2014 ATMAE Conference Proceedings

Technology- Tomorrow's Gateway

Review Process and Acknowledgements

The ATMAE 2014 Conference Presentation Abstracts and Proceedings Papers is the result of the work of many authors in technology, technology management, and applied engineering degree programs throughout the United States who gathered to share their work at the 2014 Annual ATMAE Conference, "Technology - Tomorrow's Gateway" in St. Louis, Missouri, November 19-22, 2014. The Proceedings include all of the conference presentation abstracts that were accepted through the peer-review process and which were presented at the conference, and the Conference Proceedings Papers, based on accepted presentations, which were submitted and accepted through a secondary peer-referee process.

The reviews of presentation proposals and conference papers were led by ATMAE Division and Focus Group leaders. The proposals and papers were reviewed in a double-blind process by a panel of at least three ATMAE members with expertise in the topical area. Review panelists evaluated the presentation abstract and papers pursuant to the review criteria, ranked each, and a cumulative rank-ordering system was used to help select the presentations and papers to be presented and published.

Many ATMAE members and leaders dedicated their time and expertise to review of all the Conference Presentation Proposal Abstracts, Conference Proceedings Papers, Student Research Competition Abstracts and Best Papers for the ATMAE 2014 conference. Without their time and efforts, ATMAE could not provide a thorough double-blind peer-referee process. Our thanks go to all of those dedicated ATMAE members:

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Best ATMAE Conference Proceedings Paper Award:

"Perceptions of Manufacturing Management Knowledge and the Four Pillars" Dr. Mark Doggett, Western Kentucky University and Dr. Muhammad Jahan, Western Kentucky University

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Thursday, November 20 - 11:30am - 12:15pm

Construction

The Construction Industry within a Globalized World: Challenges and Achievements

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Need: Within the current globalized world, the advances that the world has experienced in the fields of communication, information technology, and transcontinental transportation lead to the dissolution of political borders and cultural boundaries (Russell et al. 2007). The impact that globalization has on the architecture, engineering and construction industry is lagging behind the remaining industries, but it is becoming more noticeable (Cheah et al. 2005). More US firms are competing for international construction project. Furthermore, the increased sophistication of construction projects has mandated the need for collaboration between expertise from all sides of the globe. Although this phenomenon has its advantages on the market like fostering collaboration and expansion, it imposed a number of challenges on US firms including effective means of communication, cultural differences, legal systems variation among others. Consequently, new methodologies aiming at facilitating the aforementioned challenges are much needed.

Overview: The construction industry is considered to be a corner stone of the global economy. In the US the total spending in this industry in 2007 was estimated to be about $ 14 trillion (US Census, 2010). This considerable amount of expenditure is constantly at risk due to the dynamic nature of the industry. Furthermore, globalization has further imposed higher risk contingcies on the construction domain. The need for collaboration between companies at different geographic location has caused the boundaries of knowledge, culture, and business rules to disappear. To facilitate this transition, a number of researchers investigated the potential of Virtual Project Networking (Zelkowicz et al. 2013), effective means of communication, cultural effects on construction project success (Gad 2011), and trust level effects on construction contracts. Although these attempts have achieved advancements in their domains, they have not yet reached their full potential. Consequently, the objective of this study is to (1) find out what efforts have been made in the different realms of the construction domain; (2) identify the parameters leading to its success or failure; (3) define the current challenges of these researches; and (4) highlight the needed efforts to reach its full potential.

Major Points:

- Challenges facing the US construction market within a globalized business world
- Best practices to facilitating communication for construction projects
- Effects of cultural differences on the success of construction projects
- Needed efforts to enhance the US companies level of success in a globalized construction market

Summary: Attendees will (1) develop an understanding of current problems facing the construction industry due to globalization; (2) gain knowledge about current efforts attempting at increasing success of construction companies within these problems; and (3) be aware of needed efforts to ensure successful completion of projects and collaboration between companies worldwide.

Thursday, November 20 - 11:30am - 12:15pm

Construction

False Advertising? Making "General" Requirements Specific in the Construction Classroom

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Need: Construction programs typically include a course on reading construction drawings, but the other parts of the documents, the Project Manual, Procurement Requirements, the Contracting Requirements, the General Requirements, and the specifications, are often not covered in as much depth. Even when students do delve into the Project Manual, they often focus only on specific technical issues rather than the Procurement & Contracting Requirements (bidding requirements), and the General Requirements, omitting these important aspects during their preparation. However, these requirements can be seamlessly integrated into the construction curriculum at many different levels, from the freshman cornerstone course to the senior capstone class.

Overview: While Division 01 is titled "General Requirements," they should not be treated lightly but instead be considered as "specific" requirements that will affect this project's specific costs, construction schedule, and ultimately, the quality. However, it is difficult to develop classroom examples and exercises that adequately challenge and engage students while developing critical thinking skills as preparation for industry. Successful strategies to help construction faculty develop or incorporate general requirements into a single course or an entire curriculum are presented.

Major Points:
- Making bidding and "general" requirements "specific"
- Understanding types of construction specifications
- Industry views and emphases
- Example classroom examples and exercises
- Conclusions and recommendations

Summary: Attendees of this presentation will understand the importance of the Bidding & General Requirements in construction specifications and how they may be integrated into the construction curriculum from freshmen to senior year. Industry viewpoints, course examples and exercises, best practices, and potential pitfalls are covered as they relate to the construction technology instructor.

Thursday, November 20 - 1:30pm - 2:15pm

Construction

Uncertainty-Based Line-of-Balance Scheduling Method

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Need: The Line-of-Balance (LOB) is a popular scheduling technique for projects that involve repetitive tasks throughout the project duration. Examples include projects such as road construction and high-rise building construction. The LOB method, however, produces deterministic schedule, meaning it does not show the range of different potential project outcomes. This results from the fact that the basic scheduling inputs, crew production rates, are estimated using single-point average values. The current LOB technique, therefore, lacks the capability to reflect the critical fact that the crew productions change constantly due to various factors.

Overview: In this paper, how the variability of crew production rates affects schedule outcomes is demonstrated. This will show a more realistic picture of what might be a true project execution. To present a more effective and comprehensive way of incorporating this production variability in LOB, a Monte Carlo simulation technique is applied. The manual and computer simulation results are compared and discussed in terms of their pros and cons.

Major Points:
- Variability and uncertainties in the crew production rates
- Deficiency of the current LOB scheduling technique
- Ways to incorporate the production variability and uncertainties in LOB
    - Manual simulation
    - Monte Carlo simulation

Summary: The presentation will demonstrate why the current LOB does not produce a realistic project picture for planning and how this deficiency can be overcome using a stochastic simulation methodology.

Thursday, November 20 - 1:30pm - 2:15pm

Construction

Application of Fuzzy-Logic in Effective Risk Management for Construction Projects

Authors:

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Need: Efficient risk management is one of the key factors for the construction projects to be successfully completed. At site level, usually project manager (PM) breakdowns the project into manageable construction processes. Risk is inherent in all construction processes. Traditionally, PM deploys needed resources for completing any construction process based on his/her intuition and past experience. In practice, uncovered risks and uncertainty if not properly taken care of may lead to failure of the processes and eventually significant loss in a project. In this presentation, we will provide the PM with control tool based on fuzzy logic to implement, modify, or update construction resources effectively and efficiently to mitigate the risks.

Overview: Risk management (RM) is a tool that attempts to provide the decision makers to tackle construction risks in a more systematic and effective way. Fuzzy logic theory is an effective and practical risk analysis technique to analyze and evaluate the risk impacts in construction process performance. It is capable of translating and evaluating the linguistic terms into mathematical terms. Thus, fuzzy-based system enables the decision makers to calculate estimated values of the identified risks as well as suitable techniques to handle them in a cost-effective way.

Major Points:

- Importance of risk management in construction
- Discussion on the concepts of fuzzy logic theory
- Development of a decision making model based on fuzzy logic for the project managers
- Application examples

Summary: The presentation will discuss risk analysis utilizing fuzzy logic-based model. The intention is to provide the project managers an efficient tool to analyze and significantly reduce risk-related construction costs. Another important aspect of the model is to calculate probability of cost overrun due to potential risks that may occur during the execution of the construction and provide a practical solution to mitigate the risks.

Thursday, November 20 - 2:30pm - 3:15pm

Construction

Current Applications and Future Potentials of IT in AEC Project Management

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Need: Prevailing market forces and recent advancements in information technology (IT) are placing new demands on management techniques of architectural, engineering and construction (AEC) projects. Some of the important market forces are globalization, diversification and vertical/horizontal integration. These forces, combined with new awareness regarding quality, sustainability, and productivity are pushing for fundamental change in the ways AEC projects are managed. Project management techniques evolving from advancements taking place in Building Information Modeling (BIM), risk management, data accessibility and information processing are presented in this paper.

Overview: The revolution taking place in the fields of BIM, data sharing and transmission, information processing, and newer communication technology is opening up new opportunities in the AEC Industry for efficient project management functions. The dynamic nature of construction processes, interdependence of various participating entities and the need for flexibility and high degree of coordination suggest that IT can profitably be employed for effective project management. These challenges require familiarity and understanding of all applicable IT tools. It should be noted that several of these tools and processes can be employed in combination, such as BIM and project scheduling. Thus, the task of selecting IT tools and processes, particularly when technology is changing at a rate never known before, should be based on careful analysis and assessment of current availability as well as future potentials.

Major Points:

- Importance of sharing and communication of Data/Information
- Identification of IT tools for automated capture, store, retrieve data and its processing into information
- Transmission of data /information quickly and in a timely manner for decision making processes
- BIM and its impact on the project management functions

Summary: The presentation will discuss about the changing market dynamics and continuing advancements in IT tools and its impact on the AEC project management functions. With IT, projects can be managed with greater effectiveness and efficiency. The success of employing IT in managing AEC projects will depend on how well we assimilate these IT-induced requirements in AEC organizations.

Thursday, November 20 - 2:30pm - 3:15pm

Construction

Cloud Computing for Integrated Project Delivery in the Construction Industry

Authors:

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Need: The construction industry is rapidly becoming more sophisticated as new technologies are constantly being introduced. Hence, the need for the industry to quickly adapt to more fluent project delivery methods becomes critical. Also there are many processes, organizations and people involved within a project, which requires collaboration between stakeholders to maximize the productivity, enhance the efficiency and effectiveness of any project. Therefore the need for an Integrated Project Delivery (IPD) system arises. Furthermore, it is also vital that team members have access to the project information at any point in time to retrieve or update information as the case may be. Thus, cloud computing is useful for an effective IPD that allows project team members to communicate and exchange information in real time.

Overview: The researchers will present data (collected through interviews) from six large commercial general contractors concerning their current use of cloud IPD. In particular, information regarding how specifically the technology is being utilized will be examined. Moreover, the report will cover advantages, disadvantages and future possibilities that the contractors have indicated during the interviews.

Major points:

- Cloud IPD gives access to project information using any mobile device with an Internet connection
- Cloud IPD enables more efficient project delivery, collaboration and team management in real time
- Cloud IPD encourages more transparency
- Major contractors have used IPD's in several ways to enhance project management
- Cloud IPD has many advantages along with some inherent pitfalls

Summary: This research centers on understanding how large commercial contractors are currently using cloud IPD in the construction industry. Additionally, successes and pitfalls are examined. Hence, the attendees will recognize the importance and benefits of practicing a Cloud Integrated Project Delivery method.

Thursday, November 20 - 3:45pm - 4:30pm

Construction

BIM Adoption Trend among Designers, Contractors, and Owners and Paradigm Change in Construction

Author:

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Need: Industry people in construction are looking for construction management graduates who have Building Information Modeling (BIM) knowledge. In order to educate and have students prepared, knowledge on BIM adoption trend among designers, contractors, and owners and paradigm changes in project management followed by BIM adoption is essential to pursue.

Overview: Even though design firms are the biggest adopters of BIM, contractors' BIM adoption rates are growing rapidly, resulting in less gap between design firms and contractors in BIM use on projects. When it comes to impact of BIM adoption for each parties, contractors showed most positive responses. Some companies changed official job title to incorporate paradigm changes from BIM adoption in project management. BIM changed some project management aspects for both internally and externally.

Major Points:
- Need for a BIM course
- BIM adoption trends
- Paradigm change by BIM adoption for efficient project management
- BIM usage

Summary: Attendees will understand how BIM is adopted to each entities such as Architect, Engineer, Contractor, and Owner. Also, project management paradigm change by adopting and utilizing BIM on construction projects will be presented.

Thursday, November 20 - 4:45pm - 5:30pm

Construction

LEED versus Traditional Non-LEED on Single-Family Homes from Prospective of Financial and Environmental Data

Authors:

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Need: Leaders in Energy and Environmental Design (LEED) is advocated by the United States Green Building Council (USGBC). In the U.S., there are 14,088 LEED certified residential projects between the year 2006 and 2013. In the state of Kentucky, there are merely 55. A low number of LEED certified residential projects in Kentucky could be the lack of organized information pertaining to LEED certification of residential projects, specifically the financial and environmental information. This lack of information and available data makes it difficult for the residents of Kentucky to be informed of LEED homes and how they compare to traditional code built homes in respect to added cost, breakeven point, and carbon footprint.

Overview: The purpose of this study is to perform an analysis of LEED certified single-family homes in Kentucky and how they can compare with traditional residential code. The following factors are analyzed namely: a) geographical location; b) added construction cost; c) energy efficiency; d) breakeven point for the added construction cost; and e) carbon footprint. The comparison was done on a county level near the Lexington, Louisville, and Northern Kentucky areas. A body of knowledge was developed showing the estimated cost of a LEED certified new construction single-family home in each of the counties used in the study. The estimated cost was based on average new construction home values, estimated construction cost, estimated LEED added construction cost, estimated energy efficiency, and average monthly utility costs.

Major Points:
- Financial and environmental data analyzed on LEED versus traditional non-LEED on single-family homes
- Investigating geographical location, added construction cost, energy efficiency, breakeven point for the added construction cost, and carbon footprint on LEED

Summary: There are low numbers of LEED certified residential projects in Kentucky. This study help to analysis of LEED certified single-family homes in Kentucky to compare with traditional home.

Thursday, November 20 - 4:45pm - 5:30pm

Construction

On Life-Cycle Assessment for High-Performance Green Buildings

Author:

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Need: While providing physical conditions to facilitate functional requirements and thermal comfort, the construction and operation of built environments account for a substantial portion of energy and water consumptions, as well as the production of construction waste. To construct environmentally responsible, high-performance green buildings, the design and construction industry needs to incorporate in its delivery system the practice of Life-Cycle Assessment (LCA). All materials, products, and components used in building construction and operation entail energy consumption, due to the converting process of raw materials to final products, including extraction, manufacturing, transportation, and installation. LCA tools will enable green building professionals to examine the intrinsic energy of building components so as to deliver buildings with intended performance.

Overview: Developed under the governance of International Organization of Standardization (ISO) 14000 series of standards on environmental management, LCA tools are available from both private and governmental sources. LCA tools and associated databases can be used to compare and calculate the "embodied energy" of building materials and products; the information generated by the tools is crucial for the building professionals to comprehend environmental impacts and make intelligent material selections. In this study, two LCA tools, BEES (Building for Environmental and Economic Sustainability) developed by NIST (National Institute for Standards and Technology) and EIE (Environmental Impact Estimator) by ATHENA Institute will be examined and analyzed.

Major Points:

- Environmental impacts and high-performance green buildings
- Embodied energy of construction materials
- Sustainable material strategies
- LCA, Life-Cycle Assessment
- BEES, Building for Environmental and Economic Sustainability
- EIE, Environmental Impact Estimator

Summary: All built environments are realized by construction with materials, and all building materials and products involve "embodied energy" during their respective manufacturing processes. To achieve intended building performance and reduce environmental impact, the project team is to formulate a sustainable material strategy by using environmentally preferable products (EPPs) from the beginning of the building delivery process. Having been recognized as an effective methodology to assess environmental effects of building material over its life cycle, LCA is able to play a critical role in delivering high-performance green buildings.

Friday, November 21 - 8:00am - 8:45am

Construction

Supply Chain Management in the Construction Industry

Authors:

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Need: The construction industry is a project-based industry that could be benefited from the introduction of Supply Chain Management concepts, which are still not completely developed and deployed in this industry. The manufacturing industry has been using productivity and efficiency concepts and models with results in performance, profit margin, and satisfaction. This presentation explores how many of these concepts can be translated into the uniqueness of construction companies and projects to improve productivity and efficiency in this particularly important sector.

Overview: This presentation will provide information on why supply chain management is relevant to the construction industry and how supply chain productivity concepts can be implemented in construction projects to improve overall performance. It will cover challenges in the different forms of organizational structures and project types.

Major Points:

- Introduction to why the Construction industry is different than other industries when we talk about management and productivity
- Supply Chain Management concepts and practices in manufacturing settings that can be introduced in the construction industry and construction management
- Supply chain integration in the construction organization
- Challenges and limitations of the supply chain in different types of construction contractual agreements
- Conclusions and recommendations to construction companies that are looking to implement a supply chain subdivision

Summary: Attendees will understand the impact that Supply Chain Management has had in the manufacturing and service industry in the last decade and will explore the idea of introducing these concepts to the construction industry in order to increase productivity, reduce costs, and improve overall performance of construction projects. Attendees will explore the challenges of these types of implementations and the benefits that these concepts could bring to the adoption of supply chain technology and models.

Friday, November 21 - 8:00am - 8:45am

Construction

Creating Project Managers through Web-based Collaboration

Author:

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Need: Construction projects are fast becoming a total collaborative effort between all players associated with the project. Many times this collaboration is difficult to mimic in the classroom setting within many CM programs. The integration of a relatively new software program, "Construction Suite" has allowed University students to work in collaboration with other majors or industry professionals by creating a web based work zone where all players can contribute in real time to a construction project selected by a senior level student in their project management course.

Overview: The student will develop a project from design to post-construction using a variety of resources available to them through student support from other courses, other majors, and industry professionals. The project is designed as an Integrated Project Delivery (IPD) type where the student will act as the project manager. The use of the software package allows students to interface with their team members (selected by them) on a web based project planning and control application. This type of project allows the student to maximize previous learning opportunities, further their management abilities, assist in developing collaboration skills on a project, and participate in new technologies being introduced to the construction industry. Additionally, this project allows younger team members, (which are in current spring courses such as Scheduling, Construction Design, Construction Specifications, etc..), an opportunity to be exposed to the technologies as well as the rigors of a construction project. Lastly, the project expands the understanding of other majors involved on the team and helps to develop that collaborative dynamic that is paramount to today's construction projects.

Major Points:

- Collaboration of students in different courses and majors
- Ability to scaffold learning from course to course
- Student develops an IPD project from start to finish using 21st century software
- Development of managerial skills for the project manager

Summary: Attendees will have the opportunity to see how the development of this project along with the software package allows for CM students to become better equipped to step in at a supervisory capacity upon graduation. It also allows students to interact with the other project players and assume that supervisory capacity in pursuit of project completion while elevating experiences for other students serving on the team.

Friday, November 21 - 9:00am - 9:45am

Construction

A Sustainable Construction Course Development Utilizing an NSF Funded Research Project

Authors:

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Need: The construction management graduates are the potential future builders, educators, and construction leaders. Their participations in the energy efficiency, sound environmental design/construction, and sustainability research are essential to future success of energy efficiency of the nation.

Overview: Many home builders are unwilling to build energy efficient buildings beyond the minimum required building codes and consumer demands, because the energy efficient buildings tend to cost more initially and may requires special construction skills, techniques, and equipment. Often the builders of highly energy efficient/smart homes are at disadvantage, because home builders are not compensated by general public for highly energy efficient building which cost more yet needs to compete in residential market where comparable residents in the same neighborhood sales for less. In-order to achieve high energy efficiency, today's buildings also requires multitude of sensory "smart" devices. Energy efficiency and smart buildings are no longer a separate and distinct discipline.

Major Points:
- Need for a research based sustainable construction course
- Curriculum development
- Equipment requirements
- Community service requirements of course
- Course structure

Summary: The design of sustainable construction course in progress, is based on Experimental Program to Stimulate Competitive Research (EPSCoR), a NSF funded research project with the goal of expanding knowledge/ innovation and to encourage research and development including that of building construction and energy efficiency.

Friday, November 21 - 9:00am - 9:45am

Construction

Web-Based Project Administration Proficiencies recommended for CM Graduates

Author:

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Need: The use of Web Base Construction Project Management is a complicated process with many moving pieces, dispersed project participants, and tight schedules. Therefore, in order to accomplish all project-related goals in a timely, effective, and efficient manner, the right kind of tools are critical. So, to meet this need online construction project management software packages, which provides a simple web-based interface for submitting requests, managing project budgets and contracts is required.

Overview: To meet the Web Based Project Administration Proficiencies recommended for CM Graduate. A WEB base Construction Project Administration Software is being added to our program.

Major Points:

- Review of Current WEB Programs
- 100% web-based, anytime anywhere access
- Share documents, project schedules, and task assignments with remote participants
- Manage subcontracts and bids electronically
- Oversee day-to-day construction activities such as RFI, submittal, daily field reports, site photos and more
- Supervise change orders, budgets, purchase orders, pay application, contracts, and invoices A

Summary: It is becoming common practice to incorporate web base Construction Project Management on Projects. The trend is to use change from computer base programs to I pads. Therefore, A WEB base Construction Project Administration Software packages need to be introducing in Construction Management programs at the undergrad level.

Friday, November 21 - 10:15am - 11:00am

Construction

Future Role of Unmanned Aerial Vehicle (UAV) in Construction Industry and Education

Author:

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Need: Rapid development and adoption of drones also known as Unmanned Aerial Vehicle (UAV) or Unmanned Aerial System for construction activities and research/development is challenging the notion of Remote Control (R/C) model aircraft for hobby alone. Drone technology is no-longer just for surveillance, UAV's are being used for inspecting communication towers, electrical and petroleum lines, jobsite safety, bridge inspection, and natural disaster mitigation and evaluation.

Overview: Well established companies such as Trimble, a leading provider of Global Positioning System (GPS), surveying equipment, and Building Information Modeling (BIM) software have already introduced a variety of drones for agricultural, construction, and geospatial use. At the present time many UAV's operates within safety parameters long established by American Model Aeronautic (AMA) which requires model aircraft not fly higher than 400 feet above ground level, within three miles of an airport, and must be within visual range of operator. Payload carried by UAV's range from simple still/video camera to highly sensitive Thermographic cameras, and sophisticated Light Detection and Ranging (LIDAR) equipment.

Major Points:

- Fix-wing versus rotary-wing UAV's
- First Person Video/Remote Video Piloting versus Autonomous Operation.
- Building your own UAV's with off the shelve hobby components
- Required accelerometer, directional gyroscope, propulsion, remote control
- Arduino-based autopilots "ArduPilot"
- UAV software systems
- Do it Yourself UAV community

Summary: Flexible capabilities of UAV offers ground-level research opportunity for construction programs to engage in innovative application developments. Federal Aviation Administration (FAA) have already selected six sites for Unmanned Aircraft Research (UAR), along the way are host of twenty five universities that are authorized by FAA and are engaged in research and development of ground/airborne avoidance software and sensors, command/control link topology, autonomous operation, and advance electrical propulsion.

Friday, November 21 - 10:15am - 11:00am

Construction

Exploring Conceptual Cost Estimating Models for the World's Tallest Buildings

Authors:

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Need: The importance of developing reasonably accurate conceptual cost estimates during project feasibility studies is especially critical for complex multi-story buildings - skyscrapers. With very limited information at the early stages of project planning, owners and construction professionals need effective tools for predicting building costs. Regression models are explored and presented as one of the tools for analyzing conceptual estimates for the world's tallest buildings. Improved forecasting tools will enhance project planning and cost control

Overview: Cost estimates influence decision making during the early stages of construction projects. Estimators are burdened with the responsibility of accurately determining conceptual costs, when preliminary information is inadequate to prepare any detailed cost estimates. While there are a variety of tools and strategies for predicting conceptual costs, researchers and practitioners agree that the improvement of existing tools will reduce errors and uncertainty. This study is unique as it uses regression analysis to explore the predictors of building costs for the world's tallest buildings.

Major Points:
- Characteristics and trends in skyscraper construction
- Predictors of building costs for skyscrapers
- Development and analysis of conceptual cost estimate model
- Conclusion and recommendations

Summary: Attendees will understand the predictors and methods for analyzing conceptual cost estimates for complex multi-story construction projects. Practitioners will be exposed to a model that may be useful in predicting building costs at the very early stages of project planning.

Friday, November 21 - 11:15am - 12:00pm

Construction

Comparative Case Studies in Knowledge Management Practices in Construction

Authors:

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Need: Construction projects require an exchange of data, information, and knowledge to solve complex problems. Oftentimes problems on one project are similar to those encountered on other projects. As a result, some construction firms seek to capture and reuse knowledge through knowledge management (KM) practices and technology systems. Small to medium sized enterprises (SME's) in the United States often have fewer resources devoted to KM practices than their larger counterparts. This study examined three SME's and one international construction company operating in the southeastern United States for commonalities and differences in KM practices.

Overview: This research aims to better understand current KM practices among selected contracting firms in the southeast United States and serves as a starting point for discussions on ways small to medium sized construction businesses can better utilize KM practices to capture and reuse project knowledge. Using a qualitative case study method, the following research questions were investigated: 1) How is project knowledge captured and reused, 2) What KM technologies and practices are being employed, 3) How is a KM culture encouraged?, and 4) How is return-on-investment (ROI) of KM systems determined?

Major Points:

- Differences between SME's and Large firms relative to their understanding and approach to KM
- Challenges to understanding KM in construction
- Resource constraints and disparities
- Conclusions and recommendations

Summary: Many industries have adopted knowledge management as an important strategy for obtaining strategic organizational goals; yet the construction industry has yet to fully embrace KM. Attendees will gain insight into the current knowledge management practices of select construction firms operating in the Southeastern United States and understand their differences in approaches to KM practices.

Friday, November 21 - 11:15am - 12:00pm

Construction

Knowledge Management (KM) Strategies: A Construction Industry Model

Author:

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Need: With the increased sophistication and technology involvement in construction projects, the industry could be classified as a knowledge intensive domain. However, the majority of the knowledge is not explicit. On the other hands, it is latent in structured, semi-structured, and unstructured forms. The first includes examples like AutoCAD drawings, 3-D models, and schedules; while, the second and third include textual documents in the form of technical specifications, general and supplementary conditions, addendums, contractual agreements, meeting minutes, daily reports, change orders, claims, ... etc. These documents are the manifestations outlining the methods and processes of construction project management; which are often very complex and could lead projects to have less than successful conclusions. Effective knowledge management processes not only ensures cost, time, and quality compliance of the project, but also minimizes the likelihood of conflicts and disputes arising in these projects.

Overview: By definition, Knowledge Management (KM) covers a wide range of processes including strategies to facilitate (1) identifying; (2) creating; (3) representing; (4) distributing; and (5) enabling insight to experiences from lessons learned in previous similar situations in a manner that allows for collaboration to achieve satisfactory completion of new projects. its importance stems from the fact that at a time when nations are in need for effective management practices to address means of economy growth and unemployment problems, the architecture, engineering, and construction (A/E/C) industry is in an escalating trend of efficiency loss due to the inability to effectively utilizing experiences gained from previous similar situations. Although researchers have addressed the issue of KM in construction, it has not yet reached its full potential. Consequently, the objective of this study is to (1) find out what efforts have been made in the different realms of the construction domain; (2) recognize where KM application has been successful; (3) identify the parameters leading to its success or failure; (4) define the future opportunities of KM use in construction, and (5) highlight the needed efforts to reach its full potential.

Major Points:

- Different types of knowledge in the construction industry
- Success examples in the areas of Document Classification, Legal domain, visualization, 3D modeling, etc.
- Challenges facing the expansion of KM methodologies in the construction industry
- Potential area of KM use in this sector
- Needed efforts to enhance the use of KM in the construction industry

Summary: Attendees will (1) develop an understanding of KM methodologies and its successful use in the construction industry; (2) gain knowledge about the factors affecting these technologies from reaching their full potential; and (3) expand their knowledge of effective ways by which the construction industry can benefit from the full potential of KM.

Friday, November 21 - 11:15am - 12:00pm

Construction

Chronology of Erection of the Earliest Reinforced Concrete Shells

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Need: The subject of the review paper associates with today's renewed interest in thin shells. The wide-spread building of thin reinforced concrete shells ended abruptly at the end of the 1960s. Contemporary progress in numerical methods of analysis gives an opportunity to calculate the shells of non-canonical forms. It allows the engineer to closely approach the actual behavior of thin concrete shells by performing geometrically and physically nonlinear analyses. But well-educated engineer and architect must know the history of thin shells for better analyzing, designing, and constructing of them at present time. The paper presents well-known examples on early reinforced concrete shells and gives materials not containing in other publications.

Overview: The presentation studied the history of rise of thin-walled space reinforced concrete structures and gave the examples of shells of an early period. Examining this problem, the authors limited themselves by a period of the first wave of the era of thin shells (1922-1965). Between the 1920s and 1960s, considered the "golden age of thin shell structures" these constructions were developed as an engineering solution in order to achieve large spans for industrial, commercial or public structures.

Major Points:
- Portland cement
- Thin reinforced concrete shell
- Dome, cylindrical shell
- Cooling tower
- History of thin shells

Summary: The paper presents the history of the rise of thin-walled space reinforced concrete structures and gave the examples of shells of an early period. The result can be instrumental in improving construction practices and most architects will aspire to design something like structures already built but with larger dimensions, with lesser thickness or with smaller expenditures.

Friday, November 21 - 11:15am - 12:00pm

Construction

Preparing Students for Standardized Professional Construction Industry Exams through Varied Teaching Methodologies That Go Beyond "Teaching to the Test"

Authors:

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Need: Individuals can become accredited to demonstrate their knowledge of specific aspects of the construction industry. Some examples are the "LEED Green Associate (LEED-GA)" exam, which tests their knowledge of green building practices, or the "Construction Specifications Institute-Construction Documents Technologist (CDT)" exam, which tests their knowledge of specification writing. Having a professional accreditation is a significant achievement for all construction industry professionals, and for college graduates it can help differentiate them from other job seekers. However, understanding the underlying information within the exam will provide the students with the foundation to succeed in their field, rather than just "teaching to the test".

Overview: In order to increase the probability of success in either these accreditation exams (LEED-GA or CSI-CDT) or other accreditation exams, it is advisable for students to take a preparatory course. The goal is to provide students with an underlying understanding of the topic, rather than just focusing on passing the exam. Detailed knowledge related to their respective topic will provide the students with the foundation to understand the material covered within the exams. Varied teaching methodologies will be discussed, compared and contrasted, including lectures, practice exams, flash cards, case studies, speakers, field trips, and term projects. Different exams can require different approaches.

Major Points:

- Demonstrate understanding of the underlying principles and theories related to the respective topic
- Compare and contrast various teaching methodologies used to prepare for the accreditation exams
- Understand how different teaching methodologies can benefit different accreditation exams
- Apply acquired knowledge to the accreditation exams
- Pass rate statistics for the students enrolled in these classes compared to students not enrolled in these classes

Summary: Attendees will understand the importance of students acquiring professional accreditations while still in school, plus the processes and tools that can be used to prepare students for these professional construction industry exams. Attendees will understand the methods utilized to provide students with an underlying understanding of the topic, rather than just focusing on "teaching to the test".

Friday, November 21 - 2:00pm - 2:45pm

Construction

Development of Computerized Spreadsheets to Bid Projects in a Construction Estimating Under-Graduate Course and Comparing Results with WIN-Est

Author:

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Need: The use of commercial estimating applications in construction has become increasingly popular. This has been accompanied by the development of numerous spreadsheet tools to accomplish a wide array of tasks. A growing concern is that although construction students possess sound computer skills there is a need to emphasize the underlying principles, the values and formulas that make these tools useful.

Overview: Employers have noted the lack of recent graduate's ability to comprehend the basic concepts of estimating due to widespread use of specialized computer estimating software. This presentation describes the development and use of computerized spreadsheets to enhance the learning of fundamental principles of estimating and bidding for a construction project. The spreadsheet categories developed were: Cost per Item; Calculation of Salary Overhead; Calculation of Duration per Items; and Calculation of Job Overhead. After a student understands the basic principles, they are allowed to apply them using commercial estimating software.

Major Points:

- Weaknesses associated with using commercial estimating software in the classroom
- Development and use of spreadsheets as effective learning tools in the context of pricing and bidding applications
- Key learning activities for the course including the development of computerized spreadsheets for determining: (1) Estimated Cost per Item, (2) Salary Overhead, (3) Item Durations, and (4) Overtime and Project Overhead.
- Goals for students including: work in teams; familiarization with the estimating process; and development of a complete bid on a construction project
- Improvements in students' ability to understand the "fundamental concepts" of estimating

Summary: The approach taken in this course is to have students initially estimate projects using computerized spreadsheets that they have developed. Later in the semester they enter the data into a software package and compare the values received using the estimating software with those obtained using their own spreadsheets. This approach overcomes the limitations of using stand-alone estimating software but maintains the appearance of computerized estimating.

Friday, November 21 - 2:00pm - 2:45pm

Construction

Forging Interdisciplinary Construction Competition Teams

Author:

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Need: The construction industry has become a collaboration of different players in pursuit of efficient project implementation and as preparatory institutions for future leaders, it is incumbent upon program leaders to forge this collaboration at the earliest stages of a pre-professionals career. Competitions continue to develop leaders in the field and the integration of other disciplines assist in developing that collaboration.

Overview: In the field, construction managers work with a variety of disciplines or professional fields. Many times, these disciplines are developed in programs on the same university campus but not recognized as viable participants when developing competition teams. At the University, the construction management, engineering program, and business college have joined forces to further develop these collaborative interactions in construction. Each discipline has their area of expertise and the addition of members from other disciplines helps to elevate the professionalism of the team and also create a camaraderie between team members. Additionally, the expansion of the competition team lends itself to the real world application of collaboration on construction projects.

Major Points:

- Integration of competition teams with other professional disciplines
- Elevate competition success
- Infusing collaborative skills in the CM student
- Expanding opportunities for CM students in other competition areas

Summary: Attendees will have the opportunity to see how the CM program has partnered with other disciplines to elevate the awareness of competitions and the importance of collaboration in the work place today. Additionally, the importance in developing those skills necessary to thrive in a the business world today as a contributing team member.

Thursday, November 20 - 11:30am - 12:15pm

Distance Learning

Telepresence: The Classroom of the Future

Authors:

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Need: Debates ensue about advantages and disadvantages of different class delivery methods-- face to face classes are difficult for working students, online classes are lonely, hybrid classes are confusing, etc. Regardless of debate, most educators strive for an enriching, rigorous experience for their students where students leave changed and equipped to meet workplace demands. Most students, parents and industry want the same. One way to create that rigorous, demanding, industry-facing education is media rich telepresence classroom settings. The telepresence classroom allows the faculty freedom to teach face-to-face and online at the same time, in one location or multiple locations, with lecture or online discussions. Telepresence helps instructors monitor assessment and tests live in the classroom and live for online students (no need to work with a proctored exam site). The telepresence class provides a classroom experience and flexibility online to meet the demands of working students. Telepresence equips students for future work, as many businesses have incorporated telepresence into their virtual teaming and meeting structure.

Overview: Telepresence, the most up to date media rich technology, addresses that often lost human element of online only classes. It also addresses the declining face to face classroom attendance numbers and issues. The student of today is different than the student of yesterday. That new student expects flexibility, up to date technology, choice, collaboration, and community. Telepresence addresses those human factors, where the visual experience is critical to the learning experience. Telepresence allows collaboration and interaction between student to student, teacher to student, and student to content—all expectations for the national Quality Matters Certification. Using Telepresence enables improved collaboration in the academic community by bringing people together that are geographically dispersed into a single classroom to transfer knowledge through lectures, facilitate discussions, share ideas, work on group projects, take assessments, and feel a part of a community—regardless of where their desk seat is—the classroom desk seat or the comfort of a home or office.

Major Points:

- Define Telepresence
- Examine the benefits and costs of incorporating telepresence into your curriculum
- Preview a Telepresence classroom setting
- Decide if Telepresence meets your need and create next steps to get started with Telepresence

Summary: Attendees will see a telepresence classroom via video recording, understand what telepresence is, examine advantages and disadvantages of telepresence, and leave (regardless of where they are at with telepresence) knowing how to move forward or not.

Thursday, November 20 - 11:30am - 12:15pm

Distance Learning

Effective Delivery Mechanism of Online Instructional Materials for Distance Learning

Authors:

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Need: Distance, Hybrid or Blended Learning has gained an increasing trend in curriculum development. Many Researches indicated that distance learning provides many advantages to learners such as flexibility of meeting time, reduction in traveling time and self-paced learning. However, when educators in the subject area start designing and developing course materials for online curriculum, they are often challenged by the mechanisms, methods, and technological tools needed in order to deliver online materials effectively. This presentation will address the mechanisms used to publish online course materials for both synchronized and asynchronized learning.

Overview: This presentation will demonstrate the techniques used in curriculum development for an online distance workshop - Dissemination of Microprocessor Courses through Classroom and Interactive Cyber-Enabled Technologies. Presenters will discuss the processes, techniques, and problems encountered during each phase. Topics include the design and development of instructional materials, implementation of online hosting server, procedures for Moodle installation and setup, techniques used in creating Moodle courses, video production for asynchronized learning, and discussion forum.

Major Points:

- Overview of online course web portal
- Overview of Moodle server setup, problems and solutions
- Online course content management and articulation
- Video production for asynchronized online instruction
- Overview of sample courses

Summary: This presentation will provide an overview of the process for creating online course materials, hosting server selection, Moodle installation and set up, course content management, and video production.

Thursday, November 20 - 1:30pm - 2:15pm

Distance Learning

Impact of Instructional Designers and Online Learning

Authors:

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Ms. Dianna Schuster Stair, Ivy Tech Community College, Lafayette, IN 47903, 765-269-5176, dstair@ivytech.edu

Need: During the past decade, there has been a major increase in the delivery of online courses in higher education. As enrollment in online courses increases, educational institutions are under increasing pressure to ensure validity, consistency and quality to increase engagement and retention. It is not enough to put a course online, and say it is a quality course. The course must promote rigor, engagement, accepted norms, institutional, and academic standards for success. It is a proven fact that most institutions have bought into the theory that "quality matters." Through the use of individual surveys and conversations with Internet students of two institutions, we will share with the group the principal areas of concern about Internet classes from the students' point of view.

Overview: In response to best practices online, Ball State has defined seven major strategies to utilize as the foundation for designing and developing courses online. As instructional designers and educators, it is imperative for us to combine instructional best practices with the schools' different strategies, techniques, issues, courseware, and to discuss solutions and exhibit lessons learned in this process for future course improvements. Solutions are designed to help achieve the preeminent course for the students as well as the instructor. We believe this presentation will serve as a catalyst for Ball State University, Ivy Tech Community College, and others to continue to examine their online courses as well as share their institution's strategies. At the presentation's end there will be roundtable discussion sharing attendees' procedures as we continue to move toward best practices in creating better outcomes for our students.

