TVET.
- Seize opportunities to educate others about TED/TVET, history, institutions, and government policy though the use of practitioners, policy makers and managers.

- Ensure that TED/TVET advocates and insiders are placed in various committees, professional and educational settings with non-TED/TVET persons so as to develop relationships that can influence.

The embracing of TED/TVET by non-TED/TVET persons is a process that follows education and exposure to TED/TVET. Teacher educators and leaders in TED/TVET should continually seek opportunities to advance this change.

Despite the Government's expectation of TVET to support *Vision 2030 Jamaica*, there is a stigma that still pervades the society with respect to TED/TVET. This stigma, unless overcome, threatens to undermine the contribution TVET can and should make in the development of Jamaica into "the place of choice to live, work, raise families and do business" (PIOJ, 2009).

References

Caribbean Examination Council (2009a). CSEC Subjects. Available from http://www.cxc.org.

Caribbean Examination Council (2009b). CAPE Subjects. Available from http://www.cxc.org.

Johnson, H. L. (2004). *Individual Perceptions of Leadership Attributes by Industrial Technology Teachers in Selected Public High and Technical High Schools in Jamaica*. Unpublished doctoral dissertation, North Carolina State University.

Johnson, H. L. (2008). *Leadership in Technical & Vocational Education.* Master of Education Course Syllabus. University of Technology, Jamaica.

Johnson, L. (2008). *Challenges facing the Technical High Schools*. Presentation to M.Ed. Class, University of Technology, Jamaica, June 2008.

Maragh, O. (2008, April 11). The Vision that the MOE has for TVET in Light of the 2030 National Development Agenda Presentation to Annual Final Year Students' Exhibition, University of Technology, Jamaica

Ministry of Education and Culture (December,1992). Teachers' Guide Grades 7-9, Resource and Technology. Government of Jamaica/World Bank Education Programme Preparation Project (World Bank IV). Kingston Jamaica.
Reference: http://www.moec.gov.jm/projects/moec_projects/rose/rose.htm

Planning Institute of Jamaica (January, 2009). Vision 2030 Jamaica, National Development Plan (Draft). Available at: http://pioj.gov.jm/Documents/MTPFJDP/80.pdf

EDITORS NOTE: Though this informal study was completed in Jamaica, there are still some negative stereotypical viewpoints about TED in our culture in the USA. Perhaps replicating some of these techniques in our settings will help us identify problems and replace misconceptions with factual information.