Major Points:

- Seven Major Strategies to Implement as the Basic Foundation for Designing and Developing Courses Online
- Use Techniques
- Issues
- Courseware
- Shared Solutions

Summary: Attendees will gain an understanding of ways to improve their online classroom. They will see how different strategies, techniques, issues, and courseware is an avenue for future course improvement. Through surveys done by the students, and conversations with them, we will present the design areas that are generally the most difficult for on-line classes.

Thursday, November 20 - 1:30pm - 2:15pm

Distance Learning

A Strategy to Meet Quality Matters (QM) Standards for Online and Hybrid Courses

Authors:

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Dr. Shawn Strong, Bemidji State University, College of Business, Technology and Communication, Bemidji, MN 56601, 218-755-4223, SDStrong@bemidjistate.edu

Need: Due to the rapid technological changes in higher education sector, many universities start offering online degree programs to meet the workforce needs. Online courses provide students with more flexibility in completing their degrees. However, maintain quality and teaching effectiveness are the main concerns when considering developing and teaching online courses. Quality Matters responded to these challenges (e.g. maintain online course quality) by providing proper techniques (e.g. QM rubric) to obtain and maintain the quality of online or/and hybrid courses. Faculty may or may not aware of the benefits that can be gained from using QM rubric. Therefore, there is a need to highlight the advantages that can be gained from applying QM standards. A strategy that may help faculty to meet the QM standards will be presented.

Overview: Technological innovations have significant impacts on education. Universities start offering online and hybrid courses to meet the needs of their students. Online courses provide students with more flexibility in scheduling classes and completing their degrees at their own pace. Quality and teaching effectiveness should be maintained in online teaching. These challenges (maintaining quality and teaching effectiveness) may increase with the online technical or hands-on courses. Quality Matters (QM) Program, one of the most well-known programs in the United States, became aware of these challenges and realized the need to provide proper techniques and programs to maintain quality of online courses and teaching effectiveness. QM Program is a nationally recognized, faculty-centered, peer review process designed to certify the quality of online courses. This research aims to familiarize faculty with QM standards, rubric, and the review process. A six steps strategy will be shared with faculty to help them meet QM standards. A graphic model for the strategy will be illustrated to summarize and simplify the process. Techniques and solutions will be offered to overcome the challenges that might be faced during the QM review process. Sample of a QM certified course will be shared.

Major Points:

- Many challenges could be faced when faculty teach online courses
- Quality and teaching effectiveness should be maintained in developing and teaching online courses
- Quality Matters (QM) Program created standards to obtain and maintain the quality of online and hybrid courses
- The peer reviewed process is the technique that is used for reviewing courses
- Faculty need to be aware of QM rubric and the advantages that might be gained
- A strategy consist of six steps might be helpful for faculty to meet the QM standards
- Sharing screenshots of QM certified course's activities might be helpful to understand the standards
- Graphical illustration for the strategy is useful to summarize and simplify the process

Summary: Attendees will be exposed to an example of a QM certified course and will learn about strategy that might be used to help faculty improve their online courses. Attendees will have a better understanding of how to prepare a hybrid and/or online course to meet the QM rubric.

Friday, November 21 - 8:00am - 8:45am

Distance Learning

Offering Online Courses The First Year Review: Where Do We Go Now?

Authors:

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Mr. Mickey Giordano, Mississippi State University, MSU, MS 39762, (662) 325 1610, mgiordano@colled.msstate.edu

Need: All of us are under pressure to put courses online for a number of reasons and even multiple reasons. These reasons could be, but are not limited to, open up enrollment for non-traditional students, to expand class numbers, or to make better use of faculty resources. The industrial technology program at Mississippi State University began offering online courses for just lecture based courses in August 2013. The experiences have been mixed from both faculty and students. We are now looking at how we proceed from this point.

Overview: The industrial technology program at Mississippi State University has started to attract the attention of non-traditional students. In an effort to accommodate them the program began to offer in the fall 2013 semester online courses to both main campus and distance education students. With the faculty having no experience in distance education there have been many obstacles and opportunities which will be highlighted and how we overcame or embraced them as we begin our second year teaching via the online medium.

Major Points:

- The problems that were encountered by both the faculty and the students
- How did we overcome them
- Embracing opportunities and positives that came about
- Expanding the offerings
- Balancing the faculty workload

Summary: Attendees will get an insight into the opportunities and problem areas that occur to the new teachers in the online field. There will be a discussion on the problems encountered. How we dealt with them and how we are proceeding.

Friday, November 21 - 8:00am - 8:45am

Distance Learning

Assessment and Evaluation Methods for Distance Courses and Programs

Author:

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Need: Every type of course in a college environment needs to evaluate its students in some way, whether it is by conventional methods or not. The way in which we evaluate distance students is extremely important because, due to the unconventional way in which they are being taught, care must be taken to evaluate these students in a way that will be right for them and effective for the instructor. As such, there are certain things instructors for online courses can do to ensure that their assessments are effective and accurately reflect the success or lack thereof of their students.

Overview: This presentation will discuss the problems students typically have with online assessments. It will also outline several strategies that instructors can use to improve the quality and effectiveness of their online assessments, and what they can do specifically concerning the actual tests and what they can do throughout the rest of the course to improve the quality of these assessments. New test-taking and monitoring technologies will also be briefly discussed, and how they are being used to improve online test quality.

Major Points:

- Problems with online/distance assessments
- What instructors can do to improve the quality of their online assessments
- New technologies that are being developed to monitor online test-taking and how these technologies are being used

Summary: Problems with online/distance assessments will be addressed, which include technological glitches and academic dishonesty. Strategies to improve online test-taking will be discussed, such as structuring tests so that students have to use their own words and actually apply their knowledge versus multiple-choice and other objective tests. New technologies to improve online test monitoring and proctoring will also talked about, and how they are being used in online and distance courses.

Friday, November 21 - 9:00am - 9:45am

Distance Learning

Ensuring Quality and Success in Distance & Online Learning

Authors:

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Need: As distance and online learning becomes more popular, university faculty are often being asked to develop and begin teaching course online to meet this demand. Many university faculty need to learn how to prepare an existing course so that it can be well implemented online. The specifics of good online course planning and design may be unknown to many. University faculty need to learn about the qualities of exemplary online teachers and how to facilitate learner-centered teaching online. Many may be unaware of how to promote good communication with students in online education. For those who have experience with distance and online learning, they may not know about how to use self-evaluation and assessment to promote teaching improvement.

Overview: During this presentation, conference attendees will learn how to prepare an existing course to be implemented online. Examples of good online course planning and design will be shared with attendees. The qualities of exemplary online teachers will be discussed along with ways that university faculty can facilitate a learner-centered classroom online. Strategies to promote good communication with students in online education will be presented. The use of instructor self-evaluation and assessment to drive teaching improvement in distance and online learning will be highlighted.

Major Points:

- Preparing a distance and online course
- Examples of good online course planning and design
- Qualities of exemplary online teachers
- Strategies to promote good communication with online students
- Using online instructor self-evaluation and assessment to drive improvement

Summary: Conference attendees will leave the presentation with an understanding of how to prepare a distance and/or online course. The conference attendees will benefit from examples of good online course planning and design as well as qualities of exemplary online teachers. Those who attend the presentation will be prepared to go back to their universities and use strategies to promote good communication with online students through the use of discussion boards and multiple modes of communication that allow for positive interaction.

Friday, November 21 - 9:00am - 9:45am

Distance Learning

Enriching Student/Instructor Interaction in Online Learning Environments

Author:

Dr. David Hua, Ball State University, Muncie, IN 47306, 765-285-5659, dhua@bsu.edu

Need: In a traditional face-to-face classroom environment, students have the opportunity to directly engage with instructor to receive immediate feedback. While forum discussions in online learning environments do provide for interactions between students and instructors, there is typically a time delay due to the asynchronous nature of these communications. Also, text-based forums do not allow for the inflections and non-verbal cues that are afforded in a face-to-face classroom environment.

Overview: There are many benefits provided through online learning environments. At the same time, this educational format is not without its limitations. There are a number of tools available that online instructors can use to enrich the interactions with their students. Instructors can provide students with audio and video feedback on their assignments. There are screen capture tools that would allow instructors to incorporate voice and other media into their online course content. A variety of online collaboration tools are also available for instructors to engage their students synchronously when needed.

Major Points:

- Identification of the limitations of traditional asynchronous online learning environments
- Strategies for enriching student/instructor interactions
- Presentation of the tools used in these strategies

Summary: This presentation will discuss resources that are available to help online instructors address create more enriching interactions with their students. The obstacles to engaged student/teacher interactions in a traditional online learning environment will be highlighted. Conference attendees will then be presented with a variety of tools and strategies that they can use to enrich the interactions with their students.

Friday, November 21 - 10:15am - 11:00am

Distance Learning

Instructor / Student Interaction in Online Courses

Author:

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Need: Instructor interaction with students in online courses is necessary in order to better support their students and improve their online academic experience. Increased interaction with students can help to provide a more equivalent academic experience with on-campus students and can help distance students feel successful in their academic endeavors. Improved interaction can also improve the instructor/student relationship and help them perform better in the course.

Overview: This presentation will cover the topic of instructor/student interaction in online courses and how this type of interaction can be improved. The instructor benefits of this kind of interaction will also be mentioned. It will also discuss why this kind of interaction is important, and how instructors can improve their online discussion forums - one of the most important vehicles for instructor/student interaction in online courses.

Major Points:
- Major issues online students have
- Why instructor/student interaction is important
- How this kind of interaction can benefit the instructor
- Strategies to improve instructor/student interaction in the online classroom
- Several ways to improve online discussion forums

Summary: This presentation will cover the major issues students have with online courses, one of the biggest issues being the lack of instructor/student interaction. Interaction for students is important because it can help them to better succeed in the course and gain a better academic experience. Improved interaction in online courses can help instructors because it can make their schedule easier and allows them to get a better handle on how well their students are doing. Strategies to improve this kind of interaction include improving class atmosphere, being clear and thorough, providing good contact info/student feedback, maintaining a presence in online forums and improving the quality of online discussion boards, which are crucial to instructor/student interaction.

Friday, November 21 - 10:15am - 11:00am

Distance Learning

Using Videoconferencing Techniques for Advising Online Students

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Need: The number of college students enrolled in online courses increased in the past decades and the concept of advising students has been changed from the traditional technique to the online environment. There is a need to enhance the process of advising online students by incorporating audio and video into the advising sessions. Videoconferencing is one of the technological innovations that might be used for advising online students. Therefore, knowing how to use videoconferencing applications effectively is essential for faculty who advise online students. The researchers will present the use of "ooVoo", the videoconferencing software, as an example for using videoconferencing techniques for advising purposes.

Overview: Academic advising encompasses an increasing level of presence and involvement in the development of college students and the educational paths they choose. It provides a safe and respectful environment to collaborate with students on course selection, understanding degree requirements, and preparing for degree completion or credit transfer to other academic institutions. Technological innovations have significant impacts on education settings such as changing the concept of advising students. Academic advising has been changed to the online format as result for the high demand on online or hybrid courses. This research aims to explain the use of ooVoo videoconferencing software for advising purposes. The software installation process will be illustrated. The processes of creating an account will be demonstrated. Also, the researchers will explain the process of adding students to the contact list. In addition, the procedure for starting a video call with students will be explained. Inviting additional student to the video call and sharing files with them will be described. Examples, screen shots, and illustrations will be shown.

Major Points:

- Academic advising is essential for developing college students and choosing their educational path.
- The demand on online and hybrid courses forces universities to change their strategies for academic advising.
- Technological innovations helped faculty meet online students' needs by using videoconferencing software in their advising sessions.
- "ooVoo" videoconferencing software has many features that will help faculty enhance their academic advising.

Summary: Attendees will be exposed to an example of videoconferencing software that might be helpful for online advising. The technique of using videoconferencing for online advising might be used as a benchmark approach in other universities.

Thursday, November 20 - 11:30am - 12:15pm

EECT Automation

What's The Frequency, Kenneth?
Integrating RFID Theory with Microcontroller-Based Laboratory Projects

Authors:

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Need: Communications systems of the future are likely to incorporate wireless radio frequency based information harvested from tags and sensors for control purposes. The proliferation of RFID systems in the global supply chain makes this an important technology for students in EECT programs to understand and apply effectively. There is an acute need for preparing students to algorithmically process information obtained from different communication sources using microcontrollers and to make decisions in vital real-time areas such as transportation, automation, security, utilities and health care. While developing customized communication technology-based solutions students should be able to create flow charts and to translate these into structured microcontroller programs for applying suitable supervision to the overall system.

Overview: As we transition to a knowledge-based economy, technologists need to develop algorithmic ways of effectively handing data obtained over various communication channels, and apply these to solve problems in novel ways. The continuous access to multiple streams of information requires processing, prioritizing, action, and continuous monitoring. RFID-systems in particular are projected to be one of the largest interconnected sources of data in the future. Applications of various project-based learning activities in communications courses can provide technology students opportunities for students to applying theoretical concepts in a practical way. They learn about the significance of microcontrollers for automating mundane tasks thereby alleviating monotony, reducing operator error, and increasing efficiency, using a combination of RFID and microcontroller technologies.

Major Points:

- Tracking the growth of RFID and microcontroller technologies in the 21st century
- Using interlinked projects for teaching a radio-frequency and optical telecom technologies course
- Integrating microcontrollers in telecom coursework as part of project-based learning activities
- Expanding instruction regarding RFID technologies using EPC standardized hardware
- Sample RFID and microcontroller based communication projects
- Ongoing implementation challenges and recommendations for adopters of RFID-microcontroller technologies as part of telecom coursework

Summary: Communications technologies including signal generation, amplification, distribution, transmission, and reception over air or fiber offer ample opportunities for integration in project-based learning activities. Microcontrollers can be readily included in the communications coursework for providing a supervisory mechanism over various systems. Using RFID tags and Parallax microcontroller projects related to control and communications are developed. The presentation will also discuss the rapid growth of RFID and microcontroller technologies along with ideas for integrating these in within a course on telecommunications using interlinked projects.

Thursday, November 20 - 11:30am - 12:15pm

EECT Automation

Advanced Dynamic Motion Control and Object Tracking for Humanoid Robotics

Authors:

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Dr. John R. Wright, Jr., Millersville University, Millersville, PA 17551, John.wright@millersville.edu

Need: "Robotics is one of the latest technological innovations, and a humanoid robot is an ideal learning tool for classes at all levels. Robots allow students to connect theory with practice and discover a wide range of robotics-related fields, such as computer science, engineering, and mathematics. Students gain hands-on experience using NAO, and, when used in the lab, they discover exciting topics such as locomotion, grasping, audio and video signal processing, voice recognition, and much more" (NAO for Education, 2013). The future for robotics in the United States is clear. We must automate our manufacturing processes to remain competitive in the global marketplace. Robotics is an important part of that automation. Humanoids have a host of capabilities that may reveal potential new uses in industry. Investigative research and development of advanced motion algorithms and code to the control of a small humanoid soccer-playing robot will be the subject of the proposed presentation. This work adds value to the future of humanoid robotic control.

Overview: The purpose of the presentation is to provide instruction on how to develop advanced motion control and object tracking with regard to humanoid robotics. Demonstration of this capability will also be part of the presentation.

Major Points:

- Introduction custom movement programming
- Instruction on object tracking feature
- Demonstration of NAO's capabilities for tracking and kicking a small soccer ball using the new motions and tracking feature combined

Summary: Developing code for humanoid robots involves the use of object-oriented programming techniques that allow us to develop complex control in a fraction of the time that we once did with pure syntax-based languages. Today's students in applied engineering and technology programs need to be exposed to sophisticated control techniques that will prepare them for the workforce of tomorrow.

Works Cited:

NAO for Education (2013). www.aldebaran-robotics.com. Accessed January 24, 2014.

Thursday, November 20 - 1:30pm - 2:15pm

EECT Automation

Visual Analytics in Information Security

Author:

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Need: The field of information security has entered the big data era since there are too many security related data being recorded at remarkable and accelerating speed. Alternative solutions, in addition to high performance computing and data mining, are needed to analyze the data. A possible alternative is to apply Visual Analytics (VA) in the field of information security. This presentation will discuss the advantages and limitations of VA and reflects on the possible future directions.

Overview: Conventional wisdoms have been that collecting all the data and generating alerts based on patterns through log management or events management. In the big data era, the amount of log and network events generated by a datacenter may easily overwhelm top-notch computing devices. Innovations are needed for network administrators and security professionals to quickly understand the overall situations and the potential threats on the rise. Visual Analytics (VA) is a method of scientific reasoning that is built on top of techniques such as visual representations, human/machine interaction techniques, data representation and transformation. When designed appropriately, VA can greatly reduce the process time by picking up the brains and eyes of the experts to identify unusual events or hard to describe patterns. As such, VA can be of a great help for security professionals to gain better knowledge about the assets they are protecting; to detect potential and ongoing attacks; and to "see through" security risks in the ocean of data..

Major Points:

- What Visual Analytics is and why it can help IT security professionals
- What VA tools has been proposed and implemented and what are the strengths and the limitations of current VA tools
- How VA should be employed in big data security analyses:
  - Typical Overview first, Zoom in; and then details on demand approach
  - Why conventional overview first failed to over insights in silent attacks
  - What might be the better ways to design Overview
- Reflections on future directions to more effectively apply VA in IT security

Summary: Attendees will learn what major problems in current IT security are and how big data challenged the current IT security practices. Attendees will also understand what Visual Analytics (VA) is and its potentials to help IT security professionals to find out new security incidences sooner and faster.

Thursday, November 20 - 1:30pm - 2:15pm

EECT Automation

The Comparison of Network Security and Computer Systems between Small and Large Grade School Level in the Midwest Region

Authors:

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Need: With most grade schools using computers and Internet, there seems to be a real concern for the network security. According to the U.S. Department of Homeland Security, a quarter of all network security problems occur within schools (Technologies, 2009). There are several things that schools have to take into consideration when referring to network security. This security is vital in protecting the children's identity and help keep them safe from cyber criminals.

Overview: This study was conducted to determine if the different sizes of grade schools have impacts on the computer systems and network security. Within this research the smaller school districts were compared to the larger school districts, specifically in the Midwest region. There was a look to see if the smaller budgeted schools can have the same network security as the larger budgeted schools. Questionnaire and phone interviews were utilized in data collection.

Major Points:

- Definition of a small school district vs a large school district
- Need for network security within the schools system
- Major concerns for network security and computer systems in grade schools
- Who takes care of the schools' computer systems and computer networks
- Are the smaller school district's computer networks as secure as the larger school districts

Summary: Attendees will get an idea of the network security in some of the school districts within the state of Missouri. Attendees will see what the major network security problems within the school districts. Attendees will see how the smaller school districts' computer networks compare to larger school districts' computer networks security.

Thursday, November 20 - 2:30pm - 3:15pm

EECT Automation

Design of a Programmable Surface Acoustic Wave Correlator Using Binary Phase Shift Keying Encryption for Wireless Network Security

Authors:

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Need: Amid the exponential growth of WiFi networks, it has become increasingly apparent that security levels have lagged behind transmission speeds and connectivity [1]. Even in spite of the rapid growth of this technology, there are growing concerns about how secure data really is when transferred over a WiFi network. Therefore, stronger data encryption techniques are needed that keep pace with the growth of this technology and the increasing prevalence of security attacks from rogue APs. This paper proposes the use of a Programmable Surface Acoustic Wave (PSAW) correlator with Binary Phase Shift Keying (BPSK) encoding to increase the security levels of wirelessly transmitted network data in the 2.45 GHz WiFi frequency band.

Overview: A Programmable Surface Acoustic Wave (PSAW) correlator pair using Binary Phase Shift Key (BPSK) modulation and an 11-bit Barker code sequence is proposed to increase the security levels of wirelessly transmitted network data in the 2.45 GHz WiFi frequency band. Due to the unique properties of SAW correlator's interdigital transducer (IDT) fingers, their orientation, and the alternating polarity between sets of IDT fingers, they are well suited for BPSK encoding applications. This encryption is made possible with the use of well-matched PSAW correlator pairs that encode RF burst signals to produce a high auto-correlation vs. cross-correlation signal. This encrypted signal is then decoded by passing it through a reverse coded PSAW correlator to remove the modulation encryption, leaving the original data signal. The critical parameters of the author's proposed design are presented, including the piezoelectric substrate material selection, relevant equations for critical parameter, and the final proposed design.

Major Points:

- Overview of Surface Acoustic Waves and SAW Correlators
- SAW Correlator Design Considerations including piezoelectric substrate, IDT design for BPSK
- Physical Design Parameters of proposed device

Summary: This presentation will present a proposed network security design solution in for form of a Programmable SAW correlator pair equipped with an 11-bit Barker code sequence for WiFi BPSK encryption applications. This proposed design would use surface acoustic waves to increase the encryption level of network data.

Thursday, November 20 - 3:45pm - 4:30pm

EECT Automation

The Design and Comparison of Single Inverted Pendulum System Controllers

Authors:

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Need: The control of an inverted pendulum system is a classic problem in the theory of control systems. It is always used to demonstrate concepts in linear control such as the stabilization of unstable systems. Since the system is inherently nonlinear, it has also been useful in illustrating some of the ideas in nonlinear control. In this study, an inverted pendulum is attached to a cart which is equipped with a DC motor. The DC motor will be controlled by designed controllers to balance the inverted pendulum so that it won't fall. Two control methods will be used to model and design two controllers respectively, one is based on the classical control theory and the other one is based on the modern control theory. Each of them will be implemented in this single inverted pendulum system. The simulation and results of the performance of these two controllers on the single inverted pendulum system will be analyzed and compared. The study of the inverted pendulum system controllers has a significant meaning to researches such as biped robot's walking problem, rocket's flight attitude adjustment, aircraft's landing, the stability of offshore oil platforms, etc.

Overview: The purpose of this research is to study and compare the performance of two different controllers in balancing an inverted pendulum system based on the classical control theory and the modern control theory respectively. These two control methods share the same mathematical model essentially derived from Newton's laws of motion. A PID (proportional-integral-derivative) controller and a pole placement controller have been designed and compared in this study. After these two controllers were calculated theoretically, simulations were run on MALAB to verify the validity of the designed controllers. Once each parameter of the controllers passed the simulation test, a comparison of their performance has been studied. Then, the PID controller has been tested in a LabVIEW-based control system since PID controllers are always the most simplest and popular control method used in manufacturing systems. The test of the pole placement controller on a real system will be conducted in future studies to evaluate its feasibility, reliability and robustness.

Major points:

- Literature review of the research
- Introduce the procedure and system architecture
- Analyze and compare the controller performance
- Discuss of further research and study

Summary: This research project will develop and compare two different controllers for a single inverted pendulum system based on the classical control theory and the modern control theory respectively. The design, modeling, implementation, and comparison of these two different controllers will be demonstrated and analyzed in the presentation.

Thursday, November 20 - 3:45pm - 4:30pm

EECT Automation

CFD Modeling and Analysis of Oscillating Microcantilver Beams

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Need: Piezoresistive microcantilever beams have been demonstrated to be capable of sensing the presence of surrounding gas by changes in the resonance behavior of the beam. The ultimate goal of this device development is to create an integrated high-sensitivity system for gas detection, with an intended application towards the early positive identification of terrorist threats and hazardous materials. The objectives of this proposal is intended to improve fluid flow modeling to better address the drag forces which act on the oscillating beam, and its associated vibration response. The purpose of this project is to advance the state of the art in the area of microcantilevers beams used for gas sensing and detection.

Overview: This project will pursue a fundamental yet critical component of a model that can successfully predict the behavior of resonating of microcantilever beam which could be used as gas sensor. This model will consider the effect of the shape of the beam cross-section, the presence of the floor, and the impact of gas parameters (viscosity, density) on the drag force experienced by the resonating beam.

Major Points:

- A 2D computational fluid dynamics (CFD) model will be created and solved with an oscillating solid representing the vibrating beam cross-section
- The relationship between element size, time of solution, and convergence of results will be assessed.
- A family of solutions will be generated that provide parameters that can be used in later resonance simulation.
- The results of (3) will be compared to the exact solution developed by Stokes for a cylinder oscillating in an infinite gas space.

Summary: Attendees will understand the relationship between the surrounding gas and loads induced on a resonating microcantilever beams through this presentation. The work in this proposal will represent an important step in the continued development of resonating microcantilever beams used for gas detection and sensing.

Thursday, November 20 - 4:45pm - 5:30pm

EECT Automation

Keeping Our Telecom Gateways Open: Ensuring Secure Access to Online Data and Services Using Appropriate Computer Networking Technologies

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Need: Always-on, high-bandwidth, secure telecom systems will be part of the essential infrastructure utilities in the future. Ensuring that access to these systems is maintained, even as the amount of data and services being migrated online increases exponentially, are likely to pose implementation challenges. While on the one hand network administrators are responsible for the managing wired servers and clients, they also need to provide seamless data access to mobile wireless systems, increasingly from the data and services housed offsite. In this hybrid networking environment with real and virtual systems the network perimeter to be maintained is enormous. Awareness of network probing tools that may be deployed from outside or within the network will provide the network technologist with suitable countermeasures for blocking unauthorized access. Smart computer networking tools in the hands of well-trained technologists are needed in order to keep future telecom gateways open and functional.

Overview: Network administrators must routinely evaluate existing system capabilities including availability, bandwidth, and security over a variety of wired/wireless media and devices. In addition they should be able to research and incorporate suitable new or updated technologies for improving network performance. This is a challenging task even in the best of circumstances, and the typical admin requires a handy toolkit for ensuring a timely response to networking issues, along with updated management and security tools. A mixture of open-source and proprietary software can provide a high level of assurance regarding network access and security.

Major Points:

- Projections of growth in online data nodes globally and implications for IT personnel
- Challenges in managing hybrid in-house and cloud based systems while maintaining confidentiality, integrity, and availability of data and services
- Detecting vulnerabilities in computer networks comprised of heterogeneous hardware and software systems
- New and updated open-source and proprietary tools for improving security, reducing costs, downtime, increasing responsively to network incidents while managing computer networks
- Sample online research, laboratory activities, and industry projects for familiarizing students with latest networking tools and techniques along while emphasizing safety, customer service, and responsibility.
- Move towards open systems for easier integration of future computer networking technologies

Summary: As the rate of data and service migration to online systems continues to increase, the need for maintaining secure access to these systems will continue to be great importance to an organization's IT infrastructure. New and updated open-source computer networking software technologies and tools that allow monitoring, securing, managing, testing, and troubleshooting of in-house and online systems will be highlighted in the presentation. Knowledge of these technologies will allow participants to maintain high-availability, secure access to key network resources.

Thursday, November 20 - 4:45pm - 5:30pm

EECT Automation

Human Hand Ligamentous Injury Analysis through 3D CAD Modeling and Simulation Software Development

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Need: Damage to the ligaments of the wrist is a common injury, but one that is not well publicized. In 1999, traumatic wrist injuries were reported by 88,000 workers in private industry and by 580,000 people whose ligamentous injuries were related to consumer products. In particular, injuries due to recreational activities such as snowboarding, skateboarding, and riding scooters has increased at a rate of 15% per year. One region of the wrist that is commonly injured after falling on an outstretched hand is the scapholunate joint. An impact to the wrist may produce carpal instability where the stabilizing ligaments of the wrist are compromised. Instability of the scapholunate joint is frequently manifested by wrist pain and is sometimes visualized by a 2 to 4 mm gap between the scaphoid and lunate. Surgical repairs have had limited success, in part due to the surgeon being unsure which ligament or ligaments have been torn until the time of surgery.

Overview: The objective of this study is to design and implement software that is capable of simulating the motion of a human wrist, including scaphoid and lunate bones, to help examine and diagnose ligament injuries. The mathematical accuracy and ease of use are the primary considerations that drive the design and development. Ensuring that the simulation provides reliable results is essential to making it usable as base of any further studies and developments in this area. The extensible nature of SolidWorks enables software developers to embed their own products into the package as a plugin. The existing solution will be enhanced with the use of best practices of software engineering to ensure that the time to update it in the future to take advantage of latest software and hardware technology is reduced.

Major Points:

- SolidWorks add-in programming
- Wrist injury analysis

Summary: The specific application being covered in this project is important, because the role of the specific ligaments in stabilizing the carpal bones of the wrist can be better understood. This will greatly help hand surgeons in diagnosing ligamentous injury.

Friday, November 21 - 8:00am - 8:45am

EECT Automation

Development of a Programmable Logic Controller Training Unit for Engineering Technology Curriculum

Authors:

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Need: Central Washington University offers both an undergraduate and graduate course in Programmable Logic Controllers (PLCs). Until recently, the department relied on out of date, rack mounted PLC equipment to support this class. While this allowed the students to develop PLC based projects, it did not provide the students experience with current technology. For that reason, the department, in particular, the Electronics Engineering Technology program, which supports the class, developed a set of PLC training units utilizing the Allen-Bradley CompactLogix L30ER processor.

Overview: This paper presents an overview of the development cycle of the programmable logic controller (PLC) training units created to support the undergraduate and graduate engineering technology programs. It outlines the features offered by several off-the-shelf training units as well as associated costs and a comparison of the features incorporated in the in-house unit. In addition, this paper provides vendor and pricing information that may be of value to other facilities planning to develop similar units.

Major Points:
- Overview of out of date PLC trainer
- Comparative summary of off the shelf PLC trainer units
- Development cycle of in house PLC unit
- Advantages and limitations of in house PLC unit

Summary: Attendees will be able to work with a unit and become aware of the advantages and limitations of the design. An overview of the development cycle as well as vendor information will be available. Finally, a brief overview of the developed lab sequence will be available and reviewed as time permits.

Friday, November 21 - 9:00am - 9:45am

EECT Automation

Developing a Software Defined Network Curriculum for Computer Technology and Information Technology Students

Author:

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Need: Software Defined Networking (SDN) is an interesting approached proposed by the researchers from UC Berkeley and Stanford in 2008. In SDN, network system is split into control plane and data plane. Therefore, the network services can be decoupled from the complex network interfaces. With the help of SDN, network operators can easily modify the services at are needed for an organization without having to worry about specific network component control logics. In addition, SDN enables network virtualization at a large scale. It is the key to create elastic cloud that dynamically interconnect pieces from different datacenters.

Overview: Efforts have been made to include SDN in college curriculum. Stanford, GIT, and CUNY are some of the pioneers that began to offer SDN learning modules for students in Computer Science and Computer Engineering. However, not much work has been done to develop learning modules that are targeting Computer Technology or Information Technology students, who are most likely to become the future network operators. This presentation discusses what has been done, what needs to be done and how to best implement a SDN curriculum for Computer Technology and Information Technology students.

Major Points:

- What is Software Defined Networking (SDN)?
- How does SDN impact the IT industry and what changes are necessary in CT or IT curriculum?
- What SDN curriculum (or learning modules) has been developed and what is missing for CT and IT students?
- What should be include for SDN curriculum for CT and IT students
- What hardware and software resources are available to implement SDN curriculum?
    - SDN is more than OpenFlow. But OpenFlow is certainly one of the best starting points for students to understand and practice SDN
    - Mininet is another great tool for faculty and students to build and interact virtual networks for teaching and research
- What is the likely the cost for delivering SDN learning module for CT and IT students?
- Suggested learning path and schedules for CT and IT students

Summary: Faculty and students in CT or IT must learn SDN to meet the future demands from the industry and their prospective employers. This presentation will help attendees to understand why, what and how.

Friday, November 21 - 9:00am - 9:45am

EECT Automation

Curriculum Design on Microprocessor/Microcontroller Application Courses for Engineering Technology Programs

Author:

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Need: A microprocessor or microcontroller course is typically a required technical core course in Electrical Engineering Technology or Computer Engineering Technology programs. There are plenty, if not too many, of choices that are available when choosing a microprocessor to carry out the teaching activities, from 8-bit to 32-bit microprocessors, Harvard architecture to Van Norman architecture, RISC to CISC. It could be especially difficult to a new faculty when he/she teach the course the first time. Nevertheless, we need to settle down on one type of microprocessors as the main object to study or teach for any given microprocessor course.

Overview: In this presentation we will discuss different strategies and factors to be considered when implementing or updating a microprocessor course. Recently, more and more microprocessor/microcontroller development boards with powerful functions and low cost emerged in the market. For example, Raspberry pi, a 32-bit ARM based Linux box with HDMI, Ethernet and USB ports released in 2012 costs only $25; 32-bit real-time controller C2000 based Piccolo development board from Texas Instruments costs $17 while the MSP430 LaunchPad development kit with two 16-bit MSP430 is incredibly priced at $9.99. It is very important to keep up with the technology advance and trends in the industrial while to maintain the rigor and stability of academic programs. Tradeoffs have to be made during the curriculum development or update of a microprocessor course.

Major Points:

- Need for a microprocessor/microcontroller course implementation and updating in engineering technology program
- Comparison of the availability of textbooks and supporting materials, and support community
- Comparison of the versatility and cost of development board and IDE and trend in industry
- How to balance the teaching of basics of assembly language/instruction sets and the applications using high-level programming language

Summary: In this presentation we will discuss different strategies and factors to be considered when implementing or updating a microprocessor/microcontroller course. Attendees will understand the recent trend in curriculum development on the microprocessor/microcontroller courses. Various options in development hardware kit and integrated development environment (IDE) will be compared with support community information.

Friday, November 21 - 10:15am - 11:00am

EECT Automation

The Application of SAP in Human Resource Management

Authors:

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Need: Currently, lots of enterprises across the globe rely on software products for management and operation. Enterprise Resource Planning (ERP) is an important suite of integrated applications that various organizations use to store and manage data from every stage of business. Academic institutions are using multiple software packages for data processing in different departments. In future when there is a strong need for data sharing among various software packages that belong to different departments, there will be enormous challenges in terms of system integration and data consistency. Academic units used to maintain data using different software packages and applications. It will be difficult to integrate data from different systems in the future. The compatibility among these packages and corresponding applications will become a challenge too. It would be better to maintain all the data in one system that supports all modules rather than maintaining various modules in different software packages. Implementing system application products and services in business processes is an ideal solution to configure and maintain modules running in different academic units.

Overview: This presentation mainly focuses on SAP implementation in a regional university setting using ASAP (Accelerated SAP) methodology. SAP is contributing to the success of thousands of enterprises across the globe. It is the single ERP package that provides all the modules and provides best communication across those modules. ASAP methodology is best suitable to implement SAP at academic institutions. As legacy systems do not have as many functions as SAP does, customers felt much more satisfied and ease of use so that they started referring other people the best can be achieved through customer satisfaction. Employees will be able to access SAP through any web browser. In SAP Human Resource Management is a process of selecting and makes use of the employees to achieve the organizational goals and objectives. The following concepts will be executed in the process of SAP implementation: investing in employees, skills and technical training, performance appraisal. It is easy to maintain single time database for all the school's employees who will provide proper regular hours, over time hours, holiday hours and week end hours.

Major Points

- Importance of SAP
- GAP analysis, this describes previous software and present software
- ASAP methodology using 5 main steps
- How to maintain SAP after implementation

Summary: The data related to all the modules can be stored in one database. It will not only facilitate data consistency but also make communication among departments is very easy. With the implementation of SAP, there will be a good integration among employee personal master data, time management data, benefits data, courses and instructors' data, students' data and payroll data.

Friday, November 21 - 10:15am - 11:00am

EECT Automation

Develop an Effective Way to Multi-Task While Messaging on Mobile Devices

Authors:

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Need: Mobile computing is fueling economic growth, transforming industries, and is redefining the way we live. Almost everyone has a smart phone or tablet these days. These smart devices have the power to deliver computing wherever you go. Majority of the users use smart devices for multi-tasking such as messaging, reading news, and checking emails. Here multi-tasking is challenging for users. They need to switch between the apps. Due to small screen size, running multiple windows simultaneously is difficult. Majority of the users communicate through messages and exchange them on the go while multi-tasking at the same time. An average user may text multiple times within a few minutes and has to switch between apps whenever a new message comes in. This is a very inefficient way of multi-tasking and requires three to four steps minimum to perform each operation. Our project aims to reduce the number of steps to zero, which means users will be able to message from whatever screen they are currently on.

Overview: In this project, we design a floating point that captures the incoming messages. Once the messages are captured, the floating point expands to a floating window, and thus allows the user to read or reply to the message in the floating window. We will implement this design on Android system first, because currently Android is the most widely used operating system on smart devices in the world (about 75 percent market share) and has an open echo system. In this project, we will use Android with Java development environment. We are planning to create a framework for a floating point to receive and send messages. Internally we will run a service that handles the communication between the messaging client and the floating point. The Internal process communication between the service and the floating window will enable the application to respond quickly in real time.

Major Points:

- The trend of mobile computing
- Android system architecture
- The inefficiency of current multi-tasking on mobile devices when messaging
- A design of screen floating point
- The implementation of our app that fetches incoming messages and allows user to text without leaving current window

Summary: By creating this mobile app, we will efficiently implement multi-tasking without consuming too much screen space. The current messaging system takes a minimum of three steps to switch between apps. Our design reduces the number steps to zero.

Thursday, November 20 - 11:30am - 12:15pm

EECT Energy

A LabVIEW-based Automatic Solar Tracking System: Architecture & Analysis

Authors:

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Need: Since energy crisis is the most important issue in today's world, renewable energy resources are getting priorities to lessen the dependency on conventional resources. Solar energy system is becoming the major renewable system to replace the conventional energy resources due to the inexhaustible resource and its environmental advantages. In a solar energy system, solar panels are used to directly convert solar radiation into electrical energy. Solar panels are made from semiconductor materials which has a maximum efficiency of 24.5% in energy conversion. Unless a new material or technology is invented and applied in making solar panels, the most cost-effective method to improving the efficiency of solar panels is to increase the light intensity. Automatic solar tracking systems have been designed and studied by many researchers, but the high initial investment and low system efficiency still prevents a wide implementation of such type of systems. Fixed solar panels are still the major implementation for solar energy systems, especially for small-scale household systems.

Overview: The purpose of this research project is to design and study an automatic solar tracking system using a LabVIEW-based controller based on two different control strategies. A prototype of the system will be designed and built with solar panels, stepping motors, motor drives, photosensitive sensors, and LabVIEW controller. The LabVIEW controller will be programmed to implement two different control models, one designed with a classical control strategy, and the other one with a modern control strategy. These two control strategies will be implemented and compared with their different algorithms and operations. A statistic study will then be conducted to figure out the strategy with higher efficiency in energy conversion. The cost analysis of the prototype system will also be studied to compare with the average market prices.

Major points:

- Literature review of the research
- Introduce the procedure and system architecture
- Analyze and compare the system performance based on two control strategies
- Demonstrate the cost analysis of the system
- Discuss of further study

Summary: This research project will design and study the efficiency and cost of an automatic solar tracking system programed with two different control strategies. The efficiency of these two LabVIEW-based controllers will be analyzed and compared based on a statistic study. The cost of the prototype system will also be studied and compared with the average market prices of similar solar tracking systems.

Thursday, November 20 - 11:30am - 12:15pm

EECT Energy

Developing Understandings of Alternative and Sustainable Energies

Authors:

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Need: The need for clean energy has seen an unprecedented growth in the past few years. Driven by global demands for energy coupled with issues related to climate change an understanding of energy, usage and measurement is an essential part of a technology related program. We will present a curriculum development model and explain how it was used to update course content related to understanding alternative energy and sustainability. These changes are anticipated to better prepare students for immediate entry into the workforce and for the benefit of industry.

Overview: In order to develop understandings related to alternative energy and sustainability, key concepts, content, and interaction must be incorporated throughout the curriculum and undergraduate research opportunities. Varied levels of interactions strategically placed can assist in moving the learner from a level of awareness to one of conducting research for specific applications. Challenges include keeping up to date with the changes in technology, developing meaningful learning opportunities, and providing relevant context. This presentation will discuss how alternative energy and sustainability have been integrated throughout the curriculum, including introductory coursework, established and on-going activities, identifying and developing applications for areas in need (developing countries), and how it is finally integrated into the senior capstone course.

Major Points:

- Developing understandings of energy usage
- Developing technical skills in measuring and predicting energy needs
- Identifying key areas in the program for integrating alternative energy and sustainability
- Developing national and international activities and/or opportunities
- Course changes, conclusions, and recommendations

Summary: Attendees will understand the curriculum development process and see current activities and interactions used to integrate alternative energy and sustainability into the curriculum. This model can develop better understandings of energy usage, green energy, and the appropriate application of alternative energy for the benefit of students and industry alike.

Thursday, November 20 - 1:30pm - 2:15pm

EECT Energy

Design and Implementation of 2kW Hybrid Photovoltaic and Wind Energy Laboratory and Training System for Renewable Energy Classes and Research

Author:

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Need: Education and training in the applications of renewable energy for the nation's workforce has become significant. Although hiring technicians with Associate of Applied Science (AAS) degrees in the areas of electromechanical, solar photovoltaic, and wind technologies may address the needs of the industry workforce in wind and solar energy in the short term. Having a skilled technical workforce with degrees in technology and engineering, with an emphasis on advanced wind and solar power, and having engaged in projects such as variable wind speed and frequency issues, turbine generator testing, troubleshooting, data acquisition, monitoring, and advances on grid-tie technologies, together with knowledge in liberal arts courses, fosters more productive and efficient energy employees who can advance wind and solar power development.

Overview: The main objective of this project was to design and build a 2 kW solar-wind hybrid laboratory and research environment. The system consist of mainly a student built power house (station), associated data acquisition sensors, five solar panels, five wind turbines, LED loads, balance of the system components (inverters, charge controllers, battery analyzers, measurement devices etc.) and a graphics-based monitoring instrumentation system to provide a teaching and research facility on renewable energy for students and faculty members in Technology programs at the State University. A group of students and faculty from the technology programs (electronics, construction, design and development, and safety management) are involved in the design and implementation of this project. The system is being used for two renewable energy related classes' laboratory experiments (Solar and wind energy technology & Energy harvesting, conversion, and storage systems). Additionally, this system is used for Science, Technology, Engineering, Math (STEM) related workshops offered to public school students and teachers on campus. It is open to faculty and students for research opportunities in the field of renewable energy technologies.

Major Points:

- Hybrid solar-wind system design
- Complexity of the hybrid systems
- Viability of solar and wind system on campus
- Investigate safety issues of the system
- Promotion of renewable energy on campus
- Describe applicability of the system
- How to prepare manuals for course and research activities

Summary: The system allows students to become educated and trained in using real-time energy systems, and allows them to gain valuable hands-on experience in setting up a real-life solar and wind energy systems from beginning to final stage. With the increasing importance of renewable energy resources in present and future energy scenarios, an ability to design and analyze renewable energy systems is essential for educators and students in engineering and technology. All students in the project showed improved learning and understanding of concepts about renewable energy sources by complementing theory-based lectures with hands-on experimentation. All the project steps and student outcomes will be detailed in the paper.

Thursday, November 20 - 1:30pm - 2:15pm

EECT Energy

Steps Toward an Energy Smart Campus Through Planning, Implementing and Demonstration

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Need: Renewable Energy and Smart Grid Technologies are becoming more prevalent in today's energy grid. Farmingdale State College has partnered with its energy provider (PSEGLI) in order to implement these technologies on Campus. We will present the steps taken in order to develop an energy smart campus and our plans to educate the public through workforce training and offer tours of our demonstration facilities.

Overview: The Renewable Energy and Sustainability Center (RESC) at Farmingdale State College in collaboration with Stony Brook University and PSEGLI has been developed as part of a grant from the U.S. Department of Energy. Through this grant the College has been given the opportunity to enhance its energy grid through the use of renewable energy and smart grid technology. The renewable energy installations serve as both an energy source for the college as well as a demonstration/educational tool for the campus community and the public. The RESC has developed green energy workforce training available to the public.

Major Points:

- Developing course material for teaching workshops about renewable energy technologies (e.g. Solar Photovoltaic, Solar Thermal, Small Scale Wind, Plug-in Hybrid Electric Vehicles, Smart Meters)
- Discuss the various renewable energy demonstrations on campus (e.g. Solar Carport with Electric Vehicle Charging Stations, Smart Energy Home, Small Scale Wind Farm, etc.)
- Outreach and education using campus demonstration facilities/demonstrations
- Collaboration between academia and your energy provider

Summary: Attendees will understand the steps taken in developing an energy smart campus and the teaching methods used to educate the public.

Thursday, November 20 - 2:30pm - 3:15pm

EECT Energy

Modeling for More Efficient Wind Turbine

Authors:

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Need: Today, as fossil fuel reserves continue to diminish and there is greater public demand for clean, renewable energy, people are looking at wind power as a viable, cost-effective method of generating electricity. Although there are many wind turbines currently in use that supplement the energy created through other means, most turbines in use are relatively inefficient, capturing only a fraction of the power contained in the wind. For this reason, researchers continue to work to develop turbines and blades that can extract more energy, with fewer losses. Computational Fluid Dynamics (CFD) is the prediction of flows using mathematical modeling, numerical methods, and computer simulations. SolidWorks, by Dassault Systèmes, which contains a powerful CFD toolset are used for this research.

Overview: The main goal of this research is to develop a mechanism that will change with wind speed to get maximum efficiency from the wind turbine while it is operating. We will determine optimal condition to develop more efficient wind turbines using computational fluid dynamics simulations. So far we successfully made a three-dimensional model of an airfoil, applied specific boundary conditions to the flow of air, ran time-dependent simulations, and gained results of the simulation giving me force, pressure, velocity, and vorticity of the air along the surface of said airfoil. This research is being done in an effort to make wind power a more economically viable option and alternative to fossil fuels, and to gain a better understanding of the physical interactions involved in flight.

Major Points:

- Design a wind turbine with a CADD software
- Design and analysis of blades – shape, pitch, camber, length, – angle of attack of the blades, blade arrangements, number of blades used, tower design, method of regulation (braking)
- Use CFD (computational fluid dynamics for simulation of the wind turbine
- Use computational method of "solving" the designs, which is, determining the forces and necessary data on the surfaces being tested in an effort to find a design that increases efficiency.
- Find the lift and drag coefficients at various angles of attack.
- Find the surface pressure and skin friction coefficients, as a function of the position on the chord of a blade profile, at various angles of attack.
- Determine the lift and drag characteristics of each blade design.

Summary: All the information about the project will be shared with academia including design steps, issues, software tools used, theorems, and getting this type of research to classroom environment to increase student understanding on dynamic analysis, and results etc.

Thursday, November 20 - 2:30pm - 3:15pm

EECT Energy

Embedding Project Management into a Data Networking Course

Authors:

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Need: Students entering into information technology programs are already familiar with learning the "how-to's" of technology. They can configure a set of networking devices to a set of specifications. This is important for an entry level technician. To extend beyond that entry level position, students will need to develop project management skills. They need to have a system-wide perspective an organization's technology infrastructure in order to plan and implement technology projects effectively.

Overview: This presentation will provide a rationale for embedding project management into information technology curriculum. A case study will be presented exemplifying how this was accomplished in a recent data networking course. In small groups, students developed a project plan for the initial development of their network based on a set of requirements. Timelines, Gantt charts and individual student expectations were defined prior to the implementation of the project plan. Upon completion of this first phase, the various groups were informed that they were all going to be involved in a corporate merger. The merger would require students develop another project plan to determine how the respective networks would be integrated.

Major Points:

- Rationale for teaching project management in information technology courses
- Case study on how this was accomplished in a data networking course
- Strategies for incorporating project management into attendees own courses

Summary: Attendees will gain an appreciation of the need for embedding project management into information technology courses. A case study will demonstrate how this was accomplished in a recent data networking course. Conference attendees will then be presented with strategies for incorporating project management into their own courses.

Friday, November 21 - 8:00am - 8:45am

EECT Energy

Predicting Building Thermal Energy Loss from the Use of Automatic Door Openers

Authors:

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Need: In the United States, commercial buildings account for nearly 19% of the energy consumed. In 2011, this was 18.02 quadrillion British thermal units, QBtu. This is two thirds the amount consumed by the entire transportation sector including truck, railway, automobiles, and air. The Pacific Northwest National Laboratory indicates that lost opportunities in building energy consumption savings could reach 4.9 QBtu by the year 2015. That savings is approximately the annual energy consumption of 21 million passenger automobiles or the emissions of 28 coal-fired plants. Literature discusses multiple ways that a building interacts with the environment based upon passive operation of the building, in other words, how it reacts to environmental influences. Currently a gap in literature exists in the examination of some building activities. This study examines the resulting energy impact of an individually-controlled activity: holding a door open. Understanding the amount of energy that is lost through this process, among many others, is one of many steps to reducing the energy saving opportunities lost in building energy efficiency

Overview: This study aims to create a predictive model to determine the amount of heat that is lost by measuring the automatic doors on a university campus. To do this, the study collected data to develop a model to estimate the amount of thermal energy (in the form of heated air) lost during the use of automatic doors and the equivalent additional carbon footprint that results based upon the following variables: temperature gradients, air density, airflow, and the time the door is open.

Major Points:
- Thermal energy is lost in buildings though open doors.
- A predictive model for estimating energy losses
- Data collected on temperature gradients, humidity, airflow, and exchange time

Summary: This study provides a predictive model that can be used to provide an estimate of the amount of thermal energy exchanged between the outside and inside of a building when a door is held open. The independent variables measured include: temperature gradient (the difference between the indoor and outdoor temperatures); air density, air flow, and the time the door is open. The estimates can be used to validate recommendations for adjustments in automatic door timing.

Friday, November 21 - 8:00am - 8:45am

EECT Energy

Hardware Design for Harvesting Ambient Energy to Power Wireless Sensor Nodes

Authors:

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Co-Author: Dr. Bekir Yuksek, University of Northern Iowa, yuksekb@uni.edu

Need: Structural health monitoring of highway bridges is crucial to prevent large tragic incidents resulting loss of properties and even human lives. The integration of wireless sensor networks (WSNs) to structural health monitoring not only reduces the cost of cabling but also provides the ease of installation and maintenance. However, WSNs are typically battery powered, which limited their wide deployment for bridge monitoring. The self-powered WSN based system is an appealing approach to further reduce the maintenance requirement for battery change and makes the system more flexible. We will present a novel wireless bridge monitoring hardware that consists of charger circuit, energy storage component, control circuit and the wireless sensor node. The designed wireless bridge monitoring hardware uses a unique approach to power the wireless sensor node using a mini-sized film solar panel.

Overview: The proposed wireless bridge monitoring system is used to measure strains that result from ambient traffic crossing the bridge at multiple locations under the bridge. We evaluated different ambient energy sources and storage devices that may be used to efficiently power the wireless sensor nodes for the bridge monitoring environment. Design goals of the energy harvesting and storage circuit include low-cost, low-power consumption, and a simple design. We introduced a novel control circuit to minimize the energy consumption and store energy in super-capacitors. The control circuit with the ultra-low power consumption components is designed to prevent further energy loss when the voltage dropped below a given cutoff voltage and to make sure the charging circuit works close to the maximum power point of a solar panel.

Major Points:

- Design challenges for a self-powered WSN based structural health monitoring system.
- Energy harvesting techniques and circuits comparison for WSN in structural health monitoring.
- Circuit design and performance evaluation.
- Field test results and self-sustainability study.

Summary: An energy-harvesting based wireless sensor network is a promising and attractive option for bridge monitoring. We proposed a simple energy efficient hardware design for harvesting ambient energy to power wireless sensor nodes in a structural health monitoring system. The performance of the proposed circuit has been verified on the basis of the captured data through the deployed self-powered system prototype on the bridge.

Friday, November 21 - 9:00am - 9:45am

EECT Energy

Circuit Design for Improved Capture of Ambient Energy over a Wide Frequency Range by Piezoelectric Energy Harvesting Devices

Authors:

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Need: Piezoelectric energy harvesting devices, along with their supporting circuitry, have been proposed and developed, at least in prototype, to capture ambient vibrational energy from a wide variety of sources. This energy, when converted from mechanical form into electrical form by piezoelectric devices, can be used to power structural health monitoring circuitry (for bridges, dams, etc.). Electrical power from this type of source is very useful when the use and replacement of batteries, or the use of wired power is either impractical or prohibitive in cost. This presentation will focus on an application, structural health monitoring, because of the perceived need to monitor changes in structural parameters of widely dispersed and remote civil infrastructure. The core of the presentation will be a design to adjust the resonant frequency of the piezoelectric device to the relatively wide range of frequencies that are present in the ambient energy from the vibrating structure. The need for such an adjustment arises from the fact that energy transfer and conversion, from the mechanical energy of vibration to the electrical energy needed to power the monitor circuitry, is optimum when the frequencies of the mechanical and electrical system are matched over a narrow frequency range.

Overview: Energy harvesting from vibration sources, such as roadways and bridge structures, is dependent on tuning the harvesting circuitry to match the characteristic frequencies found in the ambient mechanical structures. There are a wide range of such frequencies, depending on such factors as mass and dimensions of the structure, or the amount and volume of the traffic or other loads on the structure. Piezoelectric energy harvesters, which are in the class of devices called "kinetic energy harvesters," will generate maximum power when the resonant frequency of the generator is matched to the ambient vibration frequencies. By definition, a high-Q resonant device will match frequencies from the mechanical vibrating system only over a narrow range of frequencies, thus yielding very limited frequency bandwidths over which energy can be efficiently harvested. Since many piezoelectric and other vibration energy harvesters utilize cantilever beams as the conversion element, and since the resonant frequency can be shown to be partly dependent on the length of the cantilever, then one of the proposed designs is to adaptively alter the frequency of the piezoelectric element by changing this length in response to the changes in the ambient. Furthermore, it has been established that the mass of the cantilever beam in the piezoelectric unit also affects the frequency, so that adaptively changing the mass loading on the beam can change the frequency. By these two means, this presentation will strive to show that adaptive frequency adjustment can enhance the efficiency of piezoelectric energy harvesters.

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Friday, November 21 - 9:00am - 9:45am

EECT Energy

Circuit Design for Improved Capture of Ambient Energy over a Wide Frequency Range by Piezoelectric Energy Harvesting Devices

Major Points:

- Need to use energy harvesting to power remote structural health monitoring circuitry.
- Need to match ambient vibrational frequencies to resonant frequency of energy harvesting devices.
- Altering physical characteristics of harvesting devices to adaptively change resonant frequency to match ambient frequencies.
- Comparison of effects of adaptive frequency adjustment on energy conversion efficiency.

Summary: Attendees will understand the physical principles animating the most recent energy harvesting strategies for remote structural health monitoring, and the will also understand how the electronic circuitry and piezoelectric devices work together to perform this monitoring function.

Friday, November 21 - 9:00am - 9:45am

EECT Energy

Investigation on Temperature and Pressure Profiles in a Downdraft Gasifier Using Different Biomass Feedstock

Authors:

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Need: Syngas or Synthesis gas is a fuel gas mixture derived from biomass feedstock that can be burnt directly to produce heat in power plants or be used as a fuel in internal combustion engines. The Renewable Energy Center located in the Eastern Illinois University (EIU) provides Syngas from woodchips (outsource) to produce steam up to 100% of heating demand and electrical power up to 10% of electrical demand for the University's campuses. Therefore, the EIU's Center for Clean Energy Research and Education (CENCERE) is conducting experimental studies to analyze the Syngas produced from other regional biomass feedstock and to find methods for increasing the efficiency of gasifiers in the future.

Overview: The output data of the experimental studies is based on the Syngas properties as well as observations of temperature and pressure in the four stages of a downdraft gasifier including drying, pyrolysis, combustion and reduction zones for specific biomass feedstock. Temperature and pressure sensors installed in the gasifier have shown an unstable combustion zone caused by different concentration and direction of Oxygen diffusion inside the gasifier. Thus, the displacement of the combustion zone demonstrates different temperature and pressure gradient across the gasifier in each experiment. The presence paper compares the temperature and pressure gradient curves of three experiments of a mixture feedstock including 50% woodchips and 50% switchgrass (local biomass resources).

Major points:

- Finding optimum temperature and pressure curves according to the quality of the Syngas reported by a gas chromatographer (GC)
- Suggesting modification methods to control the Oxygen flow rate in order to reach the optimum curves
- Comparing the temperature and pressure profiles for different feedstock in the future

Summary: The results of the paper provide useful data of essential factors like mechanical design, feedstock properties and Syngas quality in a gasification process. Thus, it will develop the map of manufacturing and controlling the gasification technology in the future.

Friday, November 21 - 10:15am - 11:00am

EECT Energy

Renewable Energy and the Future of Electric-Based Cars

Authors:

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Need: It has been widely observed that humans have been living unsustainably, as evidenced by our ever-increasing consumption of natural resources such as fossil fuels and alarming emissions of greenhouse gas. For example, since 1850, carbon dioxide in the atmosphere has increased more than 30% due to the fact that its release from oil and coal has quadrupled. In order for the Earth to continuously support human lives, we must achieve sustainability for the global social, economic, and environmental systems. Renewable energy offers great potentials for the world to reduce dependency on fossil fuels, which can lead to a cleaner environment, better preservation of natural resources, and more economic opportunities to the communities. With the renewed interest in the idea of marketable electric or hybrid cars, possibilities have emerged to utilize renewable energy to power tomorrow's automobile. There is a variety of systems being conceptualized or implemented, which all help in reducing the amount of greenhouse gases produced from transportation.

Overview: The idea of having an electric car is not necessarily new but advancements in technology have allowed for better developed systems within the newer breeds of automobiles. These systems are more efficient, which has contributed to the development of a few different kinds of electric vehicles. Hybrid Electric Vehicles (HEVs) utilize conventional powertrain with an electric motor (or multiple). Electronics and high voltage batteries are designed to increase overall powertrain efficiency. Earlier models of Toyota's Prius represent modern HEVs. Battery Electric Vehicles (BEVs) and Plug-in HEVs (PHEVs) could have a promising place in automotive industry because they have the potential to be operated using renewable energy. Renewable energy resources can be harnessed to charge the high voltage batteries used in BEVs or PHEVs. For example, a bank of wind turbines or solar panels could be used to meet the daily needs of charging a few PHEVs. BEVs rely on an electric motor and high voltage batteries for propulsion. Examples of BEVs include the Chevy Volt, Nissan Leaf, and Tesla. On a smaller scale, renewable energy could provide short-distance commuters an implementation of charging system at home. With cooperation on a larger scale, renewable energy could be put in place to create stations containing charging and charged batteries. These batteries could be easily switched out to allow the driver to quickly continue on. PHEVs operate similar to HEVs but offer an efficient powertrain that is more electric based than traditional HEVs. Like in BEVs, renewable energy could help with the future development and utilization of PHEVs. Based on the nature of grid expansion and the implementation of smart grids renewable energy can be expanded to meet the demand of PHEVs much quicker than systems based solely on BEVs. The advantages of utilizing renewable energy and its potentials with BEVs and PHEVs will be further explored. Systems of various sizes and scales will be analyzed.

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Friday, November 21 - 10:15am - 11:00am

EECT Energy

Renewable Energy and the Future of Electric-Based Cars

Major Points

- Alternatives to fossil fuels need to be developed and utilized.
- Renewable energy generation technologies becoming widely available and implemented.
- Existing systems that can harness renewable energy to power BEVs and PHEVs.
- Analyzing systems of varying sizes and scales.

Summary: Renewable energy has the potential to help mitigate dependence on ever-diminishing sources of fossil fuels. Conceptualized and implemented systems to power automobiles will be discussed. Exploring various systems will provide insights on future technologies and their feasibility at home and at larger scales.

EECT Energy

Curriculum Development for Renewable Energy Education

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Need: As the need for sustainable energies becomes continuously invaluable to the survival of mankind, more research is being done worldwide. As these changes are made the need for curriculum in schools and colleges becomes evident. As new careers in the job market are created more specific training and courses are needed to develop tomorrow's technical experts. Wind energy, solar power, biodiesel, and gasification are becoming household names. As research creates new developments in these energies, dynamic curriculum development is needed. It is beneficial for students to have such courses available to them as industry implements alternative energies.

Overview: Current research is being integrated into the curriculum includes, but is not limited to, the following solar, wind, biodiesel, gasification with biomass selection, and integration. This research is constant and the findings are dynamic. The focus of this presentation will center on how this research is being used to develop new curriculum as well as establish a level of continuity to the program.

Major Points:
- Development of research into curriculum
- Summer camp for high school students
- Short teachers institute
- Integration of research and practices into current and new curriculum

Summary: Current renewable energy curriculum will be shown, as well as what new research is being integrated. Though the use of this new curriculum, students will learn about past and current research. This information will be advantageous to the students and the EIU School of Technology as we continue to move forward in renewable energy research.

Friday, November 21 - 11:15am - 12:00pm

EECT Energy

Tracking Classroom Light Usage – A Sustainability Lab Exercise

Author:

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Need: There is a great national interest in energy sustainability. Presented will be an inexpensive data acquisition lab exercise in which students collect, analyze and report on the energy consumed when lighting classrooms. Teachers using the lab may emphasize various components depending upon their target audience, e.g. renewable energy courses may use the data to analyze the effectiveness of alternate lighting systems, electronics technology courses may focus on circuit design and instrumentation, the lab exercise provides upper-division and graduate courses with real-time data to develop statistical models.

Overview: Presented is a lab exercise developed in 2011 for an instrumentation course. The primary goal of the lab was to provide students with a real-world application of data acquisition and analysis. Light-sensing circuits were connected to inexpensive DATAQ DI-194 data acquisition boards ($29 for board, USB cable & software). The systems were placed in classrooms and monitored light usage over a 48-hour period. The collected data were then analyzed by the students and reports were developed outlining power usage, power costs and recommendations.

Major Points:
- Overview of the lab exercise (includes notes & handouts for attendees)
- Demonstration circuits, DATAQ boards and DAQ software
- Samples of student reports
- Suggestions on how to modify the lab to support specific outcomes
- How to modify the lab for use with LabView

Summary: Attendees will receive a ready-to-implement hands-on lab exercise based on sustainability which may be modified for use in a variety of technology courses. The lab has been received well by students, faculty and staff at Western Illinois University. Data collected by the students have generated discussion and brought attention to light usage in classrooms.

Friday, November 21 - 11:15am - 12:00pm

EECT Energy

The Static Capacity or Adequacy Evaluation of the World's Electric Power Systems

Authors:

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Need: Power system planning can be divided into two distinct different areas dealing with static and operating capacity requirements. The static capacity area relates to the long-term evaluation of the overall system requirements. Operating reserve margin analysis, on the other hand, relates to the short-term evaluation of the actual capacity required to meet a given load level or demand. Adequacy and security are major concerns for power system planners and operators. System adequacy relates to the existence of sufficient facilities within the system to satisfy the consumer load demand. These include the necessary facilities to generate sufficient electrical energy and the associated transmission and distribution required to transport the energy to the actual customer load points. Adequacy is therefore concerned with static conditions which do not include system disturbances. The main or major aspect of these developments is the evaluation of static capacity or adequacy assessment of North American electric power systems or networks in comparison with that of rest of the world. The presentation will focus on the costs analysis, benefits of electric power systems adequacy & security and assessment of independent power production or non-utility power generation.

Overview: Sufficiently high adequacy and security or reliability is a central guiding principle for the entire world electric power supply, and a very important requirement for efficient manufacturing, commerce, and industry, as well as a high standard of living. Modern electric power systems are perhaps the most complex large-scale technical undertakings developed by humankind. The study of electric power systems is concerned with the generation, transmission, distribution and utilization of electric power. The first of these, the generation of electric power, involves the conversion of energy from a non-electrical form (such as thermal, hydraulic, nuclear, wind or solar energy) to electric energy. This form of energy has given considerable impetus to the development of the many modern societies in the world today. Electricity has become a dominant factor in daily Life, an essential input to industrial production and a major form of energy. Dependence electricity has also increased with increased utilization. . The presentation will focus on the costs analysis, benefits of electric power systems adequacy & security and assessment of independent power production (IPP) or non-utility power generation (NUG).

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Friday, November 21 - 11:15am - 12:00am

EECT Energy

The Static Capacity or Adequacy Evaluation of the World's Electric Power Systems

Major Points:

- Power System Adequacy, Security, and Reliability;
- Static Capacity or Adequacy Assessment of Electric Power System; and
- Costs Analysis; and Potential Benefits of Investments in IPP or NUG

Summary: Through careful planning, continuous training and investing in new technology, electric power utilities in North America are always working hard to provide the electricity which is the engine or the driving force of every economy in the world.

Thursday, November 20 - 11:30am - 12:15pm

Graphics

Students' Perspectives of Hybrid-Learning in Design and Drafting Technology (CADD) Courses

Authors:

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Need: Evaluating educational approaches is an essential part of technical education, and students' perspectives of instructional styles (e.g., face-to-face and hybrid) play important roles in transforming educational practices to meet diverse students' learning needs. Studies have shown that some of the college students enrolled in traditional technical courses do not display retaining the knowledge learned from their previous courses. Technological advancements have had a positive impact on learning methods; therefore, Design and Drafting Technology faculty of the University of Central Missouri (UCM) is seeking innovative ways to improve and maximize students' learning while meeting different students' learning styles. In our presentation, we will display the strength and weaknesses of hybrid instructional methods from students' viewpoints, how to overcome the pitfalls associated with traditional and electronic learning (e-learning) techniques, and how to effectively implement new e-learning methods for educating the freshman students enrolled in Design and Drafting Technology courses.

Overview: Based on the literature, most academic institutions around the world have been embracing e-learning methods to provide accessible and engaging education to their students and educate skillful individuals who can continuously update their knowledge and skills and remain competitive in today's job market. The purpose of this study will be to explore students' perspectives of hybrid learning. Information pertaining students' opinions and experiences of hybrid learning will be collected via interviews involving 54 freshman students (6 groups) from three drafting courses taught by the same instructor at UCM. The results of this investigation will be audiotaped, classified, and analyzed to discover how to enhance the drafting curriculum in order to improve students' learning. The findings of this study will be valuable not only for enhancing students' learning and achievement, but also for future academic and institutional innovations.

Major Points:

- Students' perspective of hybrid learning
- Effective approaches towards the difficulties associated with hybrid instructional systems
- Effective implementation of new e-learning methods
- Recommendations and conclusions

Summary: Attendees will learn innovative and effective ways of Design and Drafting Technology instructional approaches to meet different students' learning needs. The practical activities addressed in this presentation can be incorporated into any drafting course to achieve positive outcomes.

Graphics

Designing an Introductory Cross Media Workflow Course: What Undergraduate Students Should Know?

Authors:

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Dr. Thomas H. Spotts, Associate Professor, Department of Technology, Ball State University, Muncie IN, 47306, 765-285-5913, tspotts@bsu.edu

Need: Teaching new technologies have always presented challenges for educators in higher education. Cross Media Workflow is gradually becoming a new addition to the offerings of some undergraduate or graduate graphic communications program of study. At present, there are no textbooks that address the teaching and learning of cross media workflows. For the reason cross media is new technology, the resources and information on cross media publishing and workflow are piecemeal with limited instructional resources. Pulling together available resources and developing strategies for a course requires locating reliable sources such as the Printing Industries of America, Technical Association of Graphic Arts, and Graphic Communications Education Association. This presentation provides a proposed model of instruction for an introductory undergraduate course in cross media publishing.

Overview: The most current developments, practices, and resources in cross media education, including examples of student projects, are to be provided to those attending this presentation. Specifically, the use of the Adobe Publishing Creative Suite as tools for students to create and manage digital content for cross media workflow— going beyond print media.

Major Points:
- Cross Media Workflow defined
- Adobe Creative Publishing Suite Tools for Cross Media Publication and Workflow
- Common workflows
- Issues encountered
- Teaching strategies

Summary: Attendees will gain an understanding of cross media as it pertains to graphic communications education at the undergraduate level. Recommendations for a course of study are to be presented with a sample syllabus given to each participant. The syllabus includes a proposed course title, course description, list of student projects, computer software applications, hardware, and materials.

Thursday, November 20 - 1:30pm - 2:15pm

Graphics

Green Design: Using 3D Scanners, Solid Modeling, and 3D Printers to Duplicate and Improve 3D Models

Author:

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Need: 3D scanning and 3D printing are areas that are becoming more and more popular in the design fields. This technology really fits in the applied engineering focus of many of our programs.

Overview: Things have really changed in the World of graphic design. 3D scanning is becoming available at prices that are reasonable for the limited budgets of colleges and universities. 3D printers are becoming much cheaper than they were last year and this technology can really excite students.

Major Points:

- Some of the 3D scanners are available scan to the STL format where a physical part can be copied into a 3D digital model and then duplicated on an RP. This might be considered a good place to create student enthusiasm for the new technology.
- The STL format scanners are fairly easy to use and will give the design students a positive experience
- More advanced scanners have the capability to detect features such as surface, holes and other aspects of part geometry. These usually take a higher level of skill and the focus becomes on lighting and image capture.
- After the object has been scanned the design can be improved through finite element analysis and other design technologies. These will be briefly discussed/
- The prices have dropped significantly on desktop 3D printers. Several models of these will be discussed from personal experiences using them.

Summary: Attendees from architecture, industrial technology, engineering technology, and graphics design will be encouraged to discuss what is new in scanning and 3D scanning. I am certain that as we start discussing 3D scanning and low priced RP machines attendees will gladly ask questions and give personal examples from their experiences.

Thursday, November 20 - 2:30pm - 3:15pm

Graphics

Visualization Research

Author:

Dr. Carl N. Blue, University of Southern Maine, Gorham, ME 04038, 07-780-5391, cblue@usm.maine.edu

Need: Interactivity has generally been assumed to be a natural attribute of face-to-face (f2f) conversation, but it has been proposed to occur in mediated communication settings (gaming) as well. The goal was to compare two samples of participants and observe whether interactivity had any affect on spatial visualization when compared to the static test.

Overview: The goal of this research was to administer and compare a mature visualization-testing instrument, the Purdue Spatial Visualization Test of rotations (PSVT) and create a deliverable interactive contemporary version, the Spatial Visualization Gaming Instrument (SVGI) that incorporated interactive-electronic visualization manipulation and audio gaming components. At interest was whether an interactive instrument with "gaming" characteristics had any influence on student scores compared to more conventional testing tools that utilize paper artefacts or static testing instruments.

Major Points of this Presentation
- Spatial Visualization research and testing instruments
- Visualization as a skill that can be trained and improved
- STEM careers and visualization as problemsolving
- Interactivity as an influence on visualization

Summary: This presentation will provided both a background on spatial visualization and concepts of interactivity. Characteristically these academic practices have typically employed "pre-test – treatment - post-test" arrangement to analyze and explore students' visualization skills. Previous assessments of separate groups taking both the PSVT and the SVGI demonstrated partiality for the more interactive testing tool. The results of this direct comparison of the paper PSVT to the interactive SVGI by the samples are provided, as well as ancillary data on gaming preferences, and participants' reflections on both instruments.

Thursday, November 20 - 2:30pm - 3:15pm

Graphics

Responsive Web Design for Mobile and Tablet Compatibility

Author:

Dr. Feng Jao, Ohio Northern University, Ada, OH 45810, 419-772-2172, f-jao@onu.edu

Need: Technology has a profound impact on our daily activities. In recent years, number of users of mobile and tablet device has increased dramatically. Designing website for desktop publishing no longer satisfies our end user's need. Web designers are constantly challenged to create and implement websites that are dynamic and compatible to all types of end devices such as mobile phones and tablet pcs. As an educator, it is inevitable to investigate the contemporary trends as well as the future directions of the field to ensure that the content of website design course provides learners the desirable knowledge and skillset for their work place. This presentation will address the languages, tools and various methods in designing websites for both desktop publishing as well as mobile devices.

Overview: This presentation will utilize the two fundamental languages of the web design field, HTML and CSS, to demonstrate various ways of creating website layouts that are fluid, and dynamic for both desktops and mobile devices. Presenter will introduce the concept of Responsive Framework design in comparison to fixed-layout, and incorporate design tools such as Twitter's Bootstrap, and 960 Grid System in website projects. Finally, samples of web design projects will be demonstrated in two versions; one using fluid/fixed layout design for desktop publishing; and the other using Responsive Framework for mobile devices.

Major Points:

- Demonstrate the concept of fixed and fluid layout design for desktop publishing
- Problems with design layouts that are Incompatible with mobile devices
- Overview of responsive design concept
- Overview of Bootstrap and 960 Grid System for creating responsive websites
- Demonstrate some web design projects created for various purposes

Summary: This presentation will provide an overview of web publishing, concept of responsive framework, and curriculum revisions of website design materials for projects using Bootstrap and 960 Grid System.

Thursday, November 20 - 3:45pm - 4:30pm

Graphics

The Impact of Digital Technologies in the Graphic/Print Media Workflow and Implications for the Graphics Technology Curriculum: Presentation of a Case Study

Authors:

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Need: Graphic workflow is merely a new page out of a 600 year-old history book. Workflow issues have surrounded the printing/graphic arts industry since Johannes Gutenberg printed the first bible. Not every graphics technology program houses a Computer Integrated Print Manufacturing (CIPM) workflow system in their academic laboratories. This is due to the cost and investment associated with acquiring such technology and application. As a result of this, secondary and post-secondary graphic arts programs began to disappear, this is due to impact of digital technology and the cost associated with running a graphic laboratory. For the students in the graphics technology curriculum (GTC) being able to experience the digital workflow for production as it happens in the industry and seeing how this contributes to quality work and efficiency will be invaluable.

Overview: In the graphic arts industry, a workflow represents a schematic illustration that deals with the real time production of goods and services. This is done by utilizing patterns of activities enabled by a systematic organization of analog and digital devices. In this scenario, product content, an image and its color are generated through digital input devices (text/layout/image editing applications, scanners and cameras). The digital information representing the production of a print job is stored in a data file, rasterized into bitmap data and printed (output) by using output (CMYK) digital devices (CTP's, digital printers and printing presses). Since different digital input/output/finishing devices are involved and each device is driven by its own front-end system to process the print job and finishing, the challenge is to have a reliable job data transfer of the production process across the entire workflow. The job definition format (JDF) data compatible devices (input/output/finishing), front-end systems of workflow (raster image processor), and management information system (MIS) of the business allow us to automate the CIPM process for high quality work, efficiency and profitability regardless of the type of print job to be produced. Digital print automation requires that the prepress, MIS, the print production process (PPP), and the print-finishing process (PFP) must be merged into the computer integrated manufacturing (CIM) workflow.

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Thursday, November 20 - 3:45pm - 4:30pm

Graphics

The Impact of Digital Technologies in the Graphic/Print Media Workflow and Implications for the Graphics Technology Curriculum: Presentation of a Case Study

Major Points:

- Analyze and review of existing facilities/curriculum and future curriculum.
- Establishment of objectives and need for having modern productive print/digital media workflow.
- Industry/vendor partnership, acquisition of technology/resources, training and implementation of the workflow into the curriculum.

Summary: The presentation will be based on a case study on the impact of digital technologies into the graphic workflow and its implementation into the GTC at a post-secondary institution. Implementation of CIPM based print production technologies in the GTC is important in order to prepare future graduates of these programs for jobs in a constantly evolving printing industry. The study covers technologies such as network digital infrastructure and JDF enabled workflow and their inclusion in Graphics Technology educational laboratories. The graphic arts industry is constantly changing because of technological advancements, necessitating a more educated, skilled and technically competent workforce. The presentation will be interest to educators in the graphics technology programs who are considering or planning to introduce CIPM workflow in their laboratories.

Thursday, November 20 - 3:45pm - 4:30pm

Graphics

Trends in Multimodal Human-Computer Interfaces

Author:

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Need: As computer technology becomes increasingly integrated into everyday tasks, new interaction paradigms emerge. The graphical user interface combined with a keyboard and mouse is the predominant way that humans currently interact with computers. However, today we stand on the precipice of a revolution of human-computer interfaces. Touch-screens, wireless gesture controllers, voice command and haptic feedback devices facilitate natural interactions that are precise and easy to learn. Advances in these interface technologies are evolving rapidly, prompting questions about the future of human-computer interaction.

Overview: This presentation will explore the state of the art of human-computer interfaces considering historical context and potential future directions. We will discuss the usefulness of interface paradigms, where they succeed, and where they begin to break down, citing examples from multiple industries. Finally, the results of a case study in which students used the Leap Motion wireless controller to generate electronic music will be revealed.

Major Points:
- A survey of human-computer interfaces
- Interaction paradigms and multi-modal HCI (visual, audio and beyond)
- The state of the art of interaction hardware (Leap Motion, Kinect, Google Glass)
- Potential industrial applications
- Results of a case study: the Leap Motion to control music

Summary: Touch screens, voice commands and wireless gesture controllers have the potential to provide a more natural human-computer interface than traditional mice and keyboards. While these technologies are still evolving, the usefulness of such interfaces across industries is undeniable. In this presentation, the state of the art of human-computer interfaces will be explored. We will examine the qualifications necessary for these technologies to replace traditional interface hardware and project how far this interface revolution can take us.

Graphics

Effect of Pre-Defined Color Rendering Intents (CRI) on the Process Colors (CMYK) Hue and Gray (CMY Overlap) Hue in a Color Managed Digital Printing Workflow

Author:

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Need: Advancements in science and engineering have allowed print and imaging professionals to apply scientific research methods across the prepress, pressroom, and quality control area of the graphic arts industry. According to International Color Consortium (ICC), color gamut mapping can be completed by one of the four ICC recognized colorimetric rendering intents: perceptual, absolute, relative, and saturation. The rendering intent determines how the colors are processed that are present in the source gamut but out of gamut in the destination (output). Each rendering intent tends to be associated with select types of images and/or workflow stages situations such as characteristics of the original, as well as reproduction media and its viewing conditions. These four intents are intended to produce uniquely different color/gray (hue) results and thereby have migrated toward selection based on general use guidelines. The objective was to study the influence of applied color rendering intents in the digital color printing and gray color hue appearance in a Color Managed Digital Printing Workflow (CMDPW).

Overview: In a quest to empower our students to better understand the attributes of various hue variables, this work examined standardized rendering defaults similar to those a student would encounter in a real world work scenario through software/hardware that manages color manipulation and drives output (or printing) devices such as a laser color printer, inkjet printer, or a digital color press. The experiment was conducted in a CMDPW to determine the printing colors (solid CMYK) and gray color hue variation (DE) among the four ICC standard color rendering intents. It focused on the application of various color rendering intents to print color images by using cyan, magenta, yellow, and black (CMYK) dry-toners on a digital color printing press that utilized a color laser digital printing technique (color electro-photography). The experiment examined the four ICC color rendering intents as independent groups (K = 4) using a one-way Analysis of Variance (ANOVA) with equal n's method (at a = 0.05) to determine the significant colorimetric variation (COLVA) of hue between the (K = 4, n = 80, and N = 100) group means (averages) of color deviations (DE) of these intents. With four rendering intents (groups, K = 4), a one-tailed, non-directional hypothesis was established. The colorimetric data suggests (revealed) that the selection of a rendering intent is an important activity in a CMW as it relates to obtaining accurate output colors for a desired purpose.

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Thursday, November 20 - 4:45pm - 5:30pm

Graphics

Effect of Pre-Defined Color Rendering Intents (CRI) on the Process Colors (CMYK) Hue and Gray (CMY Overlap) Hue in a Color Managed Digital Printing Workflow

Major Points:

- Purpose, limitations and methods applied for the experiment.
- Need for proper color managed workflow and its implications on the graphics curriculum.
- Use of ANOVA for evaluation of hue and gray from the printed colors, findings, and summary

Summary: The presentation will be based on the outcome of the experiment. Attendees will understand the importance of ICC rendering intents during the printing. Color Managed Workflow is becoming standard method for printing accurate colors. This presentation will enable educators to make changes in the existing color management curriculum and teach students to apply scientific methods in printing and evaluating color reproduction. Furthermore, the experience of the experiment (visual comparison of colors) and analyzed data proved that there were no color differences among the printed samples of rendering intents, such as the absolute, relative, and perceptual. One could achieve the same color output regardless of which rendering intent was used among the three (absolute, perceptual, and relative colorimetric rendering intents). However, one should be cautioned to use the saturation intent because this intent produced the highest color deviation (DE) when compared with other intents.

Thursday, November 20 - 4:45pm - 5:30pm

Graphics

Using Industry Input to Create Curriculum that is a Student's Gateway to the Real World

Author:

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Need: Industry professionals, whether on advisory boards or through other methods of communication, have indicated that there are gaps regarding their needs for employees and how students arrive to them fresh out of school. During a recent study, I conducted telephone interviews with several industry professionals who are leaders in their organizations. Three of the top needs identified are: 1. Communication & teamwork, or interacting beyond "r u 4 real"; 2. Workflow – understand the process, your job, and what other people do; and 3. Adaptability and flexibility – be ready for changes, and to learn new methods in addition to what you learned in school. Recognize that theory is not always the same as reality.

Overview: After identifying the competency needs for future employees in the Graphic Communications industry, the next step is to develop modules in the curriculum to address these needs. This does not require a complete overhaul of existing curriculum. Activities and modules can be added in smaller doses, as projects or just a brief in-class exercise, to address many of these gaps in skills and ideas. They can also be added to a variety of different classes. This presentation will discuss activities that have been developed and implemented for group activities, blogs, discussions, and a cross channel media project. In addition, it will include a newsletter project that incorporated workflow discussions, teamwork, and communication activities. Finally, it will present an activity in a class to address the technological changes that have occurred over many years, in order for students to consider their flexibility and adaptability to technological changes.

Major Points:

- Industry professionals have identified specific needs for the competencies of their future employees. These include more than just technical skills.
- Current programs address the technology content and technical skills fairly well. It is the so-called soft skills that are lacking.
- A complete overhaul of curriculum is not necessary. Minor changes and additions can be very successful. Activities, projects, and in-class time can be modified or added to existing curriculum.
- The skills and concepts addressed can be grouped together in single activities for maximum impact.

Summary: Participants in this presentation will hear the testimony that was gathered from industry professionals regarding their needs for the competencies of future employees. These needs will then be addressed with specific curriculum additions to help students gain awareness of and proficiency with these skills and concepts. Participants will also receive a list of resources for curriculum additions or modifications to adapt for their own use.

Friday, November 21 - 11:15am - 12:00pm

Graphics

Taking Action on Your Message: Using Infographics to Deliver Cross Media Instruction

Author:

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Need: In seeking to help students distill the most important pieces of information provided to them and form a conclusion, an instructors' goal is to enable them to take informed action. A good infographic makes information easily accessible, as it feeds into many students' natural tendency to learn by seeing and interacting. In order to prepare students for a rapidly evolving printing industry, graphic communication instructors need to use and guide students in development of skills to creating and using cross media materials. A well-designed interactive infographic can deliver content and a provide call to action through multiple media simultaneously.

Overview: Experienced graphic designers are creating interactive infographics to drive a user to access two or more media types in an integrated marketing campaign. Research on how individuals best access and retain information has shown that effectively designed infographics can communicate complex ideas with clarity and precision. Engagement is subsequently increased when traditional printed media is linked to digital channels. Courses in graphic communication should consider including topics and activities that address cross media trends and practices.

Major points
- Communicating effectively with Infographics
- Infographics as Teaching Tools
- Interactive Infographic Design
- Cross Media Design and Marketing
- Creating Interactive Infographics to Promote Cross Media Use

Summary: Participants will learn how infographics are designed to communicate complex ideas with clarity, precision and efficiency. Ideas for turning visual narratives into interactive infographics for cross media instruction and marketing campaigns will be discussed. Tips for adding animations, transitions, hyperlinks and QR Codes to your lectures/presentations will be provided. Be prepared to create interactive resources for your students, it's what they are asking for!

Friday, November 21 - 11:15am - 12:00pm

Graphics

Incorporating Interactive Print into Student Projects: Augmented Reality in the Classroom

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Need: The graphic communication industry has recently combined the power of print with the immediacy of digital wireless technologies, such as mobile phones, and tablets. Several leading companies have begun offering the service of creating an interactive print campaign. To do this, they employ media specialists to merge image recognition systems with augmented reality technologies. Graphic communication students need to understand this new initiative and be prepared to work across various media platforms. Also, graphic communication programs need to recruit students and keep their curriculum updated. Interactive print is an exciting new spin on traditional print media that is attractive to potential students and will provide current students with a skill that may help them land a job. This session will give graphics teachers an effective tool to boost interest and gain attention for their programs.

Overview: Augmented reality can make print come to life. It is cutting-edge technology that allows for a digitally enhanced view of the real world, connecting users with more meaningful content in their everyday life. Using the camera and sensors in a smartphone or tablet, as well as image recognition capabilities, augmented reality adds layers of digital information – links, videos, photos, sound – directly on top of items in the world around us. Interactive print can enable a reader to access additional digital content on top of interactive magazines, ads, packaging, business cards and other items. Here are a few examples of uses for interactive print:

- See videos play on top of advertising in magazines or on posters
- Watch as food packaging comes alive with links to helpful recipes
- Instantly buy items straight from your phone just by scanning your favorite catalog
- Share an interesting article that you read immediately with your friends via social media

Major Points
- Defining augmented reality and identifying uses for this technology.
- Examples of student created projects employing interactive print.
- Learn how to use an augmented reality software solution for interactive print.
- Brainstorming new applications for interactive print through augmented reality.

Summary: Many educators are beginning to explore the use of augmented reality to make learning more interesting for their students. But how many are actually teaching their students ways to create their own interactive applications using augmented reality technology? The purpose of this presentation is to share innovative approaches the presenters have developed to engage students in real projects that incorporate augmented reality technology to create interactive print media. This presentation will show how graphic communication students can combine traditional print technology with augmented reality to generate their own versions of interactive print media. Actual samples of student work will be shared and attendees will learn how to use interactive applications.

Friday, November 21 - 2:00pm - 2:45pm

Graphics

Integrating Contemporary Technology in the Graphic Design Classroom

Authors:

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Need: The field of Graphic Design has undergone significant changes over the last decade. Software, computers, cameras and processes continue to evolve at a rapid pace. In the classroom, it is often challenging to stay on the cutting edge in a field that remains constantly fluid. As teachers, it is important to integrate current technology into the classroom to keep students motivated and knowledgeable in the field. Laser cutting, 3D printing and 3D modeling utilizing digital photography are several high tech processes that can be now be implemented into Graphic Design classrooms. Combining such technologies with more traditional printing processes, one is able to develop limitless creative designs.

Overview: Laser cutting, 3D printing and 3D modeling with digital photography are processes usually associated with production and manufacturing. With some ingenuity and creative thinking these same processes can and should be integrated into the Graphic Design classroom. This presentation will demonstrate the importance and benefits of using these high tech tools to create innovative graphic designs and unique products.

Major Points:

- New technologies like laser cutting, 3D printing and 3D modeling with cameras can be integrated into Graphic Design classrooms
- These new technologies can help teachers and students be more creative and innovative in the classroom
- New technologies can be used alongside traditional printing processes to help graphic designers produce unique graphic products
- Using high tech tools in the Graphic Design classroom can stimulate creative thinking and problems solving skills

Summary: Attendees will see how contemporary technology can be used alongside traditional technology when integrated into the Graphic Design classroom. These new tools can build student interest and lead to innovative designs and unique graphic products.

Friday, November 21 - 3:00pm - 3:45pm

Graphics

Importance of Game Technology for Tomorrow's Careers in Graphics

Author:

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Need: The graphics field is profoundly dependent on the computer technology. The technology changes at the lightning speed not just in the area of graphics but also in the fields where graphics are used. It is important to keep up with the changing technology, acquire new skills, meet the industry needs, create designs according to the industry requirements, follow advisory board members' suggestions, make quick changes in the curriculum, and teach students the latest graphics technology to make them prepare for the careers in the gaming industry. With the advent of computers, internet, smart devices, 3D animations, and 3D visual effects; the gaming industry has grown drastically in just last few years. There are more games and gaming companies than ever before.

Overview: This presentation discusses the importance of game technology courses for tomorrow's careers in the graphics discipline. It provides information on various jobs in the gaming industry. The presentation includes what types of essential soft and hard competencies are needed for gaming jobs, which software is needed, and how to incorporate them in the curriculum. Students' games will be shown.

Major Points:
- Introduction
- Careers in Gaming Field
- Hard Skills for Gaming
- Soft Skills for Gaming
- Tools for Game Technology
- Students' Games
- Summary

Summary: Attendees will comprehend the importance of game technology that serves as a gateway for students in tomorrow's demanding careers. The presenter will explore skills and tools those are needed for students in the gaming industry.

Friday, November 21 - 3:00pm - 3:45pm

Graphics

Sound on the World Wide Web

Author:

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Need: The vast popularity of the World Wide Web has been in part because of the ability to include media in web pages. This then requires Web developers to understand not only how to provide media files on the Web, but also how to provide the HyperText Mark-up Language (HTML) coding that will work on all major browsers. HTML 5, the latest version of HTML, has new semantic elements that greatly increase the ability to have browsers provide the rich experience of media without the need of JavaScript and "plug-ins" in the browsers. Sound can be saved in many different formats (CODECs) and there is not one format that is used by all browsers. Developers also need to understand copyright laws dealing with sound; these laws are far more restrictive than working with print. The need for Web developers is to have the skills to edit sound files, convert the sound files into formats that work with the various browsers, use the new HTML 5 coding, and place the sound files linked to a web page on a web server for the client to access.

Overview: Working with sound on the Web requires Web developers to have the skills and ability to edit sound to provide the best quality in the smallest file to provide quick downloading from a web server to a client's computer. Developers should also be using the latest in HTML coding to ensure that no matter which browser the client uses they will hear good quality sound.

Major Points:

- Using sound in a web page.
- Understanding sound specifications: stereo vs. mono, samples rates and sample size in bits.
- Selecting a sound editor.
- Editing of sound, including changing the volume and length of sound files.
- Converting sound files into the formats used on the web, including Ogg Vorbis, MP3, and AAC.
- Working with the new HTML 5 semantic element of "audio", including the use of controllers, autoplay and looping.

Summary: This presentation will provide teachers with the information necessary for students to place good quality sound in Web pages. Not only will the sound files work properly and provide the client with the ability to control the sound, but the sound will stream quickly to the client's browser.

Thursday, November 20 - 11:30am - 12:15pm

Management

Impact of Ineffective Order Fulfillment on Customer Behavior: A Stochastic Approach

Authors:

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Need: Supply chains require highly coordinated flows of goods, services, information, and cash within and across national boundaries (Mentzer, 2001). In today's globalized and highly competitive environment, research on supply chain risk management is needed to provide companies and their managers with a quantitative and qualitative tool to identify, assess, manage, and mitigate risks associated in the supply chain process. This study will utilize statistical simulation software that provides a critical risk assessment tool to specifically measure the event and operational risks associated with the global supply chain process. This study will attempt to assign probabilities to event and operational supply chain management activities and assess how these specific processes affect the organization's supply chain process.

Overview: This paper will determine a risk management model for the event and operational risks in the supply chain process. This study will identify core inputs in the global supply chain process in order to model potential operational and event risks in the supply chain process. The paper will assess the quantitative risks within the supply chain process and develop a probabilistic model through utilizing the Monte Carlo simulation.

Major Points:

- Calculate the aggregate impact of the event and operational risks in the supply chain management process
- Assign probabilities to supply chain event and operational risks
- Provide a model and risk assessment technique for specific supply chain event and operational risks
- Run simulations on the various types of supply chain risks
    - Monte Carlo simulation
- Assess and determine a risk mitigation strategy

Summary: This paper and presentation will provide a model for assessing supply chain risks and conduct simulations across various different types of supply chain risks. It will quantify the chances and impacts each specific event and operational risk through developing probabilities and quantitatively evaluating the impact of the measured supply chain risks.

Thursday, November 20 - 11:30am - 12:15pm

Management

Is "Rank and Yank" Dead in the Technology Sector?

Author:

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Need: "Rank and yank" is a forced distribution rating system (FDRS) where employees are rated against each other based on performance, founded by Jack Welch while he was CEO of General Electric in the 80s and 90s. Under this system, the highest ranked performers were heavily rewarded, while the lowest performers (typically the bottom 5 or 10%) were fired. This performance appraisal system was once widespread, being used in some form by over 40% of Fortune 500 companies; however, its popularity appears to be declining. Microsoft was one of the most notable tech companies still employing this system, but they stopped using it in 2013, which yields the question, "Is rank and yank dead in the technology sector?"

Overview: We will first introduce the rank and yank FDRS and discuss some of the pros and cons associated with its use. Next, a simulation model developed in organizational science for analyzing the theoretical effectiveness of FDRS is applied to the technology sector. Results provide theoretical conditions under which rank and yank could likely benefit and/or degrade the overall performance of the organizations in this sector. These results are discussed in light of current trends in management practice.

Major Points:

- What is forced distributional rating?
- Pros and cons associated with FDRS
- Notable corporations employing FDRS
- Theoretical predictions regarding the overall effectiveness of FDRS in the technology sector.

Summary: Attendees will not only develop an understanding of the pros and cons associated with the use of forced distribution rating systems (aka "rank and yank"), but they will also learn how current management trends in the technology sector compare with theoretical predictions regarding the potential effectiveness of this controversial performance evaluation system.

Thursday, November 20 - 4:45pm - 5:30pm

Management

Human Modeling and Simulation for Ergonomic Risk Analysis in Assembly Line Balancing

Authors:

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Need: Industrial assembly line workers spend significant amount of time on assembly lines doing repetitive tasks that can be physically exhausting and impose biomechanical stresses on them. Various ergonomic risk factors such as repetitive movements, awkward postures, static postures, excessive noise and vibrations, and extreme hot or cold temperature can add to workers' fatigue. Poorly designed assembly lines exacerbate these factors and can lead to various musculoskeletal disorders (MSDs) among workers such as muscle strains, carpal tunnel syndrome, tendonitis, lower back pain, etc. It is difficult to assess a multitude of ergonomic risks in a real life environment. Human modeling and simulation can address this limitation by performing effective risk analysis in a virtual environment.

Overview: Human modeling involves creating digital humans in computer-simulated environments. In this presentation, we present the use of human modeling and simulation in ergonomic risk analysis of virtual products on virtual assembly lines. An example digital assembly line is developed to demonstrate the use of human modeling using a simulation tool. The goal is to re-balance the assembly line in order to mitigate various ergonomic risk factors that can cause MSDs among line workers. First, we create digital human workers and posture them appropriately to perform assembly tasks on the virtual product. Next, we analyze their performance using ergonomic analysis tools. Finally we balance the assembly line with two objectives in mind: to minimize biomechanical stresses experienced by workers while performing their tasks, and to improve their baseline performance as analyzed before balancing the line. This in turn leads to an increase in overall line efficiency, and a reduction in the number of incidents. The strength and limitations of human modeling in ergonomic risk analysis are also discussed.

Major Points:

- Discussion of ergonomic risk factors in assembly line balancing and related MSDs.
- Overview of the human simulation modeling framework.
- Modeling of an example digital assembly line.
- 3D visualization of the simulated model.
- Presentation and analysis of simulation results.

Summary: The focus of this presentation is on demonstrating the use of human modeling and simulation in ergonomic risk analysis using a practical case study of assembly line balancing. The presentation will be of interest to engineering management professionals with interests in human factors and ergonomics.

Thursday, November 20 - 4:45pm - 5:30pm

Management

An Investigation of Quality Climate and Its Association with Implementation of Quality Management Systems

Authors:

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Need: Soft quality management factors, such as employee perceptions have been associated with organizational performance. Previous research reported a clear disconnect between established quality management systems and employee perceptions about them. Quality climate, which is a measure of shared employee perceptions concerning the relative importance of quality, has been a challenge to quantify. Furthermore, little research has been done to develop a set of evaluation measures or to identify essential dimensions and constructs that can be used to develop and test a survey instrument measuring quality climate.

Overview: Past research has documented that human factors such as employee participation, commitment and training, and trust are considered substantial predictors of organizational quality. Quality climate is a key factor believed to influence employees' relationship with quality management system. This presentation will discuss the development and evaluation of indicators to be used in the creation and validation of a robust survey instrument that can measure soft quality factors such as quality climate. Potential benefits of measuring quality climate in a variety of settings will conclude the presentation.

Major Points:
- Challenges in quantifying important constructs and dimensions of quality climate
- Determining predictive factors of successful quality management systems
- Framework for measuring quality climate
- Benefits of enhanced understanding of quality climate to industrial environments

Summary: Attendees will learn the importance of quality climate and the process used to classify and categorize major constructs and dimensions of quality. Considerations used in the development of a quality climate survey instrument will be discussed. Implications for quality management professionals in academic and industrial environments will also be shared.

Friday, November 21 - 8:00am - 8:45am

Management

A Framework for Applying Sustainability Principles through Lean Six Sigma

Authors:

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Need: Trends in industry are moving to a focus on Sustainability. Looking through company websites it is usually easy to find a page about how that organization is being "Sustainable". While these organizations might be trying to be sustainable, there are aspects of continuous improvement (Lean Six Sigma) where sustainable practices can be interwoven in the changes made for organizational improvement.

Overview: This presentation will present a program style framework for applying sustainable principles through Six Sigma projects. The purpose of this framework is to help organizations focus not only on the environmental pillar of sustainability when implementing Lean Six Sigma projects, but to aid in decision making that could allow organizations to touch on all three pillars of sustainability (economic, social, environmental) while making organizational improvements. While aiding in the decision making process, this framework should help by providing structure to an organizations sustainability based goals and track their progress toward those goals.

Major Points:

- Examine tools used in Lean Six Sigma
- Emphasize the importance of sustainability along with the three pillars (social, environmental, economic)
- Show overlays in the Lean Six Sigma process with Sustainability metrics
- Present framework that would allow organizations to identify opportunities in continuous improvement that impact their social, environmental, and economic surroundings

Summary: With the focus in Sustainability appearing to gain broader appeal within companies, it seems that tools found within Lean Six Sigma would be ideal for pairing in order for companies to achieve Sustainability metrics. Early adopters in achieving Sustainable metrics may not only potentially reduce their environmental footprint while increasing their social responsibility; buy they may also gain a competitive advantage over others within their own respected industries. The framework presented in this presentation will appeal to organizations that may already have an understanding or continuous improvement process in place, but yet are not maximizing their potential in decision making in relation to Sustainability.

Friday, November 21 - 8:00am - 8:45am

Management

Barriers to Six Sigma Project Timely Completion

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Need: Six Sigma as a continuous improvement methodology has been around for over 20 years. Yet, organizations implementing Six Sigma, after an initial positive start, find difficulties in sustainability of a positive project trajectory.

Overview: This presentation is based upon research study of a major manufacturer that has implemented Six Sigma in the past five years. The results of this study will describe the strategy for implementation, based upon critical success factors (CSF's), of the organization. Based upon survey of internal Black Belts, this presentation will describe the barriers to timely completion of Six Sigma projects.

Major Points:
- Introduction of Six Sigma and review of current state of implementation strategies.
- Review of Critical Success Factors (CSF) perspective of Six Sigma.
- Description of best practices of Six sigma management.
- Challenges and limitations of study.
- Conclusions and recommendations to managing Six Sigma strategic efforts.

Summary: Attendees will understand Six sigma and strategy required to successfully implement and maintain a project portfolio of Six Sigma projects. The results of this study are generalizable to organizations in manufacturing that implement Six Sigma in a single location. An understanding of Strategic Six Sigma is an aim of this presentation.

Friday, November 21 - 9:00am - 9:20am

Management

The ATMAE Lean Six Sigma Certification Exam: Now Available and Ready for Use

Authors:

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Need: The ATMAE Lean Six Sigma Exam was developed as a low cost alternative for individuals seeking this type of certification and for programs seeking a means of external assessment with regards to accreditation.

Overview: This presentation will focus on the revisions of the exam content based upon an in depth survey administered to 54 lean six sigma black belts from a wide variety of industries across the country and from feedback by faculty members from ATMAE accredited institutions. Furthermore, this presentation will review the methods for revising the content of the exam and its implications.

Major Points:
- Review of the history of the development of the exam
- What the ANSI accreditation means for ATMAE
- Review of the format, delivery method, and data analysis provided with this exam
- Outline of the content addressed by this exam

Summary: The Lean Six Sigma exam is the first ATMAE certification exam to be developed by following the ANSI guidelines for accrediting personal certification programs. Over the past five years, it has gone through numerous iterations that have improved its credibility and scope. The focus of this presentation will be to review the content of the new Lean Six Sigma Exam as well as give the audience insight into the benefits of the exam.

Friday, November 21 - 10:15am - 11:00am

Management

Financial Impact of ISO 9000 and ISO 14000 Certifications

Authors:

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Need: In these times of global competitiveness, ISO 9001 and ISO 14000 are needed for companies to benefit from cost reduction; uniformity in management methodologies; decrease in the bulk of company papers; and the creation of common forms that can be more easily used by several operators. The presentation aims to critically discuss the potential synergistic advantages that can be derived from integrated quality-environment system and qualitative benefits of the usage of ISO 9000 and 14000 certifications

Overview: One of the greatest demands in our global economy that have compelled firms to invest increasingly in resources for the enhancement of their management practices is organizational competitiveness. Standards have been playing an increasingly important role in economic and market globalization. The presentation discusses potential synergistic advantages that can be derived from integrated quality-environment system and qualitative benefits of the usage of ISO 9000 and 14000 certifications. This presentation also discusses some of the limitations of the current literature and how this can be addressed in the future research.

Major Points:
- Importance of certification to firms
- Benefits of ISO 9000 standards
- Benefits of ISO 14000 standards
- Definition and types of integration
- The relationship between ISO 9000 and ISO 14000 standards
- The integration of ISO 9000 and ISO 14000 standards
- Financial impact of ISO 9001 and ISO 14000 on firms, conclusions, recommendations

Summary: Attendees will understand how the integration of ISO 9001 and ISO 14000 certifications synergistically impacts firms. The findings may help users of ISO 9001 and ISO 14000 to be in the position to make informed ISO 9001 and ISO 14000 purchase decisions.

Friday, November 21 - 10:15am - 11:00am

Management

Contingent Engineering Workers and Intellectual Property Concerns

Author:

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Need: Technical managers in industry have a fiduciary responsibility to protect the intellectual property of their organization. This can sometimes result in concerns about the use of contingent engineering workers in new product development. However, these concerns need to be balanced against the contributions to intellectual property that contingent engineers can provide. This presentation will review key concepts in the management of intellectual property when utilizing engineering contractors and consultants.

Overview: Technical managers in industry often utilize engineering contractors to scale up the capacity of their technical workforce to meet the work demands of projects and to obtain special engineering expertise not available on their staff. However, managers may have concerns about the protection of their trade secrets and other intellectual property when using contingent engineers. This presentation will review concepts in intellectual property protection, outlining common tactics and strategies employed by engineering leaders.

Major Points:

- Balancing benefits of using supplemental engineering workers, while managing IP security
- Review of specific intellectual property rights, including patents, copyrights, trade secrets
- Discuss elements of a prototypical IP protection plan
- Essential expectations when working with an engineering services firm

Summary: Attendees will understand how to balance access to contingent engineering workers with protection of their organization's intellectual property rights, key features of an IP protection plan and essential expectations to have of an engineering services vendor.

Management

Organizational Success Achieved Through Maximization Of Employee Engagement

Authors:

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Need: Employee engagement is important to businesses because with more engaged employees a business performs better which ultimately leads to better performance. Engaged employees are passionate about the organizations goals and are emotionally and intellectually bonded to the success of the organization. As a result, they will give 100% effort towards solving problems and tackling issues. Ultimately, high employee engagement can lead to a distinct competitive advantage.

Overview: In order for a leader to achieve world-class employee engagement, they need to develop a strong relationship with their employees through clear communication and trust. It's crucial for a leader to take responsibility for creating and maintaining an engaging environment which supports the morale and psychological needs of the employee and is designed to develop and retain its employees. Employee engagement can be measured through the utilization of tools such as performance management tools, 360 degree evaluations and employee surveys.

Major Points:
- Employee engagement measurement tool
- Performance Management
- 360 degree evaluations
- Employee Survey
- Case study
- Conclusions, recommendations

Summary: Employee engagement is a key business driver for organizational success. In order to obtain world-class employee engagement, an organization must hold employees accountable for achieving great business results and strengthening and reinforcing the quality of the relationship between employees and their direct managers. Ultimately, high employee engagement can lead to a distinct competitive advantage.

Management

Factors Impacting Leadership in Logistics Operations

Authors:

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Need: Logistics operations are responsible for the movement of billions of dollars of goods and services each year. These operations are fundamental to the success of any enterprise. At the same time, leadership is important for the success of any enterprise and it is particularly important in logistics. The goal of this work is to identify and characterize factors that impact leadership in various logistics environments. There may be significant differences of effective leadership characteristics based on the environment. There may also be significant similarities of effective leadership characteristics in any environment. These differences and similarities can provide the basis for appropriately designing activities to improve the skills of leaders with educational, training, and experiential development programs.

Overview: Logistics and supply chain management provide the support necessary for delivering goods and services around the world, which ultimately provides basic necessities for human needs such as food, as well as goods and services for human wants. Effective leadership of these logistics operations is crucial for the success of the enterprise. By studying leadership in both civilian and military environments, characteristics of effective leaders can be identified and eventually developed. Leadership may be different in the military as opposed to civilian enterprises, but it is important to learn the universal and specific characteristics of good leadership in these environments. This knowledge can then be applied to logistics operations and making them more effective.

Major Points:

- Overview will be given of leadership in logistics operations
- Potential environmental differences between military and civilian environments will be discussed
- Potential differences between manufacturing and distribution logistics operations will be discussed
- The leadership survey tool developed and the survey methodology will be presented
- Plans for further study of leadership in logistics operations will be presented

Summary: Attendees will gain a clear understanding of logistics and leadership. The importance and impact of this subject matter will be presented. Attendees will review the development of a relevant survey tool and the methodology for its use. Discussions resulting from this presentation will help shape future research on leadership in logistics operations.

Friday, November 21 - 2:00pm - 2:45pm

Management

Quality and Safety Perceptions of Undergraduate Students Enrolled in Total Quality Management Course

Authors:

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Need: Human factors such as employee perceptions play an important role in the successful implementation of workplace safety and quality initiatives. Previous research shows that despite limited formal training in quality, students perceived a high impact of quality management systems on the mitigation of safety hazards. However, little research has been done to measure the impact of formal coursework in quality on students' perception of quality and its association with workplace safety.

Overview: Educators and employers of technology graduates, share a common concern of developing a well trained workforce capable of applying classroom knowledge to work environments'. Undergraduate students enrolled in the total quality management course will likely begin careers which directly or indirectly impact quality initiatives in the workplace. Therefore, an enhanced understanding of how students in a total quality management course perceive the interaction between quality and safety (another important organizational goal) has the potential to substantially change the way both types of courses (quality and safety) are presented. This presentation will provide a summary of data collected on how undergraduate students enrolled in a quality management course perceive the association between quality management and workplace safety. An overview of the survey instrument, data gathering methodologies will also be provided. Implications for academic curriculum development and workplace training will conclude the presentation.

Major Points:

- Previous work in quality and safety perceptions that formed the basis for this research
- Development of survey instruments used to measure quality and safety perceptions
- Summary of student perceptions on the interaction between quality and safety
- Application of the findings in academic and industrial environments.

Summary: Attendees will learn the importance and impact of formal training in quality on student perceptions of quality and safety. The findings from this project will be discussed as they relate to curriculum development and workplace training.

Friday, November 21 - 2:00pm - 2:45pm

Management

Assessment and Characterization of the Critical Thinking Skills of Upper Division Technology Students

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Need: Critical thinking skills are necessary for the future success of undergraduate technology students. The use of an empirical assessment of these skills is important for both the student and the faculty. By determining what critical thinking skills are present or are lacking in undergraduate students, faculty can make curricular improvements to better develop these skills. It also provides feedback that can assist the faculty in determining some measure of the effectiveness of coursework, curricula, and departmental learning activities. We will present the results of the administration of this assessment over the past four semesters, the conclusions we were able to draw about the students and degree programs, and the implications for current and future curriculum design.

Overview: The Critical Thinking Assessment Test (CAT) was developed by Tennessee Technological University under the sponsorship of the National Science Foundation. It is an assessment tool that was designed to measure important components of critical thinking. The test was administered to four groups of undergraduate students in their final year of study. Results from the assessment were analyzed and recommendations for curriculum improvement were made. A model for future use of the CAT was developed and will be implemented to support both department continuous improvement activities and accreditation preparation.

Major Points:

- A brief overview will be given of critical thinking
- Attendees will be familiarized with the Critical Thinking Assessment Test (CAT)
- Results for CAT administration over a four-semester period will be presented
- Methods for using CAT results for continuous improvement will be discussed
- Model for implementing the use of the CAT in program evaluation

Summary: Attendees will gain a clear understanding of critical thinking skills, their importance, and the use of the CAT to assess these skills. Attendees will also gain insight into one way the tool has been used for assessment and continuous improvement in an ATMAE accredited program. Participants will leave with a model for implementing the use of the CAT in program evaluation.

Friday, November 21 - 3:00pm - 3:45pm

Management

Supply Chain Sustainability Models: The Disconnect Between Corporate and the Local Level

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Need: Long-term sustainability is important to all companies. The problem is in defining what sustainability actually means. Sustainability models are likely different for manufacturing companies than for retail companies. The industrial distribution segment of the supply chain has its own unique set of challenges with regard to identifying specific sustainability models that are specific to the industry. To further exacerbate the complicated sustainability discussion, there are no clear methods of equitably measuring different components of sustainability.

Overview: Sustainability has become a fashionable topic in the literature over the past two decades. Clearly, any sustainability model must include some form of financial measurement. However, many believe that long-term sustainability should include more than simply financial success. Environmental sustainability has received significant attention both in the press and in the literature. Social accountability has also been included in many sustainability models. Much of the problem in the supply chain sustainability discussion is that there seems to be a disconnect between what "Corporate" advertises (on the web site, to share holders', etc.), and what employees on the local level actually believe and/or practice. This paper/presentation attempts to sort out the reasons for this disconnect, and how to resolve it.

Major Points:

- Most supply chain sustainability models include some form of financial, social, and environmental component.
- While the corporate level of most publicly traded industrial distributors may publish, via their web site, that they embrace this sort of sustainability model, the local level of these distributors have not "bought-in" to the process.
- At the branch level of an industrial distributor, their success is based solely on financial performance (i.e, EBITDA, revenue, margins, etc.)
- Until Branch Managers for industrial distributors are incentivized to manage by some other means than financial performance, this disconnect will continue.
- There is an emerging trend to have this sort of sustainability accountability driven down through to the local level. However, it is not corporate that is doing it. Customers are now a driving force in forcing local distributors to engage in sustainability practices.

Summary: Attendees will learn about current sustainability models developed in the literature over the past two decades. Then the authors will explore what these models mean to industrial distributors at the local level, and how there is an emerging trend to force distributors to reexamine their own business practices.

Friday, November 21 - 3:00pm - 3:45pm

Management

The Technology Management Body of Knowledge: Most Frequently Cited Works

Authors:

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Need: Technology management has long operated without a recognized and accepted body of knowledge. This has resulted in the discipline being confused with other technical disciplines. In addition, the relationship of technology management to industrial technology, engineering technology management, or applied engineering is misunderstood. Clarity regarding the body of literature in technology management is imperative. The critical references, texts, and seminal works of literature for technology management and its associated educational programs should be recognized.

Overview: This presentation identifies the most frequently cited scholarly journal articles, books, and published works in the field of Technology Management (TM). The authors extracted the citations of the most frequently assigned textbooks of 84 ATMAE accredited programs that offer four-year baccalaureate degrees. Programs included technology management, construction management, operations management or their related equivalent. The results of the study identified the articles, texts, and seminal works most frequently cited in the discipline. The interpreted results represent a verifiable body of knowledge suitable for the compilation of a TM Book of Knowledge (BoK). In addition, the information provides critical support for the development of resource material needed by ATMAE professionals and the Certified Technology Manager exam.

Major Points:
- Need for the study
- Methodology of the research
- Findings
- Summary and interpretation
- Next steps

Summary: This is a presentation of research on the most frequently cited scholarly literature and seminal works in technology management using the assigned textbooks of ATMAE accredited technology management programs.

Thursday, November 20 - 11:30am - 12:15pm

Manufacturing

Lessons Learned: Sustainability and Eco-Efficiency in Manufacturing

Author:

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Need: Manufacturing has a significant negative impact on the environment. Current situation requires adoption of sustainable manufacturing practices. Most manufacturing businesses are reluctant to implement sustainable practices because of the perceived additional costs. It is desirable to develop a framework and a methodology to analyze the true cost of sustainability. However, sustainability and eco-efficiency analyses are difficult to perform because of the selection, definition and measurement of parameters and interpretation of the results. We will present the difficulties and common problems observed during sustainability studies and solutions to these problems.

Overview: As environment and natural resources are deteriorating, awareness of sustainability is becoming more prevalent and pressure on manufacturing industries is increasing. So far, most of the research efforts concentrated on understanding the dynamics of sustainability, developing sustainability analysis methods and identifying metrics for evaluation purposes. Evaluation of sustainability is a first step in becoming more sustainable. Defining proper parameters and metrics is a key activity for a successful evaluation.

Major Points:
- Life cycle assessment (LCA) practices and associated difficulties/problems
- Identification of proper parameters and metrics for sustainability evaluation
- Eco-efficiency analysis and associated difficulties/problems

Summary: Attendees will understand the common practices in life cycle assessment, sustainability evaluation and eco-efficiency analysis. Observed difficulties/problems and recommendations will be shared as well.

Thursday, November 20 - 11:30am - 12:15pm

Manufacturing

Sustainable Manufacturing: A Case Study of Cutting Process Parameter Optimization Using Biodegradable Cutting Fluids

Authors:

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Need: For energy sustainability and reduction in emissions, resource efficiency is one of the critical factors in attaining these objectives. Cutting fluids whose production consumes a large amout of mineral resources are used extensively in metal machining processes to reduce and remove the heat during the machining operations. Methods need to be established in identifying the total costs of cutting fluids during machining operations so as to guide the manufacturing professionals to select proper cutting fluids.

Overview: The use of cutting fluids greatly enhances the machining quality while reducing the cost of machining by extending tool life. A large variety of cutting fluids based on organic and inorganic materials have been developed. There are several types of cutting and grinding fluids in the market, including both water soluble and non-soluble petroleum based oils. However the large scale use of cutting fluids have a variety of environmental effects because of which modern production has been forced to pay greater attention to this aspect. The mist and vapor generated during the machining processes is harmful for the operator and stringent regulations exist to control them. Direct exposure of cutting fluids has been responsible for a number of skin cancer cases in addition to other respiratory ailments. A realistic cutting fluid cost model would be useful as a precursor to developing an optimization method to decide on the optimum cutting process parameters.

Major Points:

- Develop a new cutting fluid cost model taking the sustainability aspect into consideration for a single pass turning operation.
- Develop a comparison of the existing optimization processes that were utilized by other researchers for various machining operations.
- Use the developed cost model for optimization of machining process parameters (cutting speed, feed rate, and depth of cut) utilizing different types of cutting fluids with constraints such as surface finish and tool wear.
- Compare the vegetable based cutting fluids and conventional petroleum based cutting fluids from the optimization of cutting process parameter view.

Summary: Manufacturing needs to embrace sustainability at all of its levels of operation. This paper presents a method of applying sustainability as a means to reduce the overall cost and improve sustainability by employing bio-degradable cutting fluids. In this paper a case study in which a refined cost model for sustainable cutting fluids is developed is presented which could be used to demonstrate the best cutting process parameters such as cutting speed, feed and depth of cut could be obtained for a given machining operation that ensures low cost operation.

Manufacturing

Quick Changeover Design- A Systematic Approach with Fixture and Robot Integration Simulation

Authors:

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Need: Quick changeover is the key to reducing production lot sizes and thereby improving flow and cut down waste. Many of aerospace parts have very complex geometry and require very tight geometric tolerances, high surface finish, and crack-free under surface material quality. This normally requires longer time in fixture design and setup. The reason is that currently fixture is custom designed for the part. The design practice is still try and error which induces difficulties in design validation. The production efficiency and quality depends heavily on the experience of the machinist on setup. This is a big hurdle for quick changeover.

Overview: The goal of this research is to propose a new systematic approach in fixture design. It considers CNC machine, fixture, and industrial robot as a system. Configurations of modular fixtures are generated based on part geometry, surface finish, and tolerances. An industrial robot constructs the fixture by installing the fixture components on the fixture base plate which is fastened on the CNC machine. The robot then loads the part to and unloads the part from the fixture. The robot can act as a moving support for the fixture if needed. The system is modeled in a 3D modeling environment which can analyze cycle time, detect collision and verify safety conditions. Design validation and optimization can be quickly obtained based on simulation results.

Major Points:
- Modular fixture design based on part geometry and tolerances
- Robot and fixture integration
- System simulation

Summary: The project is about a systematic approach in fixture design by considering CNC machine, fixture, and industrial robot as a system. It takes advantage of the flexibility of an industrial robot and its capability of simulation with the fixture in production. The method makes it possible to have a quick changeover system for complex aerospace parts with very low lot size. Also, system design can be done in a much shorter time with the help of system simulation.

Manufacturing

Advanced Manufacturing: Increasing Innovation Technologies through Industry-Academic Partnerships

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Need: The United States is losing much of its leadership in manufacturing innovation. This nation came to the forefront of economic power because of its ability to innovate and manufacture products and sell them to global markets. Now, America's historic manufacturing leadership is at risk. Industry - academia collaboration has become a subject of great interest to industry, academics and policy makers. The primary goal of this presentation is to explore the dichotomy between the strong motivations of both industry and academia to conduct research that promotes new product development, more efficient processes, scholarly productivity, and of equal importance, to make the collaborative effort effective.

Overview: Strengthening Industry and Academia Partnerships mean industry personnel in the classroom and academic students in the industrial workplace. To develop cutting-edge products and services in a manufacturing industry at the pace that current global innovation demands, academia and industry must change the way we think about education and industrial relationships. Students must be educated to contribute immediately and innovate at faster levels. Concepts such as active learning, where students take ownership in the design and implementation of their own learning, must be encouraged. Nurturing Science, Technology, Engineering and Mathematics (STEM) schools where students who have a propensity for the STEM disciplines are encouraged to pursue career paths in these disciplines early in the education process. New manufacturing programs such as Advanced Manufacturing, Nanomanufacturing and Manufacturing Execution Systems (MES) can be taught along with more mature manufacturing concepts such as Six Sigma, Lean Manufacturing, Supply Chain Management and Enterprise Resource Planning (ERP). A joint industry-academic comprehensive approach to this very complex problem of educating the workforce will most likely yield the best results.

Major Points:

- Need improved industry-academia relationships for collaborative innovative manufacturing.
- Show how collaborations aid in "industry ready" graduates.
- Show innovative solutions that promote faster workforce development and American jobs creation.

Summary: Today's competitive global manufacturing environments demand ever increasing workforce education to promote new product introduction, to maximize innovation and to increase manufacturing process efficiencies. Industry, academia and governments must work together to educate graduates who can "hit the ground running" using effective research and development to add even more value to themselves and to the hiring organizations. Attendees will see that industry - academia partnerships are one sure way to increase American manufacturing workforce readiness, innovation and productivity.

Manufacturing

Student Robotic and Ergonomic Simulation Projects in Industry

Author:

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Need: Robotic and ergonomic applications in industry continue to be highly valued and essential for successes in many companies. Manufacturing simulations are being used to design and analyze these processes. Students who understand and can apply these technologies have additional opportunities for careers, internships and management of companies considering uses for these tools.

Overview: Our Manufacturing Technology students take a two semester sequence which includes manufacturing simulation applications for design and analysis of robotics and ergonomics processes. The courses culminate with teams of students going to local companies and using these technologies to model and identify opportunities to improve the operations or resolve issues of safety, productivity, space restrictions or changing production levels. The results of these projects are presented to the company management and engineers. This presentation documents the robotic and ergonomic projects completed by two teams during the spring of 2014 semester at a tier 1 automotive supplier.

Major Points:

- Explanation of the curriculum using manufacturing simulation applications
- Description of the robotic and ergonomic projects and requested deliverables
- Demonstration of the results and recommendations to the company.
- Description of other simulation and digital manufacturing applications currently used
- Future trends and opportunities with these or related technologies

Summary: Attendees will learn how we have built and continue a successful program using manufacturing simulation technologies. They will see examples of company projects by student teams applying these sophisticated technologies in real-world projects, providing value for the students and the companies.

Manufacturing

Investigation of a Soybean-Based Cutting Fluid on Tool Wear and Tool Life in CNC Turning Operations

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Need: Tooling cost is a significant part of machining cost. Cutting fluids are extensively used in metal machining processes to enhance machined part quality while reduce machining cost in terms of extended tool life. Currently majority of the existing cutting fluids are petroleum-based products, not only consuming a large amount of mineral resources, but also creating concerns in environment along with operator health issues. Therefore, there is a need to increase the use of environment-friendly cutting fluids in metal machining processes so as to reduce the energy footprint and pursue sustainable manufacturing.

Overview: Literature is reviewed that provide an idea of the current state of the overall consumption volumes of cutting fluids, associated health risks to workers, and other environmental impacts. Compared with petroleum-based products, vegetable based cutting fluids have many unique environment-friendly features, such as being biodegradable and less toxic. Although they have been available in the market for some time, their widespread use in industries is not prevalent. This study investigated the impact of a genetically enhanced soybean-based cutting fluid on tool wear and tool life by comparison with a petroleum-based cutting fluid, when they were used in CNC turning operations, respectively utilizing experimentation.

Major Points:
- Unique features of the genetically enhanced soybean-based cutting fluids
- Experimental setup and data collection for tool wear and tool life
- Data analysis and conclusion
- Implication on how the study results can guide industrial applications

Summary: Manufacturing needs to embrace sustainability at all of its levels of operation. This paper presents an experimental study that investigated the impact of soybean-based cutting fluid on tool wear when it was used in turning median carbon alloy steel. The study results will help manufacturing professionals better understand this soybean based cutting fluid's machining performance and also will guide the machining planning in terms of tool life and tool wear management in applying the soybean-based cutting fluids, with the final goal to reduce overall manufacturing cost, reduce the energy footprint and pursue green manufacturing through using biodegradable cutting fluids.

Manufacturing

Analysis and Reduction of Measurement Variation When Using a Coordinate Measurement Machine through Gage R & R Measurement Studies

Authors:

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Need: In order to improve quality in any production process, thereby bringing the process under statistical control, it is necessary to eliminate special cause variation as well as reduce systemic variation, commonly referred to as common cause variation, which is an integral part of all production processes. A common problem in manufacturing occurs when the measured dimensions of a manufactured component cannot be consistently repeated or reproduced thus producing variation due to measurement error. All data collected must be accurate and precise before post-processing it using quality tools such as Statistical Process Control (SPC) and Design of Experiments (DOE). This type of variation is often compounded in a multi-stage manufacturing process. Measurement error can also cause variation to be wrongly classified (special cause vs. common cause) thus making it difficult to reduce and eliminate.

Overview: The purpose of this research is to develop an improved Gage R&R Measurement Methodology for use with a Coordinate Measurement Machine (CMM) while securing high precision measurements in a multistage production process. The data will then be analyzed for the creation of effective R & R models that will enhance the total quality management of multivariate production processes. The developed R&R models will be an immediate benefit to existing process management and of even greater consequence for the implementation of new production processes

Major Points:
- Coordinate Measuring Machine
- Repeatability of Measurements
- Reduction of Measurement Error
- Precision and Reproducibility
- Quality Improvement

Summary: Proposed Gauge R&R measurement methodology will improve repeatability and reproducibility of observations, thus resulting in reduction of process variations in multi-stage multivariate production process and will enhance overall product quality for customers.

Thursday, November 20 - 4:45pm - 5:30pm

Manufacturing

A Novel Method of Determining the Manufacturing and Design Effects on Aerodynamic and Electromechanical Performance of Aerosol Particles Generated from Respiratory Drug Delivery Devices

Author:
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Need: Metered dose inhaler (MDI) is currently one of the most common types of respiratory submicronized drug particle generating device. This popular drug delivery device is used in the treatment of respiratory diseases such as asthma and chronic obstructive pulmonary diseases, because they have been shown to be effective and convenient to use. Several studies found that large quantities (approx. 80% for MDI) of the inhaled medicinal drug particles generated by these devices deposit in the extrathoracic (ET) (i.e., passages of the head and throat) region, which is due to the generation of particles with excessive electrostatic charges. However, none of those studies addressed the manufacturing and design effects of mouthpiece and nozzle on aerosols' aerodynamic (e.g., aerodynamic size) and electromechanical properties (e.g., electrostatic charge, velocity), which interactively influence deposition of costly drugs in the ET region. Our study focused on these effects experiencing in five MDIs: Qvar™, Ventolin™, Flixotide™, Tilade™, and Intal Forte™.

Overview: This investigation reports the application of an experimental methodology in determining the integrated effects of manufacturing and designing aspects that influence the electromechanical properties of five various MDIs. Submicronized medicinal particles aerosolized from an MDI may acquire charge electrostatically while generating and inhaling as an aerosol bolus. In this study we adopted a novel technique including the principle of laser-doppler-velocimetry to characterize the manufacturing issues of aerosol formation, aerodynamic and electrical properties (e.g., aerodynamic size, charge, coagulation, particle velocity and sustainability) in real time. The instrument constructed on this operating principle, is known as the single particle aerodynamic relaxation time (ESPART) analyzer. Particles were characterized by the ESPART before entering and after leaving the mouthpiece and nozzle to understand their integrated effects.

Major Points:

- Each manufacturer of the MDI makes the device according to their best performed design prototype.
- Each design plays a role in charging emitted aerosols through tribo-electrification during the generation process.
- The aerodynamic size of each device generated aerosol clouds varied significantly.
- The normalized count median aerodynamic diameter and mass median aerodynamic diameter were found comparable with the results reported by other investigators.
- All MDIs did not only generate aerosols with varying aerodynamic size distributions but also containing both positively and negatively charged particles.

Summary: Variations in aerodynamic and electromechanical properties of the tested drug delivery devices can be explained due to the differences in tiny geometry of the spray orifice design, drug propellant or carrier and ingredients chemistry. Our observation also showed that the aerosol clouds produced by the devices are very dynamic, and dramatic changes in both droplet size and velocity take place within the first few centimeters of the spray plume.

Thursday, November 20 - 4:45pm - 5:30pm

Manufacturing

Development of GIS-Based Approach for Facilities Layout Planning

Author:

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Need: Facilities layout planning is crucially important for the design of individual plants. Major layout planning problems involve shifting in products and processes, or incorporating new technologies which directly influence the design of a plant layout. Typical layout analysis focuses on flow of materials, traveled distances, and relationships between departments. However, there are several other factors that are difficult to be included in the analysis, but might play major role in efficiency of the layouts, such as infrastructures and safety information. This study proposes a new method for facilities planning using Geographic Information System (GIS) – based approach to incorporate these relevant factors.

Overview: Geographic Information System (GIS) has been used in many areas including transportation, agriculture, urban planning, and resource management. GIS analysis deals with geographical locations and information associated to specific locations on a map. GIS utilizes either vector (points, lines, and polygons) or raster (grid cells) to represent data values in the analysis. In analogy, facilities layout planning deals with locations and information of apparatuses inside a plant. This study will present a method to transform plant's data into vector or raster data and utilize these data for a planning purpose. With GIS-based approach, several factors can be included in the analysis such as lighting, water, electricity, heating and cooling systems, material handling system, available spaces, and safety areas. Each factor will be represented as a data layer and will be combined using GIS analysis functions. Finally, a visual map will be generated as a result of the analysis.

Major Points:

- Connections between facilities layout planning and GIS planning
- Transforming plant's data to vector or raster data (GIS data)
- GIS analysis functions for solving layout planning problems
- Interpretation of a visual map from GIS analysis
- Benefits of GIS-based approach for facilities layout planning

Summary: Attendees will learn how GIS analysis can be used to analyze layout planning problems. Several factors will be presented as examples and be utilized to solve facilities layout problems. The attendees will understand benefits of this new approach for solving the layout problems.

Friday, November 21 - 8:00am - 9:00am

Manufacturing

Panel Discussion with the Society of Manufacturing Engineers

Presenters:

Mr. Jeffrey Abell, General Motors Corporation & Chair, SME Accreditation Committee, Detroit, MI
Ms. Michele Anderson, ATMAE Director of Accreditation, Elmhurst, IL
Dr. John L. Irwin, EdD, Michigan Technological University, Program Chair/Associate Professor, MET, Houghton, MI
Mr. Paul Nutter, MBA, CMfgE, CQE, CQA, Associate Professor and Chair of Department of Technological Studies, Ohio Northern University, Ada, OH
Dr. Nageswara Rao Posinasetti, Coordinator Manufacturing Technology Program, Department of Technology, University of Northern Iowa, Cedar Falls, IA
Dr. Aco Sikoski, Vice Chancellor/Dean, Ivy Tech Community College, Valparaiso, IN
Mr. Mark Stratton, SME Education Relations Manager, Dearborn, MI
Dr. Ahmad Zargari, CSTM, Professor and Chair, Applied Engineering & TechnologyDepartment (AETD), Morehead State University, Morehead, KY

This panel discussion is relevant if you are preparing for a visitation for ATMAE accreditation or reaccreditation of a program and/or option related to manufacturing, and if you are interested in SME Accreditation Committee activities related to the accreditation globally of manufacturing education programs in engineering, engineering technology, industrial technology, and related manufacturing education programs. Panelists will discuss how they utilized the SME Four Pillars of Manufacturing Knowledge and other resources available to assist in accreditation at their respective institutions. The panel will also focus on ideas for acquainting ATMAE accreditation program reviewers with manufacturing curricula and how to better prepare them to evaluate manufacturing programs.

Friday, November 21 - 9:00am - 9:45am

Manufacturing

A Comparative Study of the Micro-Milling Machinability of Aluminum, Copper and Brass Using Coated and Uncoated Tungsten Carbide Tool

Authors:

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Need: There are growing needs of micro-features for various applications in microelectronics, MEMS, sensors, automotive, medical industries and so on. In manufacturing, aluminum is the second most used metal and copper is the third. Brass is also rapidly becoming one of the most commonly used materials. A comparative machinability study of these materials for micro milling will contribute to the selection and optimization of materials for different applications. Although all three materials are relatively softer than many metals, there are challenges during the dry machining of these materials at micro scale. Some of the challenges faced during dry micromachining of soft materials are higher ductility, generation of heat during machining and clogging of chips. These challenges cause the tool failure and reduce the machining speed significantly. Therefore, it is important to investigate the ways of minimizing the tool failure and improving the tool life.

Overview: This study will compare the machinability of three important materials: aluminum, brass and copper by the micro milling process. A complex machining path composed of several micro channels will be designed for testing the machinability of materials. The optimum parameters setting for machining the complex shape will be identified based on the surface roughness, dimensional accuracy and burr heights of the channels. The study will also investigate the effectiveness of titanium nitride (TiN), titanium carbo-nitride (TICN), and titanium aluminum nitride (TiAlN) coatings on the cutting tool for minimizing the tool wear and improving the machining performance. A comparative analysis on the machining speed, surface roughness and tool wear will be carried out for machining three materials using uncoated and coated carbide tools. The optimum parameters setting for the coated and uncoated carbide tools for machining these materials will also be determined.

Major Points:

- Optimize machining parameters for micro milling of aluminum, brass and copper
- Investigate the effectiveness of TiN, TICN, and TiAlN coatings on the cutting tool
- Effect of machining parameters on surface finish, dimensional accuracy, tool life and burr formation
- Comparative study of the machinability of three materials

Summary: The attendees will understand the process of evaluating the machinability of materials at micro scale and the factors influencing the machinability. The attendees will also learn the importance of using thin film coating on the cutting tools during the micro milling process and effectiveness of different coating materials for machining aluminum, brass and copper.

Friday, November 21 - 9:00am - 9:45am

Manufacturing

A Comparative Study on the Performance of Coated and Uncoated Tungsten Carbide Cutting Tool for Dry and Wet Machining of Titanium Alloy

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Need: Titanium alloys (especially Ti-6Al-4V) are used extensively in the aerospace industries because of their excellent combination of high specific strength (strength-to-weight ratio) and exceptional corrosion resistance. Besides aerospace applications, Ti-6Al-4V is used extensively in the biomedical implants, medical equipment, chemical and petrochemical industries, pollution control equipment, and marine applications. Therefore, machining of Ti-6Al-4V is of prime importance. Traditionally, titanium alloys are considered to be difficult-to-cut materials. Some of the problems associated with the machining of titanium include poor conductance of heat, strong alloying tendency and titanium's work-hardening characteristics. As a result, investigating the optimum machining conditions and selecting proper cutting tools for machining titanium alloys have become important research issues in recent years.

Overview: This study will be investigating the machinability of Ti-6Al-4V using coated and uncoated tungsten carbide tools under both dry and flood coolant conditions. The dry machining, also known as sustainable machining, is currently replacing the conventional flood coolant machining because of both environmental and performance benefits. However, the tool wear is a serious problem in the machining of titanium alloys in dry conditions. Heat dissipation from the tool-workpiece interface is very difficult in dry machining, which results in alloying of workpiece to the tool surface. Therefore, investigation will be carried out to reduce the tool wear and improve dry machining performance by applying coating of titanium nitride (TiN), titanium carbo-nitride (TiCN) and aluminum titanium nitride (AlTiN) on the tool surface. Investigation will also be conducted to evaluate the effectiveness of tool coating during the flood coolant machining.

Major Points:

- Comparison of machining time, surface finish and tool wear with coated and uncoated tools
- Comparison of the performance of the cutting tools in dry and flood coolant machining conditions
- Effect of operating parameters on the machining performance
- Identification of optimum parameters based on surface finish and dimensional accuracy

Summary: This study will investigate the effectiveness of thin film coating on the tungsten carbide cutting tool for machining difficult-to-cut Ti-6Al-4V under both dry and flood coolant conditions. A comparative performance analysis of TiN, TiCN and AlTiN coated carbide tools will also be presented.

Friday, November 21 - 10:15am - 11:00am

Manufacturing

A Comparative Study on the Micro-Electro-Discharge Machining of Soft Brass and Difficult-to-cut Titanium Alloy

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Need: Micro-Electrical Discharge Machining (micro-EDM) is the process of machining electrically conductive materials by precisely controlled sparks that occur between an electrode and a workpiece in the presence of a dielectric fluid. Micro-EDM is capable of machining electrically conductive materials irrespective of their hardness. In recent years, Ti-6Al-4V is found to be one of the most widely used materials for the successful applications in aerospace, automotive, biomedical, and other major industries for its excellent mechanical and thermal properties, outstanding corrosion resistance, and low modulus of elasticity. However, the machining of Ti-6Al-4V by conventional machining processes has always been a challenge. Therefore, it is important to investigate the machinability of this material using non-conventional machining processes, especially EDM and micro-EDM. Moreover, a comparative study of the micro-ED machining performance of Ti-6Al-4V with soft and easy-to-machine brass will help in evaluating the machinability of titanium alloys under EDM and micro-EDM.

Overview: This study will present a comparative experimental investigation on the micro-EDM machinability of difficult-to-cut Ti-6Al-4V and soft brass materials. As both materials are electrically conductive, they should be machinable using the micro-EDM process irrespective of their hardness. The machining performance of the two materials will be evaluated based on the quality of the micro-features produced by the micro-EDM process. Both blind and through micro-holes and micro-slots will be machined on brass and Ti-6Al-4V materials. The quality of micro-features will be assessed based on the dimensional accuracy, surface finish and profile accuracy of the features. Finally, the arrays of micro-features will be machined on both materials to compare the mass production capability of micro-EDM process on those materials.

Major points:

- Difficulties of machining Titanium alloys (especially Ti-6Al-4V) using conventional machining processes
- Selection of optimum parameters setting for machining brass and Ti-6Al-4V
- Machining of micro-holes and micro-slots in brass and Ti-6Al-4V at the same parameters setting
- Comparison of the quality of micro-features machined in Brass and Ti-6Al-4V in terms of dimensional accuracy, surface finish and profile accuracy
- Machining of arrays of blind and through micro-features in brass and Ti-6Al-4V

Summary: The attendees will understand the differences in the machining performance of soft brass and hard Ti-6Al-4V under the micro-EDM process. Although, both the materials are electrically conductive, there might be some differences in the micro-EDM performance due to other material properties. This study will also investigate the reasons for the differences in the micro-EDM performance of two materials.

Manufacturing

Deployment of Zero Positional Tolerance at Maximum Material Condition

Authors:

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Need: Zero Positional Tolerance at Maximum Material Condition is an approach to conveying designer intent with respect to size, location, shape, and geometric form for assemblies. Moreover, it has the potential to minimize the rejection of useable parts, therefore reducing the cost of part production. However, not every manufacturer uses this approach because misunderstandings. As an example, Cogorno, in Geometric Dimensioning and Tolerancing for Mechanical Design (2nd ed.), says that "some engineers don't use zero positional tolerancing at MMC because they claim that the manufacturing staff will not understand it." Madsen, in Geometric Dimensioning and Tolerancing, says that "zero positional tolerance can be specified at MMC by designers but managers on the floor will generally ask their machinist and operators to shoot for the nominal dimension or the 'mid-value', even though the bonus tolerance gained from Zero Positional Tolerance at MMC can actually give more flexibility to the process."

Overview: Zero Positional Tolerance at MMC is often misunderstood as being a tighter tolerance of position rather than a provision for providing greater flexibility in the production of parts. For many who do not understand this approach, it is just what it says—no tolerance at MMC. Positional tolerance has a maximum value associated with it. The greater this value, the greater the flexibility available for locating holes and other features. When zero is attached to a positional tolerance, the misunderstanding by many is just the opposite—there is no flexibility. However, when used properly it can increase acceptance rates for parts that would usually be scrapped and thus reduce the costs associated with producing parts. If this approach has the potential for reducing scrap and for reducing cost, and increasing profits, why then do some manufacturers choose to not use this approach? The purpose of this presentation is to help dispel some of the misunderstandings associated with Zero Positional Tolerance at Maximum Material Condition and to encourage its continued deployment.

Major Points:

- Specifying Zero Positional Tolerance at Maximum Material Condition.
- The mechanics of Zero Positional Tolerance at Maximum Material Condition.
- Deploying Zero Positional Tolerance at Maximum Material Condition and the outcomes.
- The social and cultural limitations and assumptions associated with specifying Zero Positional Tolerance at Maximum Material Condition.
- Overcoming the limitations and assumptions and their significance.

Summary: The deployment of Zero Positional Tolerance at Maximum Material Condition has the potential to minimize the rejection of useable parts, and therefore reduce the cost of part production. Key to its effective deployment is overcoming the engrained limitations and assumptions associated with its deployment.

Manufacturing

A Study of Temperature and Humidity Effects on Desktop 3D Printers

Authors:

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Need: 3D printing has gained in popularity during the recent year at an accelerated rate especially due to the affordability of the open source hardware and software available to the public. For example, the Replicating Rapid Prototype (RepRap) 3D printer can be obtained for as little as $500 in purchased components taking within 2-3 days to assemble and commission, which has made 3D printing accessible to high schools and individuals rather than solely industry or higher education. Numerous resources are available for how to construct, operate and how to configure the open source software, although little research has been undertaken to analyze what printing and preprocessing settings are optimal for producing accurate parts in differing environmental conditions.

Overview: A desktop style RepRap printer is mobile enough to use in various environmental conditions needing only a power source, which could be from an alternative energy source in the middle of a jungle or desert. In more practical situations the 3D printers can be operated in an office, classroom, or large auditorium during all seasons of the year subjected to varying degrees of temperature and humidity. Commercial fused deposition modeling (FDM) 3D printers unlike the RepRap keep the plastic material in humidity controlled enclosures and the printing chamber is temperature and humidity regulated to ensure part dimensional accuracy. The RepRap 3D printers are completely open to the environment where in most areas of the country during the winter months the humidity can be very low compared to summer months causing the 3D printer to either fail altogether or create the plastic material to solidify at a varied rate causing part inaccuracies. This study is intended to ascertain the required flow rates that would be feasible for a given temperature and humidity level in order to achieve parts with high dimensional accuracy.

Major Points:

- Optimum flow rate values for a temperature range of 15c (59f) to 40c (104f)
- Variation in humidity levels being from 20% to 50%
- Using Polylactic acid (PLA) 3mm diameter filament extruded through a .5 mm nozzle
- Samples are prepared for each increment of 1 Celsius and for each temperature value
- Samples are printed from an aluminum nozzle and a 100% fill percentage
- Samples are measured using a micrometer and analyzed for voids and cavities

Summary: This study involves the testing of a RepRap Mendal Prusa 3D printer performance in a controlled environment utilizing a Thermotron SM32C temperature and humidity chamber. Temperature and humidity are measured using a thermocouple device and humidity logging software. Recommendations include the optimal settings in the open source preprocessing software for flow rate for various temperatures and humidity to produce dimensionally accurate samples.

Friday, November 21 - 11:15am - 12:00pm

Manufacturing

The Maker Movement

Author:

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Need: The rise of the maker culture is closely associated with the rise of hackerspaces, Fab Labs and other "maker spaces", of which there are now many around the world, including over 100 each in Germany and the United States. These allow like-minded individuals to share ideas, tools, and skillsets. Some notable hackerspaces which have been linked with the maker culture include Noisebridge, NYC Resistor, A2 Mech Shop, Pumping Station: One, Artisan's Asylum, and TechShop. As maker culture becomes more popular, hackerspaces and Fab Labs are becoming more common in universities.

Overview: The maker culture is a technology-based extension of DIY culture. Typical interests enjoyed by the maker culture include engineering-oriented pursuits such as electronics, robotics, 3-D printing, and the use of CNC tools. This is augmented by more traditional activities such as metalworking, woodworking, and traditional arts and crafts. The subculture stresses new and unique applications of technologies, and encourages invention and prototyping. There is a strong focus on using and learning practical skills and applying them creatively.

Major points: "Maker-Culture" developed from earlier hobbyist learning environments:

- If it can be imagined it can be made.
- The first step in making a thing, even a non-physical thing, is visualizing it…and computers can greatly aid that visualization, including sketching, drawing, simulation, analysis, and prototyping
- A most effective step in refining/developing a thing is collaborating with others on it…and Internet can greatly aid that collaboration ... and digital repositories are especially useful where data is used to directly reproduce objects and their derivatives.
- Begin with the end in mind.
- Making things always combines form with function.
- The art of making should be appreciated and celebrated.

Summary: 'Maker culture' promotes learning-through-doing (constructivism), and informal, networked, peer-led, and shared learning motivated by fun and self-fulfillment. Maker culture encourages novel applications of technologies, and the exploration of intersections between traditionally separate domains and ways of working including metal-working, calligraphy, film making, and computer programming. Community interaction and knowledge sharing are often mediated through networked technologies, with websites and social media tools forming the basis of knowledge repositories and a central channel for information sharing and exchange of ideas, and focused through social meetings in shared spaces such as hackspaces. Maker culture has attracted the interest of educators concerned about students' disengagement from STEM subjects (science, technology, engineering and mathematics) in formal educational settings. Maker culture is seen as having the potential to contribute to a more participatory approach and create new pathways into topics that will make them more alive and relevant to learners.

https://www.facebook.com/AlamanceMakersGuild http://burlingtonminimakerfaire.com
http://www.youtube.com/watch?v=6o9Oj_XUXjQ http://www.makerfairenc.com

Manufacturing

Modeling and Simulation of Manufacturing Systems for Continuous Improvement

Author:

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Need: Manufacturing Industry is going through rapid changes with more modern, complicated manufacturing processes and facing global challenges. In order to sustain the challenges, manufacturing industry needs continuous improvement of its existing processes as well as assess new manufacturing entities that need to be introduced on a continuous basis. This needs complete assessment of the discrete events that go through the manufacturing process. Unfortunately, oftentimes, these analyses are not feasible using closed form mathematical formulations and the best option to assess these processes are to use simulation and modeling techniques. There are several powerful simulation software packages available today. The manufacturing curriculums need to integrate simulation and modeling in their curriculum so that students prepare themselves to serve for the industry equipped with this important tool.

Overview: In this proposed presentation, the author would discuss the basic tenets on which these simulation techniques are based, and would provide a practical approach to integrate a well-known simulation software in the manufacturing technology curriculum with examples of process from the industry to show various aspects of the simulations techniques. Sometimes, it may not be feasible to offer a full course on simulation, and the idea would be to use a module for simulation and modeling in some relevant courses like Managing Manufacturing Systems or Production Planning and Control.

Major Points:

- Manufacturing industry needs discrete event simulation for assessment of process parameters for existing processes, new design, and improving the system on a continuous basis
- Students in the manufacturing technology programs need the knowledge of modeling and simulations
- Identification of core manufacturing areas in which a simulation module could be integrated
- Example of modeling techniques for specific industrial processes using a popular simulation and modeling software

Summary: The proposed presentation would enable the audience to understand the need as well as the procedure that are essential for effectively using simulation and modeling techniques for study and analysis of discrete event manufacturing processes. It is felt that this will be of interest and beneficial to both the manufacturing industry as well as academia, specifically those who are interested to incorporate modeling and simulation in manufacturing technology curriculums.

Manufacturing

Essential Competencies in Sustainable Manufacturing: A Benchmark for Technology Program Development

Authors:

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Need: The importance of sustainable manufacturing has grown in recent times because of the realization about the problems associated with the generation of so much waste by the humans due to their industrial activity. Manufacturing has played a major role in the centrality of human existence by creating material wealth for the society. It also contributes a lot to the generation of waste and also consumes a large amount of energy. Therefore, it is imperative that all engineers and technologists should be aware of the methods required to practice sustainable manufacturing because of its global impact.

Overview: It is a fact that in the past 50 years, humans have consumed more resources than in all of previous history. Between 1950 and 2005, worldwide metals production grew six fold, oil consumption eightfold, and natural gas consumption 14-fold. It is a fact that this rate is not sustainable, and if we would like our future generations to enjoy the same type of environment and resources, then the mankind needs to address this problem as soon as possible. The harmful effects of our consumption and its final impact on the humankind are detrimental to the core survival of civilization. Various governments, national and international agencies have been making efforts to generate strategies and action plans to educate the people and organizations to minimize waste and practice sustainability in all the aspects of consumption and manufacturing. This paper will present a case for including sustainable manufacturing in the curriculum of most ETD (Engineering Technology Department) groups, so that engineers/technologists by the time they graduate would have inculcated the sustainability in every sphere of their activities.

Major Points:

- Principles of sustainability in terms of energy usage and waste reduction
- Tools available for sustainability assessment
- Examples of sustainability practices
- Typical knowledge inputs required for a successful understanding of sustainable manufacturing
- Suggested engineering technology curriculum that incorporates sustainability and follows the SME four pillar approach.

Summary: Sustainability is a concept that is well understood and there are various practices that have been attempted world over. There are methods that are available for utilizing the various tools that can be applied effectively in various phases of manufacturing activity such as design, manufacturing planning manufacturing processes, total quality management, and industrial systems. The inclusion of sustainability in ETD curricula will benefit all the associated programs. The paper also presents various competencies that can be included in the ETD curriculum from the sustainability point of view.

Manufacturing

Scheduling Multiple-Machine-Multiple-Job in Excel for Small and Medium Sized Manufacturing Companies

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Need: The purpose of job scheduling is to meet the jobs' due date and to optimize the usage of manufacturing resources. The task of job scheduling is to determine the job sequence and to establish the start and finish date for each process on each machine. The small and medium sized manufacturing companies' production model is typically the multiple products, small quantity, and long processes production. It forms a complicated multiple-machine-multiple-job scheduling problem. The situation is getting worse for them because they do not have a clear schedule for their production. Therefore, they do not know what is going on at the shop floor. Usually, they are not affordable to buy commercial software to handle this complicated problem. They need a practical scheduling tool to manage their manufacturing operation urgently. Excel is an excellent instrument for this type of job scheduling. With Excel, small companies can create their own operation schedule easily. Excel is also a visual aid to show loading and progress of each job by the Gantt chart. Finally, because of its visibility, it is easy for these companies to adjust schedule to meet some specific purposes such as speeding up the delayed job and adding a job from an important customer.

Overview: The job scheduling is based upon the objective of optimizing one or more performance measures which helps in minimizing job tardiness and machine's idle time. The approach of this research is to use Excel for scheduling multiple-machine-multiple-job problem for small and medium sized companies. The dispatching rules used in this job scheduling are shortest processing time (SPT), earliest due date (EDD), first-come-first-served (FCFS), and Johnson's rule. The developed Excel scheduling program is able to compare the results of those four rules and recommend a schedule with less delay and less machine idle time. The Gantt chart will also be provided for manager to monitor the production.

Major Points:

- This study helps the small and medium sized companies to choose a good job scheduling for their multiple-machine-multiple-job problem.
- The main value of this research is to use Excel to schedule jobs, which makes the schedule more economic, practical, and visible.
- The developed program is able to adjust schedule to meet some specific purpose.

Summary: The small and medium sized manufacturing companies need their own scheduling instruments for their multiple products, small quantity, and long process jobs' production. They also prefer to the visual scheduling like Gantt chart that Excel can provide. This study meets the needs of the small and medium sized companies to manage their multiple-machine-multiple-job problem.

Friday, November 21 - 3:00pm - 3:45pm

Manufacturing

Perceptions of Manufacturing Management Knowledge and the Four Pillars

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Need: In June 2011, a group of manufacturing educators in cooperation with the Society of Manufacturing Engineers (SME) developed Curriculum 2015, a four-year strategic plan to reverse negative trends in manufacturing education and improve manufacturing competitiveness. As a result, the Four Pillars of Manufacturing Engineering were formally introduced and supported by SME, ATMAE, and ABET. The Four Pillars consist of foundational areas relevant to the SME Certified Manufacturing Engineer Body of Knowledge. It represents the fundamental knowledge required for manufacturing practitioners and is recommended for academic programs related to manufacturing. One of the foundational areas is manufacturing management.

Management curriculum is what distinguishes four-year manufacturing programs from two-year programs across ATMAE accredited programs. It also distinguishes the discipline from traditional engineering programs. The required knowledge for an entry-level manufacturing manager is important. Hence, this knowledge should be well understood and agreed-upon by manufacturing faculty and students.

Overview: This presentation discusses survey research on the perceptions of manufacturing students and faculty regarding the Four Pillars manufacturing management foundational area. Manufacturing programs were surveyed regarding the knowledge required for entry level manufacturing managers. Specifically, the survey sought to answer the following research questions: 1) What fundamental knowledge is most important for an entry-level manufacturing manager? 2) What fundamental knowledge is most frequently covered in manufacturing education programs? 3) Is the required manufacturing management knowledge specified by the Four Pillars model congruent with what is being taught and what is important for an entry-level manufacturing manager?

Major Points:
- Background for the study
- Methodology of the research
- Findings
- Summary and interpretation

Summary: This presentation presents research on student and faculty perceptions regarding manufacturing management knowledge and the Four Pillars model.

Friday, November 21 - 3:45pm - 4:30pm

Micro / Nanotechnology

Hands-on Micro Pressure Sensor Transducer Function and Systems Integration

Authors:

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Need: Classic tech programs are under constant pressure to bring in new, cross-disciplinary technology concepts to engage and add marketable skills to students. Developing new curriculum to support these new endeavors is both time-consuming and costly. Having ready-made curriculum, with hands-on equipment and online instruction support, videos and access to subject matter experts, mitigates issues of cost, time and value. This workshop will allow participants to interact with two related activities that bring micro sensor electronics, transduction, and integration topics to their students with an interactive and engaging hands-on approach.

Overview: This will give the participants an overview of the Southwest Center for Microsystems Education's (SCME) educational materials focusing on two hands-on kits and associated supplemental educational materials. The workshop includes demonstrations of student made pressure sensor macro model incorporating a surface, strain gauge based Wheatstone Bridge, and a micro pressure sensor electronics integrated system to teach amplification and systems integration concepts.

Major Points:

- Create a working pressure sensor incorporating a Wheatstone Bridge circuit on a flexible membrane – hands-on classroom approach.
- Integrate an off-the-shelf micro pressure sensor to amplify signals and integrate into a system
- Learn how these micro tech sensors are made in the cleanroom.
- Obtain access to online resources for students and educators.

Summary: By completing this workshop and utilizing the provided resources, attendees will be able to easily integrate micro pressure sensor transduction and electronics integration into a variety of technical courses and programs. The participants will gain access to not only the specific resources provided for the topics presented, but also be apprised of the entire SCME educational materials suite.

Thursday, November 20 - 3:45pm - 4:30pm

Micro / Nanotechnology

Micromachining: A New Development in Manufacturing

Author:

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Need: Micromachining refers to techniques for fabrication of 3D structures on the micrometer scale. Recent demands for micro parts have required us to manufacture variety of micro components used in different fields from entertainment electronics to biomedical implants. The convenience and value of many products can be substantially increased with reduced size and weight. With the trend toward miniaturization, micromachining becomes increasingly important in fabricating micro parts.

Overview: With the trend towards miniaturization, micromachining becomes increasingly important in fabricating micro parts. Micro parts may have overall size of few millimeters but it has many features that falls in micro range from 1 µm to 500 µm. features size of 100 µm is common in micromachining. This means small as hair size, the average hair diameter is about 100 µm. The design and construction of tools, tool holders, cutting tools, and electrodes need to evolve as greater demands are placed on them for machining these miniature parts. A study of micromachining process proves that micro cutting processes are not just a miniaturization of the conventional cutting technology, and requires an adjustment of the entire machining setup and processes.

Major Points:

- Introduce the traditional technique of micromachining.
- Introduce mechanical micromachining technology, which is a new field in micromachining that is achieved by optimization of cutting process for micro-milling, turning and grinding process for a wide range of materials.
- Introduce the state of the art training and educational materials related to micromachining.

Summary: With increased demand for miniaturized functional equipment, micromachining is becoming an important industry. Micromachining is the technology for manufacturing micro sized structures. This technology has many applications, and has driven innovation in many areas such as the automotive and biomedical engineering fields. The potential of micromachining has been noticed by the research community, inspiring the creation of many academic works. Since its beginning, micromachining has evolved greatly to include more techniques and methods. With the prediction of nanotech and micromachining market expansion by 2015 to 1 trillion dollars and creation of new industries related to this technology the demand for micromachining will increase drastically.

Thursday, November 20 - 4:45pm - 5:30pm

Micro / Nanotechnology

Bringing Microsystems Technology to Your Tech Program

Author:

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Need: Classic tech programs are under constant pressure to continually evolve and engage students. The MEMS (Microsystems) Industry continues to grow at a rapid rate, 10-15% CAGR, fueling a demand for additional technicians and engineers. Developing new curriculum to support these new technologies is time consuming and costly for most technology education departments. The SCME, a National Science Foundation funded Advanced Technological Education Center, provides support, training, mentoring and materials targeting undergraduate tech programs, 2yr, 4yr, and secondary STEM programs.

Overview: This presentation will give the participants and overview of the Southwest Center for Microsystems Education's (SCME) wide range of modular educational resources that may be adapted, modified and inserted into existing programs or used to create new course and program offerings. The SCME has over 40 learning modules, multi-day cleanroom workshops at several sites, online streaming animations, lectures, archived webinars, and a dozen hands-on classroom kits available enabling evolving Tech and STEM programs to maintain relevancy and students to upgrade their skills. These materials include topics ranging from cleanroom protocol and safety, MEMS History and Applications, BioMEMS, and Microsystems Fabrication. This presentation will provide the participants with access and examples of SCME educational materials and electronic take-away resources. The SCME encourages collaborations and can support professional develop.

Major Points:
- MEMS concepts and terminology
- Microsystems and MEMS – a rapidly growing industry need
- Online course access for educators and their students
- Engaging Hands-on classroom resources
- Cleanroom Fabrication Workshops

Summary: Attendees will be presented with resources and opportunities to engage students in Tech and STEM education through the use of Microsystems (MEMS) technology applications at the undergraduate education level.

Micro / Nanotechnology

Online Resources in NANO Technology for Educational Development

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Need: New breed of technology and engineering technology major students would benefit in understanding new trends industry. In order to continually evolve and innovative STEM and Tech programs, conventional technical high schools, colleges, and universities, have the responsibility to seek out and implement new, innovative, emerging and technically engaging educational materials for their students. Given today's economy, these educational organizations may not have the resources (financial as well as trained educators), to teach technically advanced topics. Field of NANO technology has rapidly grown in the past decades and qualified technician and engineers will be needed for this segment of industry.

Overview: Over the last twenty years, the National Science Foundation (NSF) through its Advanced Technological Education (ATE) program has funded many ATE centers across the United State of America to advance the technician level work force in the Country. One of these centers is the Nanotechnology Applications and Career Knowledge (NACK) Network. NACK Center is committed to supporting the development of two-year degree programs in micro- and nanotechnology across the country by offering teaching resources suitable for the post-secondary level. NACK also provides materials for K-12 use. Click on a resource title below for more information.

Major Points: Available Post-Secondary Resources include:

- A series of thought-provoking nanotechnology PowerPoint presentations filled with in-depth material surveying where nanotechnology came from.
- Suitable for two-year degree programs, for certificate programs, and for freshman-sophomore use in four-year degree programs.
- Collections of interactive multimedia in nanotechnology are available. Remote Access using video learning modules and example lab experiments suitable for post-secondary and secondary classrooms are accessible for public.

Summary: Undergraduate NANO materials online can help can help cash strapped programs to stay educate students in the fields of NANO technology. Instructors can register online and attend workshops for free held annually at NACK center.

Safety

Evaluating Employees' Trust of Their Organizational Leadership and Safety Climate in the University Laboratory Environment

Authors:

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Need: Safe actions in the modern workplace are important for ensuring research excellence and worker health and safety. Research has identified employee perceptions' of trust in their leadership as a key factor for a positive safety climate in the work environment. Little research has been completed in understanding safety climate and trust perceptions and their impact in university research laboratory environments. Evaluating these factors will play an important role in developing innovative process improvements to minimize incident rates in the university research laboratory environment.

Overview: Colleges and universities have experienced an increase in both the number and severity of laboratory/shop incidents. These incidents have resulted in injuries and deaths, causing campuses to evaluate safety practices and ask questions regarding their campus safety climate, especially in research and teaching spaces. Campuses are trying to evaluate our safety climate with the intent of finding innovative process improvements. The relationship between trust and safety climate has been proven in industry but not in academic research laboratories. Determining if trust plays a part in university research laboratories safety climate may help to ensure a safer workplace.

Major Points:
- Impact of significant incidents on the academic research laboratories
- Importance perceptions of trust and safety climate in university research laboratories
- Previous work in employees' perceptions of trust and safety climate which formed the basis for this research
- Development of survey Instrument used to measure safety climate and trust perceptions
- Interactions between incidents, safety climate and trust perceptions based on university incident data
- Application of this research finding in academic teaching and research laboratory environments

Summary: Attendees will understand the role perceptions of trust have on the safety climate in university research laboratories and their impact on incident rates amongst workers. Understanding impacts on safety climate can help to develop innovative process improvements that may help ensure a safer workplace.

Safety

Understanding versus Awareness – What's the Difference? Utilizing Audience Analysis to Ensure Employees Understand Risk Under New GHS Rules

Author:

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Need: The Occupational Safety and Health Administration has changed its Hazard Communication Standard to more closely align with GHS standards. Some of the adopted changes have already taken effect, and others will take effect over the next two years. The rule changes require that workers are not only aware of risks, but that they fully understand them – something that employers will have to ensure. This presentation will suggest ways employers can make sure risk is adequately communicated to employees.

Overview: The Occupational Safety and Health Administration has updated its Hazard Communication Standard to require that workers understand the risk a material poses, as opposed to just being made aware of the risk. OSHA's new rules are an effort to align more closely with global GHS measures, and mean not only changes in material labeling, but an increased burden on employers to ensure workers truly understand the hazard various materials pose to health and safety. This presentation and paper will give an overview of the changes in OSHA's Hazard Communication Standard and the new GHS requirements. It will also outline the added burden these changes put on employers and suggest audience analysis as a tool to create effective training and communication for workers.

Major Points:
- Review of the revised HCS and GHS standards
- Review of timeline for implementation
- Review of employer responsibilities
- Discussion of audience analysis techniques that can be used to craft effective risk communication that meets the new standard.

Summary: The Occupational Safety and Health Administration has updated its Hazard Communication Standard to require that workers understand the risk a material poses, as opposed to just being made aware of the risk. That means that employers will have to bridge the gap between what the MSDS notes, and what the worker is able to understand. Audience Analysis is the process of discerning an audience's characteristics in order to tailor effective communication for that audience. What should employers consider before crafting risk communication for workers? Characteristics such as age, impairment, literacy, professional responsibility, and education are all important factors in creating effective risk communication that goes beyond the MSDS. This presentation will teach employers how to utilize this process to craft risk communication that meets the needs of employees and meets the requirement of the new rules.

Thursday, November 20 - 2:30pm - 3:15pm

Safety

How to Get Conclusive Results From Small Samples

Author:

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Need: Statistical analysis is one of the scientifically acceptable methods for data analysis and/or decision making which is commonly used by safety experts and researchers. However, depending on the nature of the project, the data collection phase could be very expensive, time consuming or even impossible because the proper data is scarce (number of a particular accident involving space shuttles). It happens quite often that safety professionals and researchers end up with a very small datasets with widely distributed variables (large variance) or sometimes missing values. Conducting any type of statistical tests and analysis with such datasets would be pointless because the large values for standard deviations will lead to large confidence intervals. Large confidence intervals means that small differences between the variables cannot be detected and the results of such analysis would inconclusive.

Overview: Small datasets with large variances should not be dismissed and thrown away right away just because of their size and imprecision. In such situations, the goal should be utilize techniques to reduce the variance of the sample. There are scientifically proven methods that researchers can use to obtain conclusive results with their analysis and bootstrapping is one of them. Bootstrapping is a resampling technique with replacement from the initial dataset in order to produce additional samples with similar size and similar values but with different frequencies, which helps to reduce the value of standard error or standard deviation of samples. This reduction can lead to smaller type I error and detecting small variations between parameters of samples. The number of resampling depends on the sample size itself and its variance and it can vary from couple of hundreds to thousands.

Major Points:

- Small samples with large variance could not produce conclusive results.
- Bootstrapping method can help to reduce the variance.
- Such method and help researchers when data collection is expensive, slow or when the data is scarce.

Summary: This is a descriptive and pedagogical presentation for students, researchers and practitioners who face challenges regarding statistical analysis on small samples. A concise description of Bootstrapping method and its application in occupational safety and health field will be provided with a case-study as an example.

Thursday, November 20 - 2:30pm - 3:15pm

Safety

Quantifying Detrimental Effects on Life Safety Rope

Authors:

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Need: Working on ropes, specifically the category of ropes called "life safety ropes," is unavoidable for military, rescue, and various construction applications. The structural integrity, including minimum breaking strength, of life safety rope is adversely affected by a variety of factors; weathering, exposure to UV light, abrasion, chemicals, impacts, and knots. This research project tested the maximum yield strength of life safety ropes after being exposed to some of these factors individually and in combinations.

Overview: This project tested rope used for life safety under the influence of various factors that are known to degrade rope strength. The project focused on quantifying how much detrimental impact results from ultraviolet (UV), oil, sand and their combinations have on the strength of the rope after exposure to these controlled conditions. A device was built to create a scenario similar to a fall factor 1 impact. Afterwards the ropes were statically tested to failure to determine the effect of the detrimental variables.

Major Points:
- Life safety ropes are negatively impacted by UV, dirt, oil, and the use of knots.
- A device was built to test the effect on strength of these variables
- A quantification of the negative effects on life safety ropes
- Recommendations for care and use of life safety ropes

Summary: The results from testing the life safety ropes to quantify the detriment of laboratory controlled negative effects on synthetic lines used in life safety applications in military, rescue, and construction applications; results of this research will be valuable to users of life safety rope for making more informed decisions regarding the use of their lines for life safety.

Thursday, November 20 - 3:45pm - 4:30pm

Safety

Integration of Technology for Learning Safety

Author:

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Need: Safety in higher education continues to be an issue. Every year there are numerous accidents and near misses. However, this is not only true for higher education but for industry as well. To assist with the training of both students and workers, integrating current technology is a way that teachers, professors, and supervisors have to educate individuals about safety. With the changing learning styles of the next generation of students and workers it is important to integrate technology into this learning process.

Overview: This presentation will analyze how learning styles of individuals have changed and that previous instruction methods are not as effective with this generation. Two examples of current technology integration will be demonstrated 1. Video game technology 2. Mobile smart devices. Besides presenting current ways technology can be integrated into safety training, there will be a discussion on how future technology might be integrated into safety training programs. One such example is the development of the "internet of things" with devices communicating and sharing data with each other.

Major Points:

- Learning Styles.
- Adapting Technology.
  - Video Gaming.
  - Mobile Smart Devices.
- What's Next.

Summary: Attendees will understand the need for updating safety training program. By realizing individuals that are entering higher education and industry have different learning styles. A way to engage these individuals is through the integration of technology. This will be demonstrated in two ways 1 Video game technology and 2 Mobile smart devices. Besides an understanding about current developments there will be a discussion on what future technology could be implemented for safety training.

Friday, November 21 - 3:00pm - 3:20pm

Safety

We Are Seed Planters: A Look at Teaching Students Nanotechnology Environment, Health, and Safety Awareness

Authors:

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Need: Tomorrow's engineers and technologists will also need to assume responsibility for establishing safe practices for working with nanomaterials and for safeguarding the environment. In the absence of specialized training in issues related to health, safety and environmental impacts of nanotechnology, the tendency will be either to focus only on the optimizing performance and cost while incorporating nanomaterials without regard to health and safety concerns, or to be overly cautious and avoid using nanotechnology. Realizing the full potential of revolutionary nanotechnologies and at the same time minimize undesirable consequences, engineers and technologists need to be educated in how to judge health and safety risks, how to weigh ethical considerations, and how to make informed decisions.

Overview: The presentation will discuss the development of modules for undergraduate-level introduction and advanced nanotechnology safety course. Also, the presentation will discuss the integration of the modules for Texas State University and University of Texas at Tyler engineering and technology courses. Students' perceptions and learning experiences from the modules will be illustrated.

Major Points:

- Purpose of project
- The urgency of implement nanotechnology courses (Why???)
- Designing of modules
- Students' perceptions of modules
- Lateral diffusing modules to other technology and engineering educators
- What did we learn from the project?

Summary: This presentation is a seed-planter to motivate ATMAE programs to consider implementation of modules/course at universities. We as educators must be more proactive in preparing the new workforce with the skill sets and competency to safely handle nanomaterials.

Friday, November 21 - 3:25pm - 3:45pm

Safety

Use of Risk Mapping Tools to Identify Hazards in Bulk Material Handling

Authors:

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Need: Identification of hazards in the bulk materials industry is challenging in terms of assessing the impact of hazards to end-users. Large quantities of product in a fast-paced environment make it difficult to both identify hazards present and control or manage the resulting risk. New policies and regulations add further complexity, requiring an efficient method to both manage risk and meet regulatory requirements. Risk assessment methodologies such as event tree analysis or fault tree analysis, could identify areas within the supply chain needing control or management, yet allow each facility to decide which control or management method best meets their needs. The goal of this type of system is to identify hazards so that they can be successfully controlled and managed to mitigate the impact of system risk on end-users.

Overview: This presentation will discuss the use of risk assessment methodologies for hazard identification and risk management, in the bulk materials supply chain. Important components of the bulk materials system will be presented. Finally, the identification of management needs or control points will be shown, along with a strategy for calculating the probability of occurrence of hazards with or without intervention.

Major Points:
- Challenges of event tree analysis methodology in a bulk materials supply chain
- Risks unique to the bulk materials supply chain
- Construction of event or fault trees for identification of pertinent hazard assessment information
- Implications for professionals in supply chain management

Summary: The audience will learn about how risk assessment tools can be applied to identify, quantify, evaluate, and mitigate risks in the supply chain. Use of the risk assessment tools will be discussed in terms of bulk materials supply chain management. Implications of use in industry will be shared.

School Administration

An Innovative Approach to Recruitment and Collaboration

Author:

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Need: The field of Technology, in many cases, need to be explained to prospective students and even school counselors. They relate the term STEM to engineering and cannot grasp that there are various Technology majors that can be considered. In addition, it is a time that all of the majors can be displayed and discussed amongst faculty, students, and the university and external community. Because of this the School of Technology at NC A&T State University has begun Technology Week.

Overview: The presentation will discuss what is covered in Technology Week and how it relates to recruitment and collaboration. Many activities are covered during this week and will be discussed in more detail during the presentation.

Major Points:

- Educating the public on technology majors
- Fostering a culture of collaboration and discussion
- Instilling excitement within the departments of Technology
- How industry takes part in Technology Week

Summary: Attendees will understand the purpose of bringing faculty, students, and the university and external community together at a set time to learn more about Technology majors offered.

School Administration

Using GIS for Recruiting in Higher Education

Authors:

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Need: The survival of academic institutions depends greatly on the recruiting of quality students. Institutions fare better when they recruit students with the desired skills and proper motivation, thereby aiding in retention, increasing graduation rates, and providing a better product (graduates) for university customers (employers). We will present data that shows the effectiveness of a Geographical Information System (GIS) as a powerful tool in recruiting quality students, tracking graduates, and identifying potential employers for graduates.

Overview: Many state accrediting agencies require a certain number of graduates each year for programs to remain viable. National accrediting agencies such as the Association of Technology, Management, and Applied Engineering (ATMAE), the Accreditation Council for Business Schools and Programs (ACBSP), and the Accreditation Board for Engineering and Technology (ABET), require universities and community colleges to collect additional data, such as job placement percentages and employer satisfaction surveys. GIS is used in many business and service application areas to provide spatial information (maps), to answer questions in spatial format, and to assist in solving problems. GIS is used in application areas such as crime analysis, homeland security, forestry, business, transportation, and many other fields, including education. These GIS maps can be products of location (point-based) and spatial (line and polyline based) features and as well geographic relational databases.

Major Points:

- GIS is an intelligent tool that can relate any database with respect to geographic map co-ordinates and produce an essential geospatial information map.
- GIS develops spatial information analysis to assist institutions in recruiting students, tracking graduates, and identifying potential employers of graduates.
- GIS creates a thematic map depicting spatial analysis data.

Summary: This paper will provide data showing how GIS can be used in higher education to recruit qualified students, to track graduates, and to identify potential employers who hire graduates.

Thursday, November 20 - 1:30pm - 2:15pm

School Administration

Assessing a Departmental Comprehensive Student Recruitment Initiative

Authors:

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Need: As enrollment continues to be a concern, faculty are challenged with taking a more active role in recruiting students into their programs than in years prior. Reviewing existing recruitment strategies, identifying available resources, then developing and implementing a goal directed plan to recruit students is difficult and time consuming. Additionally results of such efforts are not immediate, so analyzing their effectiveness is challenging.

Overview: This presentation will offer and provide an analysis of the first two years of a student recruitment plan developed by faculty. The development of a comprehensive recruitment plan includes a review how students find our degree programs, what we are currently doing to connect with prospective students, and how we can better meet the recruitment goals of the department.

Major Points:

- Student Recruitment Planning
  - First year strategies
  - Second year strategies
  - Third year strategies
- Analyzing Effectiveness
  - Student Recruitment & Selection Survey Data
  - Application Data
  - Exit Survey Data
- Conclusions and recommendations
  - Strategies that are most effective
  - Strategies that are least effective

Summary: Attendees will learn how faculty collaborated to develop and implement a student recruitment plan and the effectiveness of said plan.

School Administration

Student Perceptions Used to Drive Curriculum Development

Author:

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Need: Distance learning continues to make steady gains in becoming a viable degree attainment option. This is true for both 2 year and 4 year degree programs. Applied technology and engineering programs have lagged behind other less technical programs in establishing a significant footprint in online/distance education. One contributing factor is curriculum and its relevance to current trends in industry. Maintaining relevance combined with accessibility continues to challenge program administrators. In order to make informed curricular changes and to redesign delivery methods, understanding your current and potential student market is critical.

Overview: Changing a program's curriculum is not an activity that should be approached lightly. Careful analysis is critical to a successful outcome. Program faculty and administrators are under increasing financial pressures to reverse declining enrollment trends and to increase the enrollment of already stagnant programs. The critical analysis should incorporate input from all stake holders which includes; students, employers, and alumni. This study will investigate the curriculum needs of both traditional and adult learners engaged in face to face 16-week courses and weekend courses. The investigators believe that a difference exists in the perception of which course topics are relevant to current industrial needs. This study will determine how these perceptions influence the need for curriculum changes. These findings can be used to realign a curriculum that meets the needs of current industry as well as those of future degree seekers.

Major Points:

- Curriculum development based on perceived value
- Importance of degree completion programs
- Curriculum perspective: Tradition delivery versus weekend only

Summary: Attendees will understand the importance of utilizing student perceptions to drive curriculum development. This student perception analysis lends a different approach to curriculum development compared to industry need analysis.

School Administration

Mentoring As a Method of Retaining Female Students in a Male Dominated Academic Field Through the Use of Social Media

Authors:

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Need: Retaining female students in male dominated curricula can be challenging for administrators of technology programs. Providing a connection between female students and their future profession through mentoring can strengthen their interest and commitment to both their current academic field and to their future profession.

Overview: Both technology industries and academia struggle with attracting and retaining females. Mentoring can be the key, but finding female mentors who are near the campus can be difficult. By utilizing social media, mentors can be matched with suitable students, regardless of their geographic location. Texting, Facebook, Twitter, and Skype are the methods that can be utilized to connect the students to their mentors, and provide a sense of community. This presentation examines one program's implementation of a mentoring program for female students using social media and how its approaches can be adapted by administrators in other technology programs.

Major Points:
- Challenges to retaining female students
- Developing the plan
- Best practices for retention strategies
- Matching mentors to mentees
- Teambuilding and sharing
- Conclusions and recommendations

Summary: Attendees will learn proven methods to connect female students in a male dominated curriculum to both their current academic field and to their future profession. Perspectives of both faculty and the program director are provided.

School Administration

Student Satisfaction Analysis: Enhancing Service Quality

Author:

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Need: An understanding of students' perception of service quality could provide the administration with invaluable insights and highlight potential areas that could be improved to enhance the experiences of students and achieve institutional effectiveness.

Overview: Students are the center of the existence of higher educational institutions, and student satisfaction with the quality of student services that colleges and universities provide is critical to student learning, engagement, and success, and institutional effectiveness. The changing nature of the higher education marketplace makes it imperative for university and college administrators to recognize the importance of students' satisfaction. Hence, administrators must strategically focus on creating and reinforcing pleasurable experiences of their students in order to improve student retention and graduation rates, and their loyalty to their alma mater. This paper will present the results of a student satisfaction survey that was conducted to measure students' level of satisfaction with the services they receive, and gauge the level of their expectations.

Major Points

- Administrators must strategically focus on creating and reinforcing pleasurable experiences of their students in order to improve student retention and graduation rates, and their loyalty to their alma mater.
- If a quality system is in place, the internal processes will help in achieving customer satisfaction.

Summary: Students demand good quality service, and administrators should constantly focus in gauging their level of satisfaction with the services they provide, with the objective of satisfying students' needs and achieving institutional effectiveness.

School Administration

Dual Enrollment in Missouri Innovation Campus: Students' Perceptions of Taking College Courses

Authors:

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Need: Although most high schools and colleges in the United States cooperate to guide the high school students to the best possible paths so that students can graduate from high school with enough academic credits and pursue an accelerated college degree with less financial obligations for students, literature reviewed for this study indicates a lack of research on students' perceptions of taking challenging technical college courses while still in high school. Attending high school full-time, participating in after school activities such as sports, taking specialized college courses, and, sometimes, having some other commitments such as work, can be quite overwhelming for high school students. For this reason, leaders and faculty of the University of Central Missouri (UCM) involved in Missouri Innovation Campus (MIC) are seeking effective ways to accommodate and understand different students' needs in order to help them achieve their goals while enhancing their educational experiences. In our presentation, we will display our research findings including students' dual-enrollment experiences, what kind of support from the university would be helpful from students' viewpoints, and the highlights of our dual-credit programs.

Overview: To provide a quality education, evaluating educational programs is an essential part of a technical training program, and students' opinions play important roles in transforming current educational activities. Information pertaining students' opinions and experiences about taking college courses will be collected via an online survey involving students enrolled in Design and Drafting Technology (CADD) courses at Missouri Innovation Campus. The results of this investigation will be classified and analyzed to discover how to enhance high school students' college experiences. The findings of this study will be valuable not only for meeting students' learning needs, but also for future academic and institutional innovations.

Major Points:

- High school students' perspectives of taking college-level courses
- Possible university support measures per students' requests
- Best practices in dual credit programs
- Recommendations and conclusions

Summary: Attendees will learn effective methods to improve the high school students' college enrollment experiences. The practical activities addressed in this presentation can be incorporated into any technical program to achieve positive outcomes.

School Administration

An Exploratory Study of the Educational and Sociological Effects of Wearable Computers with Optical Head Mounted Displays (OHMD) on University Campuses

Authors:

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Need: Certain technologies that were thought to be a part of the future will soon be a part of the present. At the end of 2013 and the beginning of 2014, various companies are scheduled to release their own version of wearable computers with Optical Head Mounted Displays (OHMD). In a number of cases, it is a new form of wearable technology that is to perform many of the same functions as a smart phone, but be worn as a pair of glasses or as a headset. With the introduction of this new technology many questions arise about the potential positive and/or negative effects it will have on human welfare. Recent research endeavors in this field have been done on physical, health, and security aspects. However, an important factor to be considered is the social consequences of using these technologies. Specifically, one area that should be researched is its effect on education. The world of academia is ever evolving to coop with technological advancements that are reforming societies. With the introduction of OHMD it is important to understand how this technology affects college campuses for students, faculty, and administrators.

Overview: Since the beta release of Google Glass in early 2013 many issues have been raised by bloggers, usability testers (Glass Explorers), and professionals in various fields. Although the potential for OHMDs are vast, there are concerns with how it could affect the health of an individual (Fredrickson, 2013). Others have questioned how OHMDs will affect privacy and public safety (Arthur, 2013). Among all of the speculations, researchers did not attempt to evaluate the impact on university campuses as a result of introducing OHMDs. To fill this gap, a pilot study through a university wide survey instrument was administered at a Midwestern university to investigate how OHMDs are expected to affect social and educational aspects for student, faculty, and administrators on university campuses.

Major Points:

- The expected changes on social lives of students, faculty, and administrators due to the use of OHMDs;
- The suitability and expected changes on educational component from the perception of students, faculty, and administrators;
- The affordability threshold for adopting OHMDs on a university campus; and
- Security concerns related to using wearable computers with OHMDs on campus life

Summary: Attendees will gain knowledge about behavioral, social, and attitudinal perceptions of students, faculty, and administrators at a Midwestern university about the positives and negatives of using wearable computers with Over Head Mount Devices (OHMD). They will be introduced to the current status of the aforementioned parameters and the expected changes. Furthermore, they will be engaged in a lively discussion about the topic.

School Administration

Maintaining a Safe and Healthy Learning Environment in the University Classroom

Authors:

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Need: With increasing diversity in university classrooms, there is a need to educate faculty about how to maintain a safe and healthy learning environment for students. There are instances where intolerance and disrespect can occur in the university classroom, and faculty need to learn ways to skillfully deal with these serious issues to promote a safe and healthy learning environment. Faculty needs to learn new ways to promote acceptance of differences and promote respect in the university classroom.

Overview: During this presentation, conference attendees will be introduced to the growing types of diversity in the university classroom. Strategies to encourage respect and acceptance of cultural diversity will be presented. Forms of invisible diversity such as learning disabilities and sexual orientation that are not directly observed like skin color or accents will be discussed along with ways to promote a safe and healthy learning environment for diverse students. Conference attendees will learn how to deal with situations when respect and acceptance of differences does not occur in the learning environment.

Major Points:

- Introduction to the need to maintain a safe and healthy learning environment for university students
- Information relating to increasing diversity in the university classroom
- Strategies to encourage respect and acceptance of cultural diversity
- Forms of invisible diversity such as learning disabilities and sexual orientation will be presented
- Ideas to deal with situations when respect and acceptance of differences does not occur in the learning environment

Summary: Conference attendees will leave the presentation with an understanding the increasing types of diversity in the university classroom. The conference attendees benefit from strategies to maintain a safe and healthy learning environment for all students regardless of their visible or invisible diversity. Those who attend the presentation will be prepared to go back to their university classrooms and implement strategies that encourage respect and acceptance of diversity. Attendees will also be better prepared to skillfully react to situations when acceptance of differences fails to occur in the classroom.

Friday, November 21 - 8:00am - 8:45am

School Administration

Technology Alumni and Employer Surveys for Program Accreditation: Findings and Feedback to Tomorrow's Gateway

Author:

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Need: With the transition to outcomes-based models for the accreditation of institutions and academic programs by both regional and specialized accreditation bodies, the survey of alumni and the employers of program graduates, have become an indispensable and invaluable part of successful accreditation efforts. This presentation will discuss the feedback and findings from surveys of Applied Engineering and Technology program graduates as part of the self-study process for the accreditation and reaccreditation of academic programs by ATMAE.

Overview: Outcomes-based accreditation and assessment have become the norm throughout much of higher education in the US and several other countries around the world. The accreditation of academic programs in Engineering (as well as Applied Engineering and Technology) has moved to outcomes-based accreditation and assessment, which has informed specialized accreditation in other disciplines and countries (Schachterle, L.; "Outcomes Assessment and Accreditation in US Engineering Formation," European Journal of Engineering Education, vol. 24:2 1999). Outcomes-based assessment is critical to program accreditation that uses outcomes-based models (Bresciani, Marilee J.; "Outcomes-based academic and co-curricular program review: A compilation of institutional good practices" Sterling, VA: Stylus Publishing 2006) and continuous accreditation models. Since the feedback and findings from alumni and employer surveys inform outcomes assessment, as well as the development of program outcomes, alumni and employer surveys are indispensable parts of the self-study process for ATMAE accreditation.

Major Points:

- Outcomes based accreditation relies on the feedback and findings from the survey of alumni and employers for assessment purposes.
- Alumni and employer surveys are necessary for an effective self-study process for the accreditation and reaccreditation of academic programs by ATMAE.

Summary: The session will discuss feedback and findings from surveys of alumni and employers of the graduates of ATMAE accredited programs in Applied Engineering and Technology.

Friday, November 21 - 8:00am - 8:45am

School Administration

Where Are They Now? Demographics Gathered From LinkedIn.com about Graduates from B.S. Programs in Industrial Technology

Author:

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Need: The results of this study will help faculty to understand the career development paths of Industrial Technology graduates and to visualize the patterns of influence of IT programs within industry.

Overview: This presentation will be focused on a demographics study about individuals who listed themselves as graduates holding the degree of B.S, Industrial Technology, on the web site LinkedIn.com. The author devised a sampling plan to select among users within this population, and then gathered data available from each person's LinkedIn profile, such as the degree-granting institution, job titles held, industries worked in, current geographic location, subsequent education, professional certifications, etc. No personal data, contact information, employer names, or LinkedIn connections were recorded.

Major Points:

- Summary of job titles, aggregated by industry, degree-granting institution, region, etc.
- Network analysis of relationships between degree-granting institutions, current industries, current job titles, and current geographic locations
- Analysis of career development trends
- Details about the research method

Summary: This presentation will illustrate the results of a demographic study that profiles graduates from B.S. programs in Industrial Technology who are users of LinkedIn.com. The results will be in the form of summary information, trend analyses, and network analyses.

Friday, November 21 - 9:00am - 9:45am

School Administration

ATMAE Alumni: A Trends Analysis and Demographics of 2009 ATMAE Accredited Programs Alumni

Authors:

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Need: The ATMAE accredited programs alumni survey results were among the indicators that created the need for changing the name of NAIT to ATMAE. A trends analysis of ATMAE graduates will help to determine the market value of our graduates, and to help promote ATMAE programs. This presentation presents the data obtained from selected ATMAE accredited institutions alumni of 2008 regarding their positions and responsibilities, salaries, job satisfaction, professional achievements, qualifications, and promotions. The data presented will contribute to the revision and development of the discipline.

Overview: A review of literature regarding the need for obtaining feedback from alumni will be presented. The results of the surveys will be analyzed, and the process of developing, validating, and administering the questionnaire will be discussed

Major Points:

- The salary trends during the past five years will be explained.
- Positions held by ATMAE graduates as well as their responsibilities and salaries will be presented.
- Highest academic degree and qualifications of graduates will be presented.
- Perceptions of graduates regarding potential improvement in programs and courses will be discussed.
- The professional impact of ATMAE accreditation on program's graduates will be discussed.
- Graduates perception of ATMAE certifications such as CTM, CSTM will be discussed.
- Graduates reactions to our profession's new name - ATMAE – will be discussed.

Summary: Although ATMAE has recognized the importance of programs graduates feedback by asking ATMAE accredited programs to conduct an alumni survey and disseminate the results, a review of literature indicates that very limited research data is available on alumni perceptions of their programs. This presentation will provide a trend analysis of ATMAE alumni of 2009 at the national level.

School Administration

Program Assessment: Closing the Loop

Author:

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Need: Of the various pieces that make up the program assessment process, the piece that seems to give programs fits is the piece frequently referred to as "closing the loop". The focus of program assessment is to get the desired programmatic results. To do so effectively, a systematic process of gathering and analyzing data about program performance is deployed. While it may seem like the last step in the assessment process, "closing the loop" is in fact the springboard from which we continue the process of improving. Program assessment then is an iterative and ongoing process of purposeful reflection and planning, where one systematically evaluates dimensions of a program, in an attempt to identify strengths and areas for improvement and then uses the results to make informed decisions.

Overview: An overview of the assessment process will be provided at the onset of the presentation. The presentation's focus however will be on the piece frequently referred to as "closing the loop". A concrete example will be provided to confirm the relative ease with which "closing the loop" can be used to pursue desired programmatic results.

Major Points:
- Overview of the Program Assessment Process
- Terms Defined
  - Program Assessment
  - Program Assessment Process
  - Desired Programmatic Results
  - Closing the Loop
- Closing the Loop in Practice
- Results
- Discussion
- Conclusions and Recommendations

Summary: It is anticipated that audience members will be more effective in deploying the iterative process of making programmatic improvement with the aid of what seems to be the last step in the assessment process, "closing the loop".

School Administration

Closing the Loop: Assessment Plans Utilizing Certification Exams Provide Efficient Results for Curriculum Validation or Change

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Need: Many states are implementing procedures in an attempt to increase the ROI of public universities and institutions. Outcomes Assessment is a tool that is used to formulate many indicators on a dashboard of performance. Assessment has often been done separately and inconsistently throughout the various college units and often has been dependent on specific program accreditation

Overview: The loop becomes a circle as the certification exam results effect changes in the curriculum. Consistent exam results can indicate a needed curriculum change/intervention. This presentation will concentrate on the incorporation of certification exams in assessment plans as it describes an institution's practices, progress, and results in consolidating and streamlining the assessment activities related to regional accreditation; multiple program accrediting bodies, e.g., ABET and ATMAE; and state and institutional requirements. ABET and ATMAE accreditation standards are used as a framework for the process. ATMAE Certification is also an integral part.

Key Points:
- The role of ATMAE Certification exams as effective assessment instruments
- Making curriculum changes based on sound assessment practices
- Consolidating and reconciling the multiple assessment audiences, e.g., regional accreditation, ABET & ATMAE, etc.
- The role of ABET and ATMAE accreditation practices

Summary: Certification exams, when used as assessment tools, can guide effective changes in curriculum and lighten the assessment burden on faculty. An effective assessment plan can be incorporated that minimizes the faculty assessment burden and melds the assessment requirements of educational institutions with regional and program accreditations. Program accreditation practices can provide the framework for various assessment requirements and other faculty and administrative concerns.

School Administration

Outcome Assessment- Program Student Learning Outcomes: How Do You Measure Success?

Authors:

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Need: Continuous Assessment of Students' Learning, developing the culture of Evidence and documenting results continue to be a major challenge to many institutions. There is ample evidence that this is the case as once read about sanctions, "show cause" stipulations that are issued to institutions by numerous regional accrediting agencies. On-going professional development is necessary on the topics of Outcome Assessment, Institutional Effectiveness and the Accreditation Processes in General in order to continue to address the issue of Accreditation and Re-Accreditation.

Overview: Accreditation and Reaccreditation processes require the continuous assessment of Educational Programs that are offered by institutions of higher education. Each program offered by an institution must have an assessment process with documented results. Evidence must be presented that the results of assessment are applied to the further development and improvement of programs. The Assessment processes must demonstrate that the outcomes important to the mission of the institutions and the objectives of the programs are being measured. It is an imperative that institutions develop the culture of evidence to document that assessment is taking place and that the results are being used for continuous improvement of programs, and the college mission.

Major Points:

- An Overview of the Assessment Processes
- Review of Courses Student Learning Outcomes
- Discussion of how to measure program Success
- How to use program Student Learning Outcome to improve Programs
- The relationship of Program Outcome Assessment to Institutional Effectiveness.

Summary: Attendees will understand the Program Outcome Assessment Processes and how to develop a culture of assessment based on Evidence.

School Administration

Technology Is Changing American Society

Authors:

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Dr. Gerald Watson, Dept. of Applied Engineering Technology, North Carolina A&T State University, Greensboro, NC

Need: Researchers demonstrated that a large share of economic growth -- more than one-third -- is driven by technological advances. Capital and labor accounted for less than two-thirds of growth. Technological change has had the largest impact on changes in labor composition. Changes in the employment structure are towards more highly educated workers. The value of education is enhanced by technological change, because greater knowledge or skill enables firms to implement new technologies more effectively.

Overview: A new industrial revolution was born every few years in human history. Railroads, electricity, telephony, radio, antibiotics, highway networks, air travel, and television were important historical examples. The IT revolution is the latest and a most dramatic industrial revolution. Indeed, innovations in information technology (computer hardware, software, and communications) have produced astonishing improvements in every corner of the economy. Information technology could generate substantial spillover effects into other sectors. Examples include microprocessor, satellite technologies, local area networks, computer-aided design (CAD-CAM), electronic banking, Internet retailing, statistical quality control, and computerized inventory control.

Major Points:

- Technology is enabling businesses to better manage everything. It is helping eliminate unnecessary production processes, speeding the delivery of goods to market, compelling businesses to keep prices low and, enabling companies to better meet individual customers' needs.
- The majority of modern industries are being significantly affected by computerization, because information technology has the broad power to reduce the costs of coordination, communications, and information processing.
- Technological unemployment is a reality, which does play an important part in creating economic and social insecurity. Technology may force part of workforce to switch to jobs that still require human skill in the short term; but in long term, individual and society as a whole generally end up wealthier.
- Ultimately, innovation and technology lead to a direct rise in overall productivity, the ability to make goods cheaper and cheaper and the wealth of society.

Summary: Increasingly, the high-tech industry is playing a key role in building a productive and successful American economy. The current wave of technology is the role of information. Owing to the availability of real-time information of customers' needs and of the location of inventories and materials flows throughout complex production systems, businesses management has been enabled to remove large swaths of inventory safety stocks and worker redundancies, to shorten the lead-times on the delivery of capital equipment, and has armed with detailed data to fine-tune product specifications to most individual customer needs. The Information technology sector is and will remain one of the largest employers. In 2013, the global tech market grew by 8%, creating jobs, salaries and a widening range of services and products.

School Administration

The ATMAE Assessment and Certification Exams: What's New to Make Your Life Easier?

Authors:

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Need: As the ATMAE Certification Programs gear up for ANSI accreditation, fundamental changes need to be made to the programs to allow for this distinction. By doing so, certain certification exams can now be used for assessment while new certification exams are created to allow for ANSI accreditation. This change will allow institutional programs that use the exams for assessment to continue to do so without effecting the accreditation of ATMAE certification programs.

Overview: This presentation will focus on the key factors that are involved with accrediting the ATMAE certification exams. In addition, this presentation will review the content that is now covered on the new assessment and certification exams.

Major Points:
- Brief overview of the need for the ATMAE certification and assessment exams
- Description of how ATMAE exams are currently being used for assessment by programs
- Outline of the content covered by the exams for improved program fit
- A review of effective methods for improving the pass rate of certification exams
- Review of ANSI accreditation guidelines and what it means to the certification program

Summary: As a greater number of programs continue to use the ATMAE certification exams for assessment, the overall annual average pass rate for them has continued to fall over the past several years. This presentation will focus on what has been done to rectify the situation and to enlighten individuals with the best alternative for their immediate needs.

School Administration

How to Develop and Prepare Online Programs for ATMAE Accreditation

Authors:

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Need: As the demand for online courses/ degrees in technology programs is increasing, the need for ensuring quality becomes essential. The online Technology Management degree was designed to meet the expanding need for challenging jobs in technology and technology management. The BSTM program specifically targets Community and Technical College associate degree graduates from technology/engineering-related disciplines.

Overview: As the state and federal funding for higher education institutions decline, colleges depend upon student's enrollment to support their programs. Technology and engineering related programs move toward expanding access to higher education for non-traditional/employed students through offering online/hybrid courses. With a significant number of online technical programs, maintaining and ensuring the programs quality has become an issue of major concern. Adhering to the ATMAE accreditation standards will increase the quality of technology programs and enhance their visibility. The BSTM goal is to strengthen the program quality using contemporary educational technology and Quality Matters certified instructors.

Major Points:

- Enhance the delivery of online programs
- Maintain quality of online programs (Quality Matters)
- Assessment of online courses
- Prepare online programs for ATMAE accreditation
- Future challenges and directions
- ATMAE accreditation of online programs

Summary: This presentation focuses on preparing an online technology management program for ATMAE accreditation. The issues concerning the assessment of online courses will be discussed. The opportunity for ATMAE to accredit the online programs will be discussed

School Administration

Assessing the Cost, Productivity, and Value of Academic Programs

Author:

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Need: The changing landscape of higher education is forcing institutions to find means to more effectively manage the enterprise and its resources. This is driven by a new economic reality resulting from decreased state appropriations, implementation of performance-based funding models, and an increasingly competitive market. The market is increasingly student-driven and less bound by distance and physical space. It is also influenced by increasing student costs and resulting debt that often lead to questions of the very value of a degree. In many locations, there is also the pressure of a changing demographic that is reducing the number of high school graduates. Traditional program review has been based on a variety of measures that are both qualitative and quantitative in nature describing the performance and status of an academic unit. Increasingly, the desire is to collect and analyze data that can inform decisions regarding program structure, administration, and resource allocation in the context of not just the unit, but the overall university. Rather faced with insufficient resources to sustain programs or the desire to reallocate funds, many institutions are under the additional pressure of prioritizing programs in terms of their importance. Much is being written about ways to assess cost, productivity, and value, and use those in determining priorities.

Overview: Program review processes, including accreditation, are primarily focused on quantitative and qualitative measures that indicate a level of performance of a program. A review includes faculty and students measures that historically have been based on inputs but are increasingly focusing on outcomes indicating how well a program achieves stated goals and objectives. Generally, issues of cost and productivity are those related to determining if resources are adequate and deployed in a manner that allows a program to successfully achieve its outcomes and provide students with a desired level of competence. Often driven by a desire to reduce expenses, increase revenue, or reallocate resources, institutions are reviewing academic program cost and productivity in ways different from that historically undertaken in traditional program review and accreditation. Such reviews may be driven by a desire to determine if programs should be sustained, have increased level of investment, decreased resources allocation, or a candidate for elimination if a program is no longer relevant, is performing below expectations, or has a high cost to benefit ratio. Those decisions are informed by collecting and assessing comparative cost and productivity data along with value judgments across an array of programs within an institution as well as benchmarking against peer institutions.

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Friday, November 21 - 2:00pm - 2:45pm

School Administration

Assessing the Cost, Productivity, and Value of Academic Programs

Major Points:

- Factors resulting in increased assessment of programs.
- Overview and discussion of measures used in determining cost and productivity.
- Examples of assessment criteria and measures used in program prioritization.
- Difficulties in assessing value and prioritizing programs.

Summary: Academic program operation and personnel costs comprise a significant portion of overall expenses of an institution. As institutions seek to reduce costs, increase revenues, and reallocate resources, academic programs are increasingly facing assessment of their value and possibly a decision on their very existence. This presentation is intended to provide an overview and discussion of cost, productivity, and value in developing academic program prioritization. It will focus on examples of criteria and measures used in evaluating program performance and benchmarking. Included is a discussion of participant experiences with program review processes, strategies, and outcomes.

Friday, November 21 - 2:00pm - 2:45pm

School Administration

Do Public Higher Education Institutions that Receive State or National Quality Recognition Perform Better than Their Peers do on the Persistent Challenges of Cost, Accountability and Access?

Author:

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Need: There has been broad agreement that public higher education in the U.S. is facing seemingly intractable challenges. Cost, accountability and accessibility have been nearly universal challenges in higher education for decades. MBNQA process is one approach that may help higher education institutions to address these challenges, but currently there is little empirical evidence of its effectiveness relevant to the challenges. This study examines the performance of public higher education quality award recipients relative to these three challenges. Results of this study may influence institutional decisions regarding implementation of the Baldrige process and approaches to address key challenges.

Overview: Public and private organizations in every sector have used The Malcolm Baldrige National Quality Award criteria and process. This comprehensive approach to management has helped these organizations to address major challenges. Yet relatively few higher education institutions have embraced this approach, in spite of major persistent challenges. This presentation offers preliminary results from an exploratory study using publicly available historical IPEDS data from the U.S. Department of Education. This study identified twelve dependent variables associated with cost, accountability and access. Fifty-eight public higher education institutions that received quality recognition from state or national award programs are compared with other similar institutions on these variables. The study compares performance in the award winning year and change in performance from five years previous. The institutional size is used as a control variable, and award recipients are matched with non-recipients on type, and region.

Major Points:

- Award status may affect cost, and accountability but not access in the award year.
- Award status had a significant effect on scholarship and fellowship spending in the award year and over time.
- Award status may affect direct spending and tuition funding in the award year and over time.
- Graduation rates increased at 2-year schools, but declined at 4-year schools over time.
- Funding of tuition increased over time for award recipients, but declined for non-recipients.
- Award status had a significant effect over time on minority success.

Summary: This study may help to inform both administrators and policy makers regarding the efficacy of management solutions such as the Malcolm Baldrige National Quality Award process in addressing major public higher education challenges. Attendees will have a deeper knowledge of how the Malcolm Baldrige National Quality Award criteria and process can affect the performance of public higher education institutions. Attendees will also have a better understanding of limitations of this approach.

Friday, November 21 - 2:00pm - 2:45pm

School Administration

Managing Expectations with Industry – A University Indirect Rate Survey

Author:

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Need: As budgets dwindle and universities look to faculty to help develop funds with which to run the university, junior faculty are finding it necessary to conduct paid research. Within Engineering Technology types of departments (regardless of ATMAE and ABET accreditation) much of the externally funded work is applied activities done for private companies. The resulting issue that many researchers have to contend with is a lack of understanding by those private companies of what indirect (facilities and administration) fees are, the reason for indirect within universities and a lack of appreciation of just how low the indirect is when it is compared to many of the Carnegie "very high research activity" research universities. If faculty, especially tenure track faculty, are to secure funding from the private sector, a better understanding of where their university stands on the indirect rate scale can be a powerful selling tool when approaching companies.

Overview: This presentation will discuss what some of the current indirect rates are and how the presenter has managed to overcome industry misconceptions to successfully secure in excess of $500,000 in corporately funded contracts over a six year period. The presentation will specifically discuss and evaluate the indirect rates of many of the "research" universities, stressing some of the differences between many of the ATMAE schools and the "research" universities. Suggestions will be provided on how to work with the attendee's internal research support groups (e.g. research support services, research and sponsored programs, office of sponsored programs, etc.) and there will be a discussion some of the terms that will help alleviate confusion between the faculty member and the research support staff. Additionally, the presenter's methods of explaining why companies should go with their specific university will be shared.

Major Points:

- Key research office terms that can help smooth the proposal/contract accounting process
- Evaluation of indirect rates between ATMAE schools and Carnegie "very high research activity" research universities
- Suggestions on how to obtain corporate funding in today's economic environment.

Summary: This presentation aims at helping faculty (both tenure track and already tenured) to obtain corporate funding. A discussion of the indirect rates – something that many private companies don't understand – will be the center piece of the discussion, but suggestions on how to work with the attendee's internal research support staff will be included as will tips on how the presenter has obtained over $500,000 in corporate funding over a six year period.

School Administration

Community Engagement -- Measuring the Impact of Your Program

Authors:

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Need: All programs from time-to-time are required to justify or defend their existence. Therefore, evaluation of our academic programs are vital. Programs often prepare for various accreditation processes as a mechanism to measure the quality of the instruction, research, facilities, faculty, etc. However, often the measurement of the impact of our programs on the local, state, and national community goes unmonitored and unmeasured. We will present strategies for community engagement, collecting data, assessing data, and use of data from community, state and national stakeholders to improve the program.

Overview: Measuring the impact of individual programs effectively requires the proper tools for data collection, data analysis, and plans for use of data to make program improvements. Collecting and assessing the data presents many challenges such as: (1) tracking the community perception(s) of the program , (2) including community engagement in marketing materials, (3) identifying community engagement opportunities, (4) providing a mechanism for the community to have input in community engagement activities, (5) budgeting for community engagement, (6) measuring impact of program on students, faculty, community , and institution and (7) making the scholarship of community engagement part of the promotion and tenure process.

Major Points:

- Creating a culture committed to community engagement
- Identifying community engagement opportunities related to the discipline
- Understanding curricular engagement
- Enhancing and rewarding the scholarship of community engagement
- Using the results to validate that the program is relevant to the needs of the community

Summary: Attendees will understand the strategies for monitoring and measuring community engagement as well as the benefits to the faculty, students, institution, and overall community. Community engagement has been identified as a strategy for increasing retention and success of students in programs.

School Administration

Universal Design in Technology Programs: Reshaping Learning Spaces and Instructional Techniques for Improving Student Competencies

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Need: Providing a student learning centered educational environment with equitable access for both traditional and nontraditional learners in different settings can be a challenge. This is especially true for technology classes which often have a significant laboratory component. The learning environment should be conducive to motivate students, to provide options about how they can access key information and also about how they can demonstrate competencies associated with a topic or course. Doing so requires the course to be designed with deep understanding of the content, of the learner, of appropriate learning strategies, and of the appropriate learning environment. In order for all or most students to be engaged in learning to the extent possible, the learning environment often needs to be redesigned.

Overview: Universal Design (UD) principles have traditionally been applied to products and environments for providing access and usability to all with little or no adaptation or design alterations needed. These ideas can be readily extended into an educational setting, as has been done with the Universal Design of Learning or other adaptations. Using UD principles learning can be facilitated for all and to the greatest extent possible. UD ideas such as equitable use and flexibility in accommodating individual preferences or abilities, simple and intuitive usage, as well as tolerance for error can be adapted for use in classrooms and laboratories. This will result in providing students multiple ways of accessing the information made available in different formats, include flexibility in expressing and evaluating student competencies, and increase interest in the subject. It will improve students' teaming skills along with individual achievement of goals, organization, communications, and thinking skills, all of which are valued highly in industry.

Major Points:

- Overview of universal design principles and adapting these in learning environments
- Addressing considerations regarding the what, the how, and the why of learning for all
- Strategies for engaging technology students in their learning and for motivating interest in core, supporting and supplemental classes required by tech majors
- UD principles for guiding learning in traditional and online technology classes
- Special challenges regarding UD in technology laboratories and possible remedies

Summary: The presentation will provide ideas adapted from the principles of Universal Design (UD) for improving learning and student engagement in technology classes. Classrooms designed using these principles will be more resilient to change even as instructional and communication technology advances, and will thus prepare students well for facing future professional challenges.

Friday, November 21 - 3:00pm - 3:45pm

School Administration

Faculty Team Member Integration: New Perspectives

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Need: While much of the literature focuses on how to conduct a successful faculty search, technology administrators recognize that the search is only the first stage in the continuous process of building an effective program team. Faculty integration is a critical component in retaining and developing new members into productive and satisfied components of the program team.

Overview: Just as in industry, teamwork is essential for a technology faculty team. Whenever a new member is introduced, the team must re-form itself, integrating the new instructor and often changing the way the seasoned members interact. This process begins during the search for candidates that demonstrate the potential to integrate into the team and continues throughout the faculty member's development, beginning again when another new faculty member comes on board. This presentation examines the approaches used by one program through the perspectives of a new faculty member, seasoned faculty teammates, and the program director. Other technology administrators can adopt and adapt these strategies into their own programs for future success.

Major Points:
- Job search considerations
- Initial integration
- Curricular approaches
- Continuous team building
- Challenges and lessons learned
- Conclusions and recommendations

Summary: Attendees of this presentation will understand successful approaches for integrating new faculty members into technology programs as well as how to continue this process throughout the development of the faculty team. Perspectives of administrators, new faculty members, and seasoned faculty are provided.

School Administration

Best Practices for Advisory Boards in a Technology Program

Authors:

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Need: The rate of technology change is increasingly accelerating, which challenges higher education curriculums to continually evolve. One of the primary tools used in academia is an advisory board comprised of industry executives that conduct annual or semi-annual reviews of departmental degree programs. These boards are tasked with providing an external review of curriculum and recommending changes or modifications. The problem this paper will address is that the typical internal processes used by academic units to act upon board recommendations are often too inefficient and at times counter-productive in meeting the needs of students to adapt to an ever changing industry.

Overview: Technology based curriculum must provide education in state of the art technologies, but the nature of technology makes this goal a moving target. One of the most significant challenges faced by technology programs is that of anticipating change and managing the conflict between accelerating changes in technology and the glacial pace of academic curriculum modifications. While changing course content is relatively easy to enact, directional changes or implementing new courses are a much larger concern. This paper will review various methods employed by university technology programs to involve industry in the process of maintaining relevant coursework in existing curriculum and discuss associated benefits and drawbacks. The purpose of the paper is to focus on external advisory boards including: 1) composition of board members, 2) additions and changes to the board composition, 3) advisory board duties, 4) advisory board meeting preparation and agendas, 5) documentation and tracking of recommendations, 5) managing change to the curriculum. This paper will also present an implementation plan for the recommended processes.

Major Points:

- Technology curriculum needs to constantly evolve and change to meet industry needs
- Advisory boards for technology programs need to be continually evaluated and modified to anticipate the needs of emerging industries and/or technologies
- Obtaining feedback and council from advisory boards requires a standardized methodology / process
- Course changes are relatively easy, but curriculum modifications to meet emerging technology trends are more difficult to implement in a timely manner and hampered by university process.

Summary: Attendees will be presented with a process to design, manage, and exploit external advisory boards to enhance efficiency and responsiveness in meeting ever changing technologies and industry requirements. The advisory board model and processes presented will be applicable to all technology related undergraduate degree programs.

School Administration

Developing a Technology Leadership Program

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Need: One of the strategic needs identified by US industry for college graduates is leadership. Two years ago, a program of general leadership in a College of Technology initiated a program transformation to Technology Leadership, to better prepare graduates for leadership positions in technology rich organizations. The program members initially engaged in work to better define the role of a technology leader, examining the research-based literature and interviewing recognized technology leaders across several industries. We found that leaders must possess a broad base of technological knowledge; its processes, products, and implications, as well as the leadership skills necessary to be able to influence change and motivate others. This was then molded into a program and plan of study.

Overview: This session will discuss the development of the Technology Leadership concentration in the Technology Leadership and Innovation Department. The competencies of technology leadership and where these are introduced, developed, and assessed will be discussed. Integral in the design of the program are Technology Focus sequences to provide each student with depth of technological knowledge. Students have a number of options here. The rationale and characteristics of these options will be presented. The program then culminates with a technology leadership capstone that integrates each student's technological expertise into a challenge project. We will provide an overview of the entire program and highlight the seven different courses in the TL concentration, with objectives and outcomes.

Major Points:

- The transformation of a leadership program to a technology leadership focus
- Integration of research into the program design
- Leadership curriculum for the program as well as details about the various Tech Focus options

Summary: Attendees will learn about the development of a Technology Leadership program, from idea to fruition. Details of the program, of the design down to the individual courses, will be presented.

School Administration

Boosting Assertiveness

Author:

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Need: The number of women entering STEM career tracks and likewise STEM careers is increasing. Yet few of these women are adequately prepared to study and work in an environments comprised mainly of men. This presentation aims to provide women and their educators with action items that can be used to increase their comfort level and ability when speaking up.

Overview: The presentation is designed to aid female students and young professionals in developing assertiveness skills to build and enhance their communication, delegation, planning and conflict resolution abilities. Time is allows for discussion of best practices to aid those in program planning and execution when setting benchmarks.

Major Points:
- Gender impact on collaboration
- Differences of passivity, assertiveness and aggression
- Essence of hot buttons (anger cues)
- "Girl talk" versus "guy talk"
- Avoiding manipulation

Summary: Attendees will learn techniques that support self-efficacy as they journey deeper into male-dominated fields. This presentation targets female students, young professionals and those who advise, teach and mentor females with a new look at an old subject: helping women who are stepping up to do so with courage, confidence and finesse. The goal is to demystify the male-dominated classroom and workroom by aiding females in the transition to learning and working partners.

School Administration

Implementation of a Technology Management Skills & Knowledge Analysis

Authors:

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Need: As defined by ATMAE, the field of technology management (TMGT) is very broad encompassing "production and operations management, project management, computer applications, quality control, safety and health issues, statistics, and general management principles." While these general areas reflect the needs of most, if not all, technology-based companies, technology management schools serve different regions across the county, each with a unique industry base and identity. While the literature addresses the broad areas within the field, very little exists related to entry-level skills and knowledge standards. Recognizing this fact, TMGT faculty at Texas A&M University-Commerce (TAMU-C) implemented a process to indentify the skills and knowledge requirements of potential regional technology-based employers to better align the curriculum within the Bachelor of Science in Technology Management program and respond to the university's program assessment requirements.

Overview: Faculty researchers at TAMU-C designed and implemented a process to identify entry-level skills and knowledge required by regional technology-based employers. A focus group was convened to identify categories and specific skills and knowledge across a broad range of business and industry sectors. The researchers then identified and surveyed technology-based employers across North Central and Northeast Texas, which were or potentially could be employers of the BS TMGT graduates. Data were collected through the survey and analyzed for use in a curriculum alignment process for the BS TMGT program.

Major Points:

- Development of a list of entry-level Technology Management skills and knowledge
- Identifying and surveying appropriate personnel within related technology-based employers
- Analyzing skills and knowledge survey data to guide curriculum revision/development

Summary: Attendees will be guided through a process implemented to identify entry-level skills and knowledge sought by employers of Technology Management baccalaureate degree graduates. The analysis and utilization of survey data to guide curriculum alignment will also be addressed.

Thursday, November 20 - 11:30am - 12:15pm

Teaching Innovations

Development of Decision-Making Scenarios for Teaching and Learning

Authors:

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Need: Direct, experiential learning has been found to have a very positive effect on student learning outcomes. The use of decision-making scenarios, which closely reflect working conditions, can provide students with similar benefits in a low-risk environment. Decision-making scenarios present intriguing benefits to educators seeking to maximize their students' decision-making effectiveness post-graduation. Additionally, using decision-making scenarios in an educational setting allows educators to gauge how well students are learning course concepts. Developing decision-making scenarios for use in higher education can be a challenging and time-consuming process. Providing educators with a general framework may reduce the time and resources required to develop educational decision-making scenarios.

Overview: The presentation will discuss the development process of writing a decision-making scenario designed specifically for a quality management classroom. Factors considered in the development of an educational decision-making scenario will be presented, particularly as they relate to teaching and learning. Implications for the traditional, virtual, and hybrid higher education classroom will also be shared.

Major Points:

- Value of using decision-making scenarios to promote teaching and learning in higher education classrooms
- Factors considered in the development of decision scenario learning objectives, scenario structure, measurement metrics, and student learning indicators.
- Challenges in the scenario development process
- Implications for higher education teaching and learning

Summary: The audience will learn about the process used to develop, refine, and evaluate decision-making scenarios for educational purposes. Use of decision-making scenarios will be discussed from a teaching and learning perspective. Implications for educational applications will be shared.

Thursday, November 20 - 11:30am - 12:15pm

Teaching Innovations

Problem Solving Approach and Team Performance: Preparing Technology Students for Tomorrow's Gateway

Authors:

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Need: Technology students need to be able to think and solve technical problems. Each individual has an approach he or she prefers in tackling today's technology problems. This approach is a consistent way individuals approach new ideas, manage change, and respond effectively to complex challenges. Research shows that individuals approach problems differently and this approach does have an effect on problem solving. There has been an abundance of research on distinguishing between problem solving approach and problem solving ability. Little research has been done on problem solving approach and team performance.

Overview: This presentation will focus on the approach that students take when dealing with problems, not on problem solving ability. The proposed subjects of the research are students enrolled in a technology program at a Midwestern university. Participants will be asked to complete an instrument to assess his or her problem solving approach. In addition, the students will be given a problem to solve. The presentation will provide the results of this on-going study.

Major Points:
- Identifying problem solving approaches of technology students
- Results of the study will be presented
- Tips and techniques for using problem solving approach to help students in problem solving

Summary: Attendees will understand how individuals approach problems and how this understanding can help them in solving technology problems. This presentation provides results of a study on problem solving approach and team performance. Additionally, tips and techniques for using problem solving approach to help technology students in problem solving for tomorrow's gateway.

Thursday, November 20 - 1:30pm - 2:15pm

Teaching Innovations

Adapting the Case Method to Optimize Simulated Experiential Learning in Higher Education

Authors:

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Need: Students need experience and guided practice making decisions to solve technology problems before entering the workforce. The case method is one instructional method which has been used to provide students with simulated experiential learning. The case method provides students with realistic workplace situations, promotes development of decision-making skills, and enables students to broaden their academic perspective. However, recent secular trends, such as the rapid growth in online learning in higher education, present educators with unique challenges and opportunities to effectively apply case study methods in conventional formats.

Overview: This presentation will discuss ways of altering the traditional case method to deliver an optimal learning experience for the traditional, virtual, or hybrid classroom. A literature analysis on conventional uses of the case method will illustrate the potential value in optimizing this instructional method for various learning environments. Discussion of goals and challenges of using the case study effectively will conclude the presentation.

Major Points:
- Current uses of the case method in higher education
- Identification of major future themes changing landscape of higher education
- Opportunities to adapt case method elements to provide optimal simulated and experiential learning experiences
- Measuring effectiveness of the adapted case method

Summary: The audience will learn how current trends in higher education are presenting challenges for educators who aim to facilitate simulated experiential learning opportunities for students. Implications from a teaching and learning perspective and considerations when adapting this instructional method will be shared.

Thursday, November 20 - 1:30pm - 2:15pm

Teaching Innovations

An Updated Critical/Creative Thinking Toolkit for Solving Future Issues Using Technologies That Do Not Yet Exist

Authors:

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Need: The technologist of the future will have to deal with integrating information in novel ways while trying to solve problems that are difficult to imagine. This is in large part due to the specialized nature of technological progress including nanotechnology, mobile interfaces, 3-d virtual reality systems, interlinked and integrated global communication networks. The maintenance of existing systems relies on phasing in new systems in a thoughtful way even as revolutionary new technologies are being introduced in the marketplace. In order to make effective use of these technologies and to manage change effectively technology programs need to provide students with opportunities for synthesizing information through lecture, laboratory, project or online activities.

Overview: A knowledge-based workforce requires technologists to use critical and creative thinking techniques alongside their technical knowledge and skills while designing, implementing, testing, troubleshooting or managing complex systems. Even as systems evolve the proficient technologist should be able to synthesize information effectively, reliably, and safely while solving problems. The presentation will provide information about an expanded selection of higher-order thinking techniques that can be used in for achieving these objectives. Each technique will be illustrated with an example of practice drawn from various technical settings, so that these can be easily adopted for use within a technology curriculum.

Major Points:

- Projected competencies of technologists in a knowledge-based workforce
- Identifying opportunities for students in technology programs to practice critical and creative thinking across the curriculum as part of in-class/online activities, laboratories, or projects
- Selecting appropriate critical/creative thinking techniques from an expanded, free, online thinking toolkit to supplement existing technology class planners
- Sample activities drawn from various technology-oriented disciplines that can be readily adapting while teaching a specified critical/creative thinking technique
- Separating the context within which technical skills are being taught independent of the actual thinking processes such as analysis, synthesis, and evaluation
- Emphasizing that developing higher-order thinking skills as not optional activity, rather these serve as indispensable requirement for future-proofing ones career

Summary: In addition to specialized discipline-specific skills, technologists also need to leverage creative and critical thinking techniques effectively while solving problems that occur in complex systems. The interactions, assumptions, positive, negative or unforeseen consequences need to be considered while determining or synthesizing an appropriate course of action. Attendees of the presentation will learn about new thinking techniques that can be brought to bear while solving complex problems, deploying new technologies, performing systems integration, or understanding issues deeply, using an expanded critical/creative thinking toolkit.

Thursday, November 20 - 2:30pm - 3:15pm

Teaching Innovations

Implementing an Online Business Simulation into Your Curriculum

Author:

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Need: The challenge for educators is how to design a capstone course for upcoming graduates that is a challenging activity requiring students to apply skills and knowledge from their coursework in an intensive, active learning environment. Not an easy task, but one solution is incorporating an online-based business simulation program into the capstone course.

Overview: The "Capstone" online program by Capsim (www.capsim.com) has students in charge of a multimillion-dollar company manufacturing five types of products, which are required in building various electronic devices. The web based "Capstone" program is designed to be team based, but can be done individually, as well. With the simulation being online, teams can be given the flexibility to schedule face-to-face or virtual meetings to complete and post their business decisions. The simulation includes up to eight rounds of team competition. At the end of each round, teams download a report showing their team's performance in comparison to the other teams. This 12-page report reflects profits, stock prices, market share of all products, inventory levels, etc. The online "Capstone" simulation is designed for students to:

- Apply entrepreneurship skills learned throughout their program.
- Build team-working skills.
- Create and execute a business strategic plan.
- Develop leadership skills.
- Analyze financial statements and the current business market for decisions in marketing, production, finance, and research and development. (Optional decision modules include human resources and total quality management.)

Major Points:

- "Capstone" by Capsim is an online business simulation that can be worked together in the classroom or completely online at www.capsim.com
- Challenge is to turn around a poor performing $100 million company with 5 average products
- Each "round" is about a week and is equivalent to one year in the company's life
- Decisions are made in research & development, production, marketing, finance
- End of each round students have access to a 12 page comprehensive report showing the company's performance…similar to the Wall Street Journal.
- Rehearsal Tutorial is included that shows students how to "steer the company"

Summary: Attendees will understand how to structure a fun, competitive capstone class by using an online business simulation from Capsim. This is a complex business simulation designed to teach strategy, as well as advanced business tactics to build a successful organization. Versions of Capsim are available for graduate and undergraduate courses. A live demo of the software will be included in the session.

Thursday, November 20 - 2:30pm - 3:15pm

Teaching Innovations

Tools of Engagement: Recasting Mobile Devices in the Classroom

Authors:

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Need:
To say that smartphones and tablets are popular devices among university students would be a comical understatement. Indeed, mobile technology and its pervasive affect on student life are unprecedented. Still, many university professors insist that mobile devices not be used during their classes because they feel students will be distracted. While personal technology affords access to a multitude of Internet resources, it also provides persistent connection to social media, games, entertainment, and other diversions. How can teachers keep these students engaged?

Overview:
In this presentation, we introduce recommendations to deal with the daunting challenge of engaging students distracted by personal technology. Instead of disallowing mobile devices in the classroom, we offer suggestions to leverage students' personal technology to enhance the classroom experience. We will address best practice approaches to texting during lectures, social media, academic dishonesty, and electronic communication etiquette. The presentation will be conversational and interactive, allowing audience members to contribute their own experiences and concerns.

Major Points:
- Mobile technology in a historical context
- Common issues with students using mobile devices in the classroom
- Mobile applications to engage students during lecture
- Results of a study on student perception and use of personal technology in the classroom
- Summary and recommendations

Summary:
Attendees will learn ways in which teachers can utilize student's smartphones, tablets and laptops to enhance the classroom experience. Live interactive activities will demonstrate how easy and effective these techniques can be.

Teaching Innovations

Networking Alumni with Current Students to Create Unique Internship Opportunities

Authors:

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Mrs. Laura Leach, Architect, Assistant Professor, Western Kentucky University, Bowling Green, KY 42101, 270-745-7083, laura.leach@wku.edu

Need: When seeking job opportunities in the field of architecture and construction, preference is given to those with related work experience. Many students seek experience to fulfil this preference, but find it difficult to get their first field-related job. Research, conducted by Sarah Hall at the University of Nottingham, shows the importance of alumni networks when "first entering the work force following graduation" as well as after "their careers progress"(Hall, 2011). Departmental alumni are influential sources of opportunity and leverage in the job field. Partnering alumni with current students will provide opportunities for students to travel to other states, broadening and enriching their internship experience.

Overview: This feasibility study surveyed the departmental alumni to determine their interest in creating a program that will partner current undergraduate students with alumni to assist with homestay and internship opportunities across the country. In conjunction with the results from the feasibility study, legal issues, university, college, and departmental support systems were analyzed to determine the available resources for the creation of a networking program. This program would provide the necessary resources for opportunistic students to gain their first field-related job experience, and lead them to becoming prominent professionals in their field.

Major Points:
- Alumni survey results and feedback
- University, college, and departmental support systems
- Potential legal issues
- Conclusions of research and future of the networking program

Summary: Attendees will hear the results of the feasibility study of creating a network, linking alumni and current students, and establishing opportunities for students to obtain internships across the country with the assistance of their predecessors. Data from an alumni survey; university, college, and departmental support systems; and potential legal restrictions and constrains will be used to determine feasibility of creating this type of networking program.

Teaching Innovations

Experiential Learning Through Internships

Authors:

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Need: Internships serve as a critical component of technology curricula, bridging the gap between classroom and real-world application. A robust internship program provides students with experiential learning in work settings that cannot be easily replicated in a university. However, without proper planning, internships can be relegated to the status of simple summer jobs.

Overview: Internships can provide students with valuable learning opportunities where they are simultaneously able to put the theories studied in the classroom into practical use in industry while gaining experience and becoming more employable for the future. However, this critical experience requires considerable efforts on all parties involved for success: faculty, students, and industry included. This presentation examines one successful program's internship program and how it integrates experiential and immersive learning components that differentiate its approach from many other institutions as well as how its internships are not simply summer jobs.

Major Points:
- Experiential and immersive components
- Course requirements and administration
- Integrating program goals and internship requirements
- Challenges and opportunities
- Partnering with industry
- Conclusions and recommendations

Summary: Attendees of this presentation will understand one technology program's innovative approach to its internship course. This required course provides students with immersive and experiential learning in an actual, applied setting. Perspectives of both course instructors and the program director are provided.

Thursday, November 20 - 3:45pm - 4:30pm

Teaching Innovations

Tangents as Normal Classroom Practice

Author:

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Need: In an assessment rich environment, all too often the curriculum is interpreted as a forced march toward learning objectives. Educators pride themselves on navigating a narrow pathway. However, this narrow pathway is often maintained at the expense of students' interest and engagement. Why not indulge these/ interests? Sacrificing a few moments to capture a broader spectrum of students' interest may be well worth the risk of jeopardizing a portion of today's lesson plan.

Overview: Students' interests are often the barometer of their engagement level and success. Decreeing that something is topically important or mandated by accreditation requirements, will not generate interests or revive the classroom dead, especially when introducing a new topic. Thus while Bernoulli and Pascal were decreed as being important to the study of Fluid Power, a vast majority of the class disagreed. By virtue of their behavior and relative disengagement it was evident that they strongly disagreed. Furthermore, it was equally evident that the instructor's viewpoint of what would be interesting or engaging did not align with the viewpoints of students who were 40 years his junior. Two sections of a Fluid Power course were the basis of an informal study regarding engagement. In one section, all tangential interests were indulged; in a companion section which used the same syllabus and order of coursework the lesson plans followed with a higher degree of rigidity. Based upon test scores the indulged section performed better and graded the course significantly higher on SIRS.

Majors Points:

- Tangents are not the enemy
- Tangents are often an indicator of student's interest
- Indulgence often requires a broad knowledge base, and a willingness to say I don't know or do on the spot internet
- Course objectives are not necessarily put at risk
- Students performed better and awarded the course a higher assessment score

Summary: Attendees will embrace tangents as a means to generate and maintain student interests. They will understand are not necessarily the hallmark of inferior pedagogy.

Thursday, November 20 - 3:45pm - 4:30pm

Teaching Innovations

Incorporating Lean in Engineering Technology Undergraduate Curriculum

Authors:

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Need: With global economy and unprecedented competition, in the past two decades lean manufacturing techniques have gained popularity among businesses in the United States and worldwide. Even though in the mid 90's mostly manufacturing companies were the ones embracing lean, in the past decade its popularity has out grown to other sectors such as government, healthcare, education etc. The researchers have found in a study conducted by them that knowledge of lean principles and techniques has been one of the most required skills demanded by employers while hiring four year graduates in engineering in 2013. Employers could see a new hire with lean background adding value to their organization quickly. Therefore it is imperative that students from engineering technology program have gained lean skills when they graduate.

Overview: This presentation will focus on the details of a Lean Enterprise Methods course that Engineering Technology and Management Department at Ohio University offers for their undergraduate students. The presenters will discuss and narrate course contents as well as class projects that solved real world problems.

Major Points:
- Introduction to Lean
- Skills employers want
- Lean Enterprise Methods course development
- Course Syllabi
- Hands on class project and examples
- Conclusion

Summary: The presentation attendees could gain knowledge of a framework that could be adopted to develop a lean manufacturing undergraduate course that suites engineering technology type programs.

Teaching Innovations

Marketing Students to Industry: Much More than a Field Trip

Authors:

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Need: Faculty want to know how to interest industry in their students, how to interest industry in their programs, how to develop soft skills in their students, and how to develop industry support for activities

Overview: Motorsports students exhibited at the Performance Racing Industry Trade Show in 2013. This prestigious annual event attracts thousands of motorsport industry participants from around the globe. Fifteen students contributed significantly to the planning processes. The students developed promotional materials, timelines, and detailed schedules for the show specifically targeting the specified programs. Due to the event occurring during finals week, only ten of the fifteen students were able to participate in the set-up, work the booth, interact with industry professionals, and walk the trade show. These students actively enhanced their motorsports connections pertaining to their particular majors. This presentation will detail the processes used to secure funding and resources necessary to develop a quality exhibit. The student selection process and education/training for the students will also be detailed.

Key Points:
- Event planning and marketing
- Set-up, display, and tear-down
- Contacts: prospective students, alumni, industry partners
- The follow-up

Summary: Students in the motorsports management minor, with majors from across campus, planned and exhibited at the PRI Show in December 2013. These students were the "face" of the university as they marketed the university, the motorsports management minor, the automotive engineering technology major and their racing enterprise, Team Sycamore Racing. Sharing the plan and outcomes should help other faculty with similar project ideas.

Thursday, November 20 - 3:45pm - 4:30pm

Teaching Innovations

Bridging the Gap Between the Classroom and Industry: Review of Best Practices with Undergraduate Research and Senior Design

Authors:

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Need: Undergraduate research and Sr. design capstone projects have become a critical part of engineering curriculum. These learning opportunities can come in many forms such as independent projects, departmental industry sponsored projects, or university sponsored projects. There are many challenges that present themselves to all stakeholders (sponsors, students, and faculty) involved with theses project.

Overview: This presentation will detail lessons learned in all three types of projects (noted above) as well as offering an example template for project evaluation. This presentation will offer the audience a detailed overview of one institution's current practices regarding undergraduate research and Sr. design capstone projects by examining current practices and preventative strategies that help to ensure a positive experience for all stakeholders along with approaches for project evaluation.

Major Points:

- Need for undergraduate research and senior design projects within engineering curriculum.
- Review of existing literature regarding experiential learning as it relates to undergraduate research and senior design projects.
- Review of best practices and lessons learned.
- Types of project sponsors and expectations.
- Value of the project to all stakeholders.

Summary: Join us for an information session on how one engineering technology program tackled the challenges of making the undergraduate research and senior design capstone projects a meaningful and valued experience for all stakeholders involved. This presentation will also share tips and offer examples on project evaluations.

Thursday, November 20 - 4:45pm - 5:30pm

Teaching Innovations

Being Innovative when Incorporating Experiential Learning in the University Classroom

Authors:

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Need: There are instances when university students struggle to understand information and/or procedures in a classroom setting. University faculty need to learn about innovative ways that experiential learning can assist students in understanding complex material. Faculty may be unaware of ways to incorporate experiential learning in the university classroom. Common forms of experiential learning may also not be commonly understood.

Overview: During this presentation, conference attendees will be introduced to experiential learning and how it can benefit students in the university classroom. Common forms of experiential learning will be discussed. Strategies to implement a multitude of different types of experiential learning in the classroom will be presented. Conference attendees will learn about issues that may be encountered when using experiential learning, and they will learn how to overcome those issues.

Major Points:

- Introduction to experiential learning in the university classroom
- Common forms of experiential learning
- Strategies for implementing experiential learning
- Issues that are often encountered with experiential learning
- Overcoming problems with experiential learning

Summary: Conference attendees will leave the presentation with an understanding of experiential learning in the university classroom. The conference attendees will learn about common forms of experiential learning. Those who attend the presentation will be prepared to go back to their university classrooms and implement experiential learning. Attendees will also be better prepared to overcome problems with experiential learning.

Thursday, November 20 - 4:45pm - 5:30pm

Teaching Innovations

Computer-Based Automotive Scan Tools as Laboratory Instruments

Author:

Dr. Phillip Cochrane, Indiana State University, Terre Haute, IN 47809, 812-237-3978, phil.cochrane@indstate.edu

Need: One difficulty in trying to form student based automotive project teams is attracting students from other disciplines, particularly from the electronic and electrical disciplines. Although there would seem to be a natural gravitation between automotive electronics, with its computers, networking, and sensor suites, and electronics/computer (EEC) majors, it very seldom occurs. This is to the detriment of the team's understanding and application of advanced EEC topics/technologies which don't fall with the normal range of an automotive or mechanical curriculum. The problem may be a more a question of environment sensitivity as opposed to interest in the technology.

Overview: One of challenges of a recent project was bringing the electronics/computer (EEC) majors on board. Used to working in a comparatively antiseptic electronic lab environment devoid of the noises, vibrations, and smells associated with automotive engine dynamometer testing, EEC students were very reluctant to engage the engine testing at any level. This created a huge scheduling and communication problems, which still persists albeit of a lesser degree. The proposed solution to the problem is the use of computer based scan tools to access engine computer functions. Scans tools are generally used by service technicians to access various vehicle computer and data functions. However, many companies offer scan tool software, which can easily be uploaded into mobile devices. The hypothesis is that these students can be gradually brought into the full testing environment by first observing engine and computer operations, using scan tool software, in the comfort of a familiar less intimidating environment. Mobile devices with the scan tool software can form the basis for many interdisciplinary laboratories

Majors Points:

- The nature of some laboratory operations can be intimidating to students
- There may be a need to bring students along slowly
- Scan tool software can provide a bridge for students trying to acclimate to an automotive environment
- Scan tool software is relatively inexpensive and has the potential for being strong laboratory tool

Summary: Attendees will understand that the very nature of the environment often inhibits participation by other majors in automotive based projects. Mobile device scan tools may offer a solution.

Thursday, November 20 - 4:45pm - 5:30pm

Teaching Innovations

Designing Curriculum Involving Industry Participation: Positive Outcome on Students Learning and Development

Authors:

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Need: With more than ever increasing competition among student to seek meaningful jobs, it's essential for course to address the industry needs. For students to stay ahead in the competitive climate they need to learn Lean Principles' concepts in classroom but it's important for them to understand the way it's applied in manufacturing or service industry. The best way to achieve the students understanding of industry is to actively involve student and industry participation. This participation helps student understand the relevance of classroom education and ways it can be translated when they enter the real-world. It has been noted that students who participate in industry interactions earlier in their career have better job performance after graduation.

Overview: For professors to disseminate useful concepts and information to students in the classroom active industry engagement is essential. It was observed in Introduction to Lean Manufacturing class that students who participated in industry-based project enjoyed the course more, and ended up finding a summer internship with the industry. We have identified three important objectives for bridging the academic and professional communities: Balancing student learning goals and industry requirements, collaborative learning, and developing industry-university partnerships.

Major Points:

- Discuss the ways for designing curriculum to actively have opportunity to involve industry
- Describe the issues faced by students prior to industry based learning
- Explain the ways for professor to seek industry collaboration
- Highlight the student's perception of industry based learning
- Explain the challenges and outcomes of the industry based learning
- Demonstrate the role of industry based engagement in positive learning outcome

Summary: The audience will learn to recognize the influence of industry-university partnership in students learning. Furthermore they will become aware of ways to revise their existing curriculum to make it more suitable for industry needs and ways in letting students participate in industry based final project for the class or inviting guest speakers to bring their industry expertise in classroom.

Teaching Innovations

Developing Employable Information Security Workforce Knowledge Skills and Abilities

Author:

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Need: There is a real need for professionals in the field of information security. Colleges and universities have developed programs to provide for this need. Students also need the correct mix of knowledge, skills and abilities so that they can advance in their careers, rather than just fill immediate, entry level gaps. Designing a curriculum to fulfill student needs as well as industry needs requires the addition of elements that enable student success in their career endeavors.

Overview: The development of a curriculum takes significant resources, as do changes, hence, once done they tend to remain fairly static. This presents challenges in the information security field, one where the field is still evolving and change is the theme of the day. In developing the Knowledge Unit (KU) based curricula model, the NSA has created a plug and play model that enables differentiation and control at a sub-class level. This paper will examine the use of the KUs in creating a curriculum that develops the correct set of knowledge, skills and abilities in students to begin careers in information security. The paper will also address the critical success elements needed to achieve a career. The 10,000 hour experience requirement, the complementary skills needed, and the critical thinking skills needed for success will be addressed. The KU based system enables the mapping of curricula elements to the knowledge, skills and abilities and the pathway to student success. The presentation will show how to connect the dots between recent Federal government cybersecurity initiatives, including the National Initiative for Cybersecurity Education (NICE).

Major Points:

- How to utilize KU based curriculum elements to enhance your own curriculum and enable flexibility.
- How to model programs to create career value for students and employers
- Examine Federal initiatives that provide useful resources
- Careers take more than training, 10,000 hours more, and critical thinking

Summary: This paper presents an alternative to the standard class centric curriculum that limits the change needed in many programs. At the conclusion of the paper, attendees will see how they can use these elements to enhance their own curricula. This paper is part detail on the pieces, part how to, and part sample road map for those wishing to move their information security program into the present and the future.

Friday, November 21 - 8:00am - 8:45am

Teaching Innovations

Teaching Product Design and Development Using STEAM Principles in a Drafting/CAD Program

Author:

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Need: Design and manufacturing in many industries is moving towards solids modelling and digital manufacturing. Educators are tailoring their courses to accommodate these changes. Educators are also finding the benefits of infusing more science, technology, engineering, art, and math (STEAM) into their courses to prepare students for technical problems they will encounter in work situations. I will present a project-based course in which the solid-body electric guitar is used to touch on all of the components of STEAM and excite student's interests as well.

Overview: If students are taught the principles of design and manufacturing using projects that the find exciting, it will lead to a better understanding of the material and a higher completion rate for the course. There are few college level students (male or female) who do not find an electric guitar to be an enticing object to craft. This object also provides ample opportunity to develop the students understanding of complex CAD/CAM processes. At the same time, integration of STEAM principles comes easily and is readily understood through this process. This class also serves as a capstone course for the program that encourages students to become proficient at the prerequisite classes, so that they can pursue a more complicated design.

Major Points:
- Integration of Design into Computer Aided Drafting (CAD) courses
- Full development and correct dimensioning in CAD program
- Computer Aided Manufacturing in the production process
- Integration of STEAM principles in prototype production
- Prototype project documentation

Summary: Attendees will understand how the solid-body electric guitar project can be used in a CAD program to teach CAD/CAM, teach STEAM principles, and encourage higher participation in your program.

Teaching Innovations

Teaching Sustainability in an Engineering Graphics and Design Technology Program

Author:

Dr. Mehmet Emre Bahadir, Murray State University, Murray, KY 42071, 270-809-3293, mbahadir@murraystate.edu

Need: Everyday our ecological footprint on earth is increasing. Maintaining a continuously improving or at least a stable standard of living with the current population growth and consumption of natural resources is not possible unless sustainable approaches are adopted by government and private businesses. In these circumstances, teaching sustainability to the next generation of administrators, engineers and technicians is becoming more vital. Concepts, principals, and terminology of sustainability, evaluation of sustainability, common practices and methods in manufacturing and design should be incorporated into technology courses.

Overview: Manufacturing processes and strategies have been continuously improving for higher productivity and profitability. Today, being productive and profitable is not enough to be competitive at the global level. A sustainable approach integrating productivity, profitability, and environmental, social and financial sustainability is required. Increased consumer awareness about environmental issues is redefining the goals of modern manufacturing. Fundamental changes in engineering, manufacturing, and design activities require parallel changes in education. In certain disciplines such as, civil engineering, chemical engineering and environmental engineering, sustainability issues have been addresses by proper curriculum changes. However, design activities, starting at the very early stages of product development and production, have significant impact on the sustainability of products and production processes. Integration of sustainability concepts, tools, and practices into appropriate technology courses is essential.

Major Points:

- Teaching sustainability
- Sustainable materials, sustainable manufacturing, sustainable design
- Life Cycle Assessment and Eco-efficiency measurement tools in education

Summary: Proposed presentation will demonstrate how sustainability concepts, tools and practices can be incorporated into selected technology courses. The impact on the students will be presented as well.

Friday, November 21 - 8:00am - 8:20am

Teaching Innovations

The STEM Cycle Challenges

Authors:

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Co Authors: Mr. Steve Garrett, Director, EVChallenge, 415.710.1566, info@evchallengekids.org; Ricky Lewis, Advisor/Instructor of Advance Alternative Vehicles, James Dudley High School, Greensboro, NC, 336.392.6422, ricky58lewis@gmail.com

Need: Many of today's challenge competitions are one dimensional. One event, resulting in an artifact that may never be used again. The STEM (Science, Technology, Engineering Math) Cycle (vehicle- parts used over and over again) Challenges (25 already identified) has many challenges and a modular adult erector set to develop the competitor's designs.

Overview: STEM Cycle Kit (Modular, student built and competitive) "The objective here is not to have an artifact, but a kit of possibilities!!!! Integrate, Innovate, Invent, Create! " (The kit is just a beginning. Over a period of competitions an array of additional components can be fabricated and added; wheels and tires, steering geometries, pedal power, solar power, floats, multiple motors; expanding opportunities.) This presentation will be an overview of a STEM Cycle workshop.

Major points:

- The prototypes will be built and tested at North Carolina Center for Automotive Research and at the FREEDM Project at NC State University, Graduate Mechanical Engineering at Duke University and the Sustainable Transportation Club at Appalachian State University.
- The Workshops will be beta tested by the Triad Electric Vehicle Association at Appalachian State University, Alamance Community College, Cape Fear Community College and the National Alternative Fuel Training Center at West Virginia University.
- The Light Electric Vehicle Association will then offer the STEM Cycle Challenges workshop at their shows.
- We will offer kits, upgrades and consultation and event organization.
- As we progress through the steps we will video document and prepare training and update the website.
- We will then take the STEM Cycle Challenges on the road to interested communities and help them build their own.

Summary: Attendees will learn how the STEM Cycle Challenges are developed and how vehicles are designed, built and competed.
http://www.youtube.com/watch?v=6o9Oj_XUXjQ

Friday, November 21 - 9:00am - 9:45am

Teaching Innovations

Using a Student Term Project to Teach Work Design, Process Design, and Facilities Layout

Author:

Dr. Darren Olson, MSET Program Coordinator, Department of Industrial & Engineering Technology, Central Washington University, Ellensburg, WA 98926, (509) 963-1913, lsondar@cwu.edu

Need: Attendees will learn about a comprehensive plant layout project that helps students to learn work design and facilities design principles through application to a realistic scenario. They will also be invited to share their own insights on this topic and about this project. Attendees will be free to obtain and adapt the presenter's materials to their own courses, as desired.

Overview: This presentation will be focused on the use of a term project in a Work Design and Facilities Layout course. The project presents students with a scenario and they must each design a production facility to manufacture a group of products. They are provided with design information for a family of related products, along with data about required manufacturing and assembly operations, standard times, product demand levels, required types of machinery and equipment, etc. Each student is assigned a unique subset of the product family and is required to configure and balance the assembly lines as well as design some workstations. They are required to design the layout of the process-centered and product-centered portions of the facility, along with the front offices and operations support areas, and to incorporate these into a complete facilities layout plan. Finally, they are required to design a plot plan for the factory site.

Major Points
- Overview of the class and its learner outcomes
- Overview of the student term project
- How the project provides context for student learning
- How students are guided throughout the process
- Examples of student work

Summary: This presentation will demonstrate how students can learn to apply work design and facilities layout principles via completion of a comprehensive facilities design project. Examples of student work will be provided.

Friday, November 21 - 9:00am - 9:45am

Teaching Innovations

Teaching Our Future Students Engineering Design

Authors:

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Dr. David Wanless, Michigan Technological University, Houghton, MI. 906-487-3656, ddwanles@mtu.edu

Need: Introductory Engineering Design courses are challenged with a great deal of foundational material to cover over the course of the first semester. These courses are reflective of the needs voiced by industry and the academic program itself. It is often times difficult to successfully focus on introducing students to modeling with CAD software, developing an understanding of the engineering design process, group design projects and the practice of transferable skills within a single semester course.

Overview: In our presentation, we will present how we flipped the introductory engineering design course curriculum model, with the incorporation of emerging classroom technology, allowing the foundational content to be presented outside of the classroom. The results permitted us the ability to devote class time to in-depth topic discussions, assessment of foundational content understanding, group studies/presentations and more one-on-one interactions between the instructor and students. It also allowed for classroom technology and student devices to have a place in the learning process.

Major Points:

- Need for students to have a stronger foundational understanding of the engineering design process
- Incorporating more transferable skill sets into the curriculum (advisory board)
- The integration of classroom technology and student devices as learning tools.
- Engage the student in a more active role of learning.

Summary: A presentation on the successes and struggles of flipping an Engineering Design course curriculum. The challenges of restructuring the course to meet industry and academic needs while helping students to better understand the foundational segments to the engineering design process will be discussed.

Teaching Innovations

Designing for New Material Technologies: Investigating Corian® as an Exterior Cladding Material

Author:

Dr. Andrew Phillip Payne, Indiana State University, Department of Built Environment, Terre Haute, IN 47809 812-237-3267, andrew.payne@indstate.edu

Need: Designing by trial-and-error can be a successful process only when supported by in-depth investigations into users, use, and context. In this comprehensive architecture studio setting students were asked to conceive, develop, and design a creative workspace for artists. Therefore, using current technologies to expose the creative possibilities of an everyday material enriches the educational experience.

Overview: A focus of this design problem was incorporating DuPont™ Corian® solid surface as an exterior cladding or interior finish beyond the typical kitchen countertop and bath surround. Opportunities to incorporate various manufacturing, customization, and installation technologies were endless. Students were encouraged and assisted in exploring CNC routing, laser cutting and etching, hand carving and milling, and countless panel fastening systems. An additional goal of this course was to develop synthesized design theory and practical architectural solutions including technical considerations of materials for detailing. In doing so the studio required the students to respond to an actual client in the form of representatives from C.H. Briggs Company of Pennsylvania and a group of manufacturing engineers from DuPont™.

Major Points:
- Technology can be enhanced by innovative materials and their creative use
- Academic exercises must convey professional settings and outcomes
- High-tech and Low-tech methods can enhance hands-on learning

Summary: Attendees will see examples of high-tech and low-tech methods of manipulating Corian® solid surface as completed in an architectural design studio. The combination of a well advanced construction material and endless opportunities to explore creative uses is demonstrated in the design solutions.

Teaching Innovations

Teaching from the Cloud: Using Zero Cost Technology as a Learning Management System, Research, and Writing Tool and Overall Educational Platform for Tomorrow's Workforce

Author:

Dr. Brian H. Stone, Engineering Technology, Western Illinois University, Macomb, Il 61455, 309-255-8776, b-stone@wiu.edu

Need: To educate students and instructors on the dynamics of a free cloud-based business application as a Learning Management System within the realm of teaching, conducting research and writing.

Overview: As today's student population prepares to become the future workforce, several elements of technology have affected their methods of learning. They have become accustomed to accessing more of their learning and education via web-page sources as compared to past generations who learned in classrooms and from printed text. The access sources have changed from paper page to monitor to pad screen to smart phone; all of which are capable of viewing the same material while being mobile. Additionally, they become increasingly accustomed to managing their music, photos, journals, friendships and other various aspects of their lives through an array of cloud-based database management systems that are increasingly being offered without cost. With such trends in the public's use of technology, classroom instructors face the challenge of utilizing such avenues for teaching, as they are both available and affordable. The use of Learning Management Systems (LMS), are a common trend among schools and universities that allow for transactions to occur more efficiently, via cloud-base software packages, between instructors and students. Large LMS software packages such as Blackboard, Desire2learn, or Edmodo, though beneficial in facilitating the instructor/student relationship, require huge investments of funds, training and other resources in order to justify their cost. Additionally, these systems have a tendency to be rigid in their capabilities, underutilized, unreliable during high-traffic periods and lacking in simplicity and standards of format. If one were to try to design a more ideal cloud-based system for managing classrooms, it would be necessary to address the issues of cost, simplicity, speed, reliability, compatibility and standardization of formatting. This presentation proposal would attempt to demonstrate the empirical uses of one such cloud-based software package, Google Apps, in its use of course management and teaching, research data collection and writing.

Major Points:

- Upcoming student generation can be considered mature in its understanding and use of "free" cloud-based management
- For educators, existing cloud-based classroom management systems are useful, yet have setbacks in such areas high cost, high resource commitment, reliability, format complexity and standardization
- An empirical real-time overview of how Google Apps, a free cloud-based data management system which is used by several million companies in industry, is currently being used as a Learning Management System at a University level

Summary: As cloud-based technology become increasingly commonplace and affordable to students and industry, the challenge of the educator lies in gaining mastery of its application and successful teaching of its components. This presentation attempts to demonstrate an example where the industrial use of such technology can be linked with the learning environment of a classroom management and student-instructor transactions.

Friday, November 21 - 10:15am - 11:00am

Teaching Innovations

Cooperative Interactive Exercises for an Applied Process Improvement Course

Authors:

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Dr. Jess Godbey, Jacksonville State University, Associate Professor, (256) 782-5080, jgodbey@jsu.edu

Need: Effective process improvement strategies are critical to the continued success of any organization. Advanced applications of six sigma methodology become complex and students may struggle without a strong working knowledge of basic principles. Many university courses are still taught using the traditional lecture methodology. Interactive exercises can be used to enhance the instructor's lecture and help strengthen the students' competence in these areas.

Overview: This presentation provides participants with descriptions of several simple, inexpensive active-learning exercises that can be used to effectively convey concepts fundamental to process improvement. Most of the hands-on exercises are conducted by teams of students which provide an opportunity for cooperative learning. Many of these exercises encourage student discussion of course topics and sharing ideas on their relevance to real-world application. In addition, most of the exercises allow the instructor to assess the level of student comprehension and provide immediate feedback to students.

Major Points:
- Need for active learning exercises
- Understanding variation as it relates to six sigma
- Design of Experiment Exercises with Minitab
- Control Chart exercise

Summary: Participants will leave this presentation with examples of simple, interactive exercises that may be used to illustrate basic process improvement concepts and enhance student learning.

Teaching Innovations

The Optimal Tool for Multimedia Instruction

Author:

Mr. Rustin Webster (PhD candidate), Intuitive Research and Technology Corporation, Huntsville, AL 35805, 309-253-1512, rustin.webster@irtc-hq.com

Need: The digital fluency of students has never been higher. Their daily lives are filled with screens pushing vast amounts of video and audio to the user. As teaching institutions continue to make strides away from the chalk and talk form of instruction they may be missing the latest sensory enticing technologies. Instructor-led lectures with digital presentations can be effective but are they the optimal form of multimedia instruction? Do they optimally entertain and engage students while offering high levels of interaction and immersion?

Overview: Details and results from a research study, which compared routine classroom instructor-led training and immersive Virtual Learning Environments (VLE) training in terms of declarative knowledge acquisition will be presented. The success of this project has led to the investigation of various other commercially available interactive visualization tools for educational purposes, specifically the Oculus Rift® by Oculus VR® and Leap Motion®. Finally, there will be information delivered on the implementation of a low-cost gesture controlled device for computer aided design (CAD) and Science, Technology, Engineering, and Mathematics (STEM) education, specifically in secondary school chemistry, mathematics, and physics courses.

Major Points:
- The latest interactive visualization tools for educational purposes
- Details on recent research studies in search of the optimal form of multimedia instruction
- Alternatives to Death by PowerPoint®
- Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and gesture/motion control

Summary: Attendees will be made aware of alternative forms of multimedia instruction for the classroom. The presentation will provide knowledge on the latest low-cost and commercially available interactive visualization tools and hopefully ease their fears of introducing some into their current curriculum. Finally, tips and lessons learned through various projects will be discussed.

Teaching Innovations

Using Automation Studio to Expand Face-to-Face Laboratory Facilities and to Construct an Online Classroom

Authors:

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Need: There is a growing need in education to do more with the same or less resources. To undertake this relies on the faculty being more and more creative. Lecture courses can just have the number of students enrolled increased. The problem comes down to the lab classes. This paper will look at two possibilities that we are exploring at Mississippi State University through the use of Automation Studio.

Overview: The industrial technology faculty at Mississippi State University have been conducting a yearlong evaluation of Automation Studio software. This endeavor was to see if the software has the capability to be used not just as a teaching aid, but for expanding our current laboratory facilities. This would become a virtual laboratory with the final intent at offering some laboratory classes completely online using an Automation Studio virtual lab.

Major Points:
- Overview of Automation Studio
- Using Automation Studio as a teaching aid
- Student laboratories using Automation Studio
- Student experiences using Automation Studio
- Faculty experiences and hopes for Automation Studio

Summary: Attendees will be shown that simulation software is getting to a point where it can be incorporated not only as a supplemental piece of teaching equipment but as a whole teaching facility.

Friday, November 21 - 10:15am - 11:00am

Teaching Innovations

Computer-Based Automotive Scan Tools as Laboratory Instruments

Author:

Dr. Phillip Cochrane, Indiana State University, Terre Haute, IN 47809, 812-237-3978, phil.cochrane@indstate.edu

Need: One difficulty in trying to form student based automotive project teams is attracting students from other disciplines, particularly from the electronic and electrical disciplines. Although there would seem to be a natural gravitation between automotive electronics, with its computers, networking, and sensor suites, and electronics/computer (EEC) majors, it very seldom occurs. This is to the detriment of the team's understanding and application of advanced EEC topics/technologies which don't fall with the normal range of an automotive or mechanical curriculum. The problem may be a more a question of environment sensitivity as opposed to interest in the technology.

Overview: One of challenges of a recent project was bringing the electronics/computer (EEC) majors on board. Used to working in a comparatively antiseptic electronic lab environment devoid of the noises, vibrations, and smells associated with automotive engine dynamometer testing, EEC students were very reluctant to engage the engine testing at any level. This created a huge scheduling and communication problems, which still persists albeit of a lesser degree. The proposed solution to the problem is the use of computer based scan tools to access engine computer functions. Scans tools are generally used by service technicians to access various vehicle computer and data functions. However, many companies offer scan tool software, which can easily be uploaded into mobile devices. The hypothesis is that these students can be gradually brought into the full testing environment by first observing engine and computer operations, using scan tool software, in the comfort of a familiar less intimidating environment. Mobile devices with the scan tool software can form the basis for many interdisciplinary laboratories.

Majors Points:

- The nature of some laboratory operations can be intimidating to students
- There may be a need to bring students along slowly
- Scan tool software can provide a bridge for students trying to acclimate to an automotive environment
- Scan tool software is relatively inexpensive and has the potential for being strong laboratory tool

Summary: Attendees will understand that the very nature of the environment often inhibits participation by other majors in automotive based projects. Mobile device scan tools may offer a solution.

Friday, November 21 - 11:15am - 12:00pm

Teaching Innovations

Putting a Cap on Technology Leadership

Authors:

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Need: One of the strategic needs identified by US industry for college graduates is leadership. Two years ago, a program of general leadership in a College of Technology initiated a program transformation to Technology Leadership, to better prepare graduates for leadership positions in technology rich organizations. We found that leaders must possess a broad base of technological knowledge; its processes, products, and implications, as well as the leadership skills necessary to be able to influence change and motivate others. We designed these "necessaries" into our Technology Leadership program. To tie all this together, we designed a "capstone focus" experience for our students.

Overview: This session will discuss the development of the Technology Leadership capstone focus experience in the Technology Leadership and Innovation Department. In our newly redesigned plan of study, four course Technology Focus sequences will provide each student with depth of technological knowledge. Students will have a number of Technology Focus options to choose from, including computer graphics, biometrics, computing systems, engineering technology, advanced manufacturing and electrical engineering technology. The rationale and characteristics of these options will be presented. The intent is to provide a technology consulting experience for each student. The students will be assigned to groups and will then engage in a challenge project to enable integration of each student's technological expertise, while exploring the impact of their leadership skills on goal achievement, both individually and in their group.

Major Points:

- The transformation of a leadership program to a technology leadership focus
- Identification and Integration of Technology Focus sequences into the program design
- Details about the various Tech Focus options
- Integration of leadership and technology utilizing an immersive methodology

Summary: Attendees will learn about the development of a capstone approach in a Technology Leadership program, from idea to fruition. Details of the program, the integration of the capstone into the program design, down to the outcomes and objectives of the capstone course will be presented.

Teaching Innovations

Course and Laboratory Development on Structural Health Monitoring

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Need: Structural health monitoring (SHM) is a technical inspection to monitor the integrity of a structure in a continuous and autonomous way during its operation. SHM technologies are expected to lead to improve structural safety, extend the service life of structures, and reduce maintenance costs. There is an imperative need to integrate emerging technologies into the existing curriculum in a timely manner. We need to develop an effective method for teaching engineering and technology students how SHM systems are implemented.

Overview: Four course modules have been developed to expose undergraduate students to sensors, actuators, data acquisition, and data analysis techniques for monitoring of the health of structural systems. In the system, a piezoelectric actuator is used to excite the guided Lamb waves in the structure. The response of the structure is monitored by piezoelectric sensors. Information about the structural health condition is extracted from the analysis of the responses processed using wavelet analysis. The course modules balance theory and application, classroom lectures, and laboratory experiments. These modules are designed to introduce SHM concepts to undergraduate students. Students can learn to use hardware, software, and instrumentation in the context of real world applications. After taking the class, students can participate in research activities which provide a forum for faculty to mentor and teach undergraduates outside the classroom.

Major Points:

- Help students understand SHM and its application.
- Strengthen students' knowledge of and attitude toward engineering and technology.
- Strengthen students' general foundation in the sensors, actuators, piezoelectricity, data acquisition, signal analysis, and vibration control areas.

Summary: Structural health monitoring is a multidisciplinary field. Four course modules (Piezoelectric Materials, Data Acquisition, Guided Lamb Waves, and Wavelet Analysis) have been developed for introduction of SHM technologies to undergraduate students. The presentation will also address the laboratory equipment setup.

Friday, November 21 - 2:00pm - 2:45pm

Teaching Innovations

Social Media Video Collaboration Utilizing Wireless Camera Tethering to Support Active Learning in Photography Instruction

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Need: The advent of digital imaging and dslr cameras in photography education introduced instructional challenges to demonstrate, and actively involve students, in learning camera controls and imaging concepts. Based on previous experimentation with tethered cameras in the classroom, the authors perceived a need for an innovative way to document the positive results of the tethering process and to apply that record for (a) student learning as an online resource, (b) as a means of promoting the program and to strengthen recruitment, and (c) as documentation to administrators and grant sponsors of the positive results of this collaboration.

Overview: Tethering is a technique to connect a camera to a computer or tablet to display the image so the results can be quickly and clearly seen on a larger screen. A freshman course utilizing this technique has produced positive results to encourage active learning by student engagement. A video collaboration project will be conducted documenting student learning through tethered capture for utilization through university web links, by prompting the program in social media, and presentation to academic communities.

Major Points

- Tethering uses a cable connecting the camera to a device to project an interactive real-time visualization of photography's technical concepts of focal length, aperture, ISO, focus, depth-of-field, shutter speed, color balance, and lighting. The interaction of the controls for these factors is often baffling for beginning photographers. Live-view tethering instantly presented complex interactions in a form that is complete and easier to learn.
- Wireless tethering in the classroom provides an interactive learning experience. Faculty members believe current and future students can use a well-produced video documentation of this active learning experience to enhance continued educational experiences. This same video resource can be shared through university web links and social media for program validation and student recruitment.
- This educational documentary video production is a collaboration of several members of the photography faculty in filming, editing and presentation. It draws on the latest imaging and communication technology using iPads/tablets, wireless mobile connections, digital capture cameras, and group shared photographic experiences both in the classroom and on actual location shooting exercises.

Summary: Hands-on real-time visual confirmation of photographic concepts can provide a powerful force for active learning. Moreover, documenting this process through video imagery can provide an innovative student learning resource, as documentation to validate program relevance; to attract new students already acclimated to this technology, and to inform administrators and sponsors of the worth of these endeavors.

Friday, November 21 - 2:00pm - 2:45pm

Teaching Innovations

A Cultural Approach to Plagiarism Training

Authors:

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Need: Despite access to APA manuals, online resources, and class instruction, students continue to struggle with properly paraphrasing and citing sources in their graduate work. Students especially have trouble in their first semester, as they acclimate to the expectations of graduate faculty.

Overview: Research indicates nearly all students view plagiarism negatively, yet plagiarism continues to be a problem in students' writing. Cultural training explaining the plagiarism views of U.S. higher learning institutions may help bridge this gap. Students in the UCM SOT Graduate Programs will have the opportunity to receive APA training that includes a cultural component explaining how the university's cultural view on plagiarism differs from other cultures, such as the Facebook culture and universities in other countries. Students who complete the training will understand how plagiarism is perceived in the U.S. and be aware of the cultural implications of plagiarizing. Once students understand the damaging effects of plagiarism, plagiarism occurrences should reduce.

Major Points:
- Plagiarism issues in graduate student work, especially first assignments
- Current how-to approach is not effective
- Faculty and students need to understand the fundamental, cultural beliefs on plagiarism
- Quantitative and qualitative data on effectiveness of cultural training
- Course changes, conclusions, recommendations

Summary: Attendees will understand the U.S. university cultural beliefs on plagiarism and how this belief differs from other U.S. and foreign cultures. Attendees will also see an example of cultural training and how it affected the performance of graduate students. Industry has long touted the importance of cultural training before entering a strange environment. Our students are entering graduate school (a strange place, indeed) without such training. Supplementing our how-to instruction to APA guidelines with cultural instruction may be the solution to repeated plagiarism issues.

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EECT Automation

Design of a Programmable SAW Correlator Using Binary Phase Shift Key Encryption for Wireless Network Security

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Abstract

A Programmable Surface Acoustic Wave (PSAW) correlator pair using Binary Phase Shift Key (BPSK) modulation and an 11-bit Barker code sequence is proposed to increase the security levels of wirelessly transmitted network data in the 2.45 GHz WiFi frequency band. Due to the unique properties of SAW correlator's interdigital transducer (IDT) fingers, their orientation, and the alternating polarity between sets of IDT fingers, they are well suited for BPSK encoding applications. This encryption is made possible with the use of well-matched PSAW correlator pairs that encode RF burst signals to produce a high auto-correlation vs. cross-correlation signal. This encrypted signal is then decoded by passing it through a reverse coded PSAW correlator to remove the modulation encryption, leaving the original data signal. The critical parameters of the author's proposed design are presented, including the piezoelectric substrate material selection, relevant equations for critical parameter, and the final proposed design.

Introduction

IEEE 802.11 Security Issues

Amid the exponential growth of WiFi, it has become increasingly apparent that security levels have lagged behind transmission speeds and connectivity (Ramakrishna & Ravi, 2011). Even in spite of the rapid growth of this technology, there are growing concerns about how secure data really is when transferred over a WiFi network. A common concern is the prevalence of rogue access points (APs), which present themselves as trusted routers but in reality snoop the transmitted data in an attempt to obtain sensitive information (i.e. usernames, passwords, personal information). These rogue APs are hard to patrol and pose real security concerns for WiFi users (Park & Kim, 2013). Therefore, stronger data encryption techniques are needed that keep pace with the growth of this technology and the increasing prevalence of security attacks from rogue APs.

Purposed Solution to IEEE 802.11 Security Issues

This paper proposes the use of a Programmable Surface Acoustic Wave (PSAW) correlator with Binary Phase Shift Key (BPSK) encoding to increase the security levels of wirelessly transmitted network data in the 2.45 GHz WiFi frequency band. Similar work by NASA has been completed in which a PSAW was used for low-power communication links between ground and space transceivers (Elkordy, Elsherbini, & Gomaa, 2013). Additionally, Gallagher, Malocha, Puccio, and Saldanha (2008) have completed research using SAW correlators in wireless spread-spectrum and RFID applications to increase date rates and increase code encryption diversity. Also, a patent filed by Edmonson and Campbell (2012), has proposed the use passive SAW correlators for wireless communications in the 2.45 GHz Bluetooth spectrum. It is clear therefore that the author's proposed design is consistent with current work related to wireless network security.

Overview of Surface Acoustic Waves and SAW Correlators

Surface acoustic waves are produced by means of the electrometrical conversion process of a special type of transducer. This transducer, called a SAW transducer, converts electrical waves to mechanical surface acoustic waves by stimulating interdigital transducers (IDTs) etched onto a piezoelectric substrate with electrical radio frequency (RF) signals, as depicted by Figure 1. The IDTs are thin film metal electrodes, with a frequency dependent width ranging from a few micrometers to a few hundred nanometers. The IDTs act like antennas, launching the electrical signals onto the piezoelectric substrate between the IDTs. These launched signals are then converted into mechanical surface acoustic waves that propagate across the substrate and back onto the IDTs where they are converted back to electrical signals. ST Quartz is commonly used as the piezoelectric substrate because of its relatively slow acoustic wave velocity (~3,158 m/s), which enables the SAW device to produce large delays in the electrical to mechanical signal conversion process. These delays enable encoding of RF electrical signal with either frequency shift or phase shift chips (Token, 2010). These chips can be configured in such a way as to emulate a Barker code sequence, which can be used to encrypt RF burst signals (Malocha, Puccio, & Gallagher, 2004).

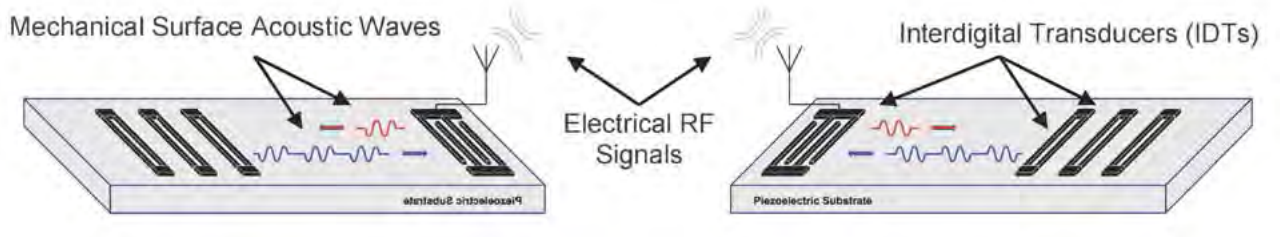

Figure 1. SAW transmitter (left) and receiver (right) correlator pair.
(Source: Malocha, Puccio, & Gallagher, 2004)

Decryption of this coded RF burst signal is easily accomplished by passing the encrypted signal back through a matched SAW receiver correlator. If the receiver correlator has an identical IDT structure design, the output signal will have a high auto-correlation to the input signal, meaning the original RF burst will be decoded with high accuracy. If the receiver correlator is not well matched (i.e. the IDTs do not have the same structural design), its output signal will be cross-correlated and resemble white noise similar to the side lobes of the auto-correlated output signal, as established by Malocha et. al. (2004). Figure 2 illustrates this contrast between auto and cross-correlated signals. Therefore, with a well-matched SAW correlator transmitter/receiver pair, an RF burst signal can be encoded in such a way as to produce a high auto-correlation vs. cross-correlation encryption scheme. It is also important to note that increasing the number of coded chips included in the SAW correlator will increase its encryption strength.

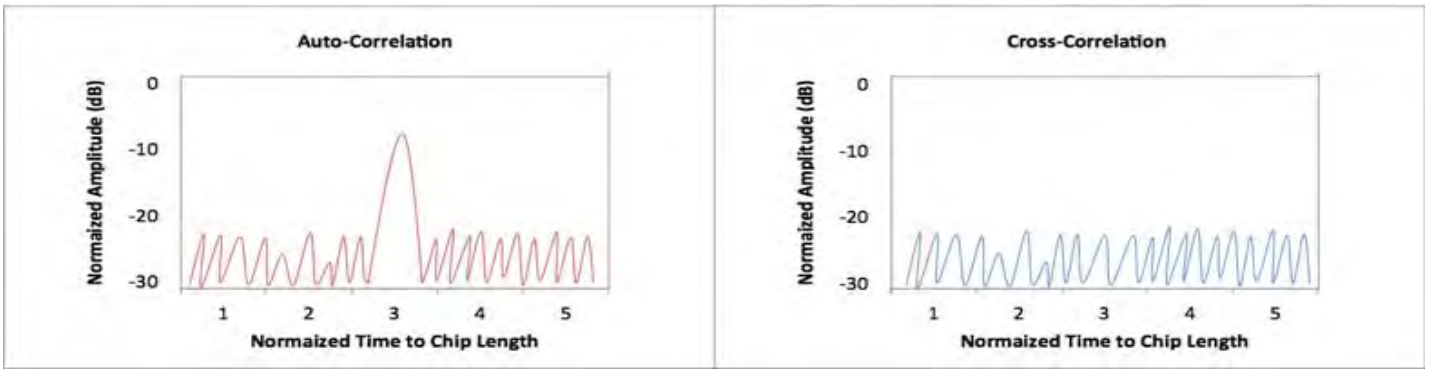

Figure 2. Auto-correlation vs. cross-correlation of SAW encoded signal.

SAW Correlator Design Considerations

Piezoelectric Substrate

As indicated above, a SAW device's ability to encode a signal is related to the propagation delays produced by the piezoelectric substrate material. As the alternating electrical signals are launched off the IDTs, they are converted to mechanical waves and propagate through the substrate at a reduced velocity. As previously mentioned, ST Quartz is a common substrate used in SAW devices and has an acoustic velocity of ~3,158 m/s. Other materials are available with their own unique velocities that affect the propagation speeds of surface acoustic waves. In addition to substrate material, Morgan (2007) indicates that temperature changes also have an effect on surface acoustic waves. Table 1 lists some of the common piezoelectric substrate materials used in SAW devices, and indicates the velocity [vf (m/s)] and temperature [TDC (ppm/°C)] affects of these substrate materials, as well as some advantages, disadvantages and suitability considerations of various substrate materials. This table has been adapted from Morgan's text titled Surface Wave Acoustic Filters (2007).

Table 1. Common piezoelectric substrate materials used in SAW device

	Y–Z lithium niobate ($LiNbO_3$)	128°Y–X lithium niobate ($LiNbO_3$)	ST–X quartz (SiO_2)	36°Y–X lithium tantalate ($LiTaO_3$)
***vf* (m/s)**	3488	3979	3158	4212
TCD (ppm/°C)	94	75	0	32
Advantage	Low diffraction, strong coupling	Low bulk waves, strong coupling	Small TCD	Strong coupling, moderate TCD
Disadvantage	Large TCD, strong bulk waves	Large TCD	Weak coupling	-
Suitability	Wide-band filters, RACs, convolvers	Wide-band filters	Narrow-band filters, resonators, pulse compression	Low-loss filters, RF filters

IDT Design for BPSK

BPSK is a common modulation scheme used in digital communications systems to encrypt binary data, especially in WiFi communication networks. The prevalence of BPSK can be attributed to two facts, 1) Phase Shift Key (PSK) encryption has higher signal to noise ratios (SNR) compared to other modulation schemes, and 2) BPSK is the simplest form of PSK and lends itself readily to WiFi communication scenarios (Elkordy, Elsherbini, & Gomaa, 2013).

With BPSK encoding, a signal is encrypted into a binary code by modulating the original signal between 0° and 180° phase shifts. In this scheme a 0° phase shift may indicate a digital 1 bit while a 180° phase shift indicate a digital 0 bit. By shifting the phase of an RF signal between these two phase angles in a specific sequence (code) the signal is encrypted with a cipher key. This encrypted signal can be decoded by passing it through a reverse coded phase shift sequence key to remove the modulation encryption leaving only the original data. Due to the physical properties of SAW device's IDT fingers, their orientation, and the alternating polarity between sets of IDT fingers, they are very well suited for BPSK coding applications (Campbell, 1989).

The BPSK encoding scheme described above is easily achieved with specific design configurations of a SAW device's IDT fingers. These fingers can be arranged in such a way as to emulate a Barker code sequence, which is preferable due to reduced power requirements in the side lobes of the auto-correlated signal. A simplified IDT finger arrangement design to achieve a 5-bit Barker code sequence of + + + − + for BPSK encryption is depicted in Figure 3. As illustrated, the phase shift, and thus the encoding, is accomplished by alternating the arrangement of IDT finger pairs (chips). The relative polarity of the finger pairs stays constant as long as the arrangement is constant. When the arrangement is flipped, as seen in the 2nd IDT finger pair from the left, the polarity changes. This change in polarity causes a 180° shift in the phase angle of the signal passing through the SAW correlator, which corresponds to a change in the binary code (Elkordy, Elsherbini, & Gomaa, 2013). In this manner, an RF burst signal can be easily encoded with a Barker code sequence.

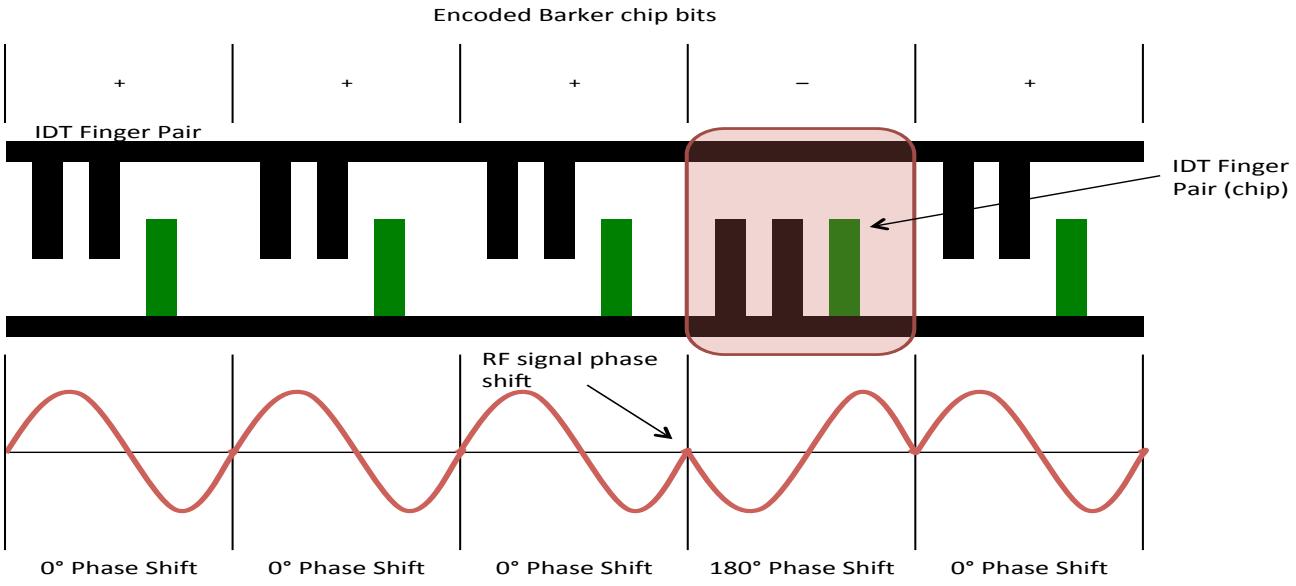

Figure 3. BPSK encoding by means of IDT finger pair arrangement

Physical Design Parameters

When determining the specific design dimensions of a BPSK SAW correlator, the first parameter to consider is the total length (LT) of the correlator's coded IDT pairs. As indicated by Malocha et. al. (2004), this length is contingent on the bit period () of the RF burst signal being imposed on the correlator. The relationship between these two variables is depicted in Equation 1 and 2, where (v) is the velocity of the piezoelectric substrate of the SAW correlator.

$$L_T = v \cdot \tau_B \qquad (1)$$

$$\tau_B = \frac{1}{Bit\ Rate} \qquad (2)$$

The next dimensional consideration is that of the number of IDT chips and their individual lengths. The number of chips is simply based on an integer number of Barker code bits desired in the encryption scheme. The length of each of these chips is determined by first determining the period of each chip (τ_C), which is found with Equation 3, where the number of chips (j) is an integer number based on the desired Barker code (Malocha, Puccio, & Gallagher, 2004). Once the chip period is determined, the length of each chip (LC) is then found with Equation 4,

$$\tau_C = \frac{\tau_B}{j} \qquad (3)$$

$$L_C = v \cdot \tau_C \quad (4)$$

The dimensional relationships between Equations 1 – 4 are depicted in Figure 4.

The individual IDT finger width and inter-IDT spacing between adjacent fingers is the next critical parameter to consider. According to Satoh, Ikata, Miyashita, and Ohmori (2012), this dimension (W) is proportional to the wavelength (λSAW) of the piezoelectric substrate, as indicated by Equations 5,

$$W = \frac{\lambda_{SAW}}{4} \quad (5)$$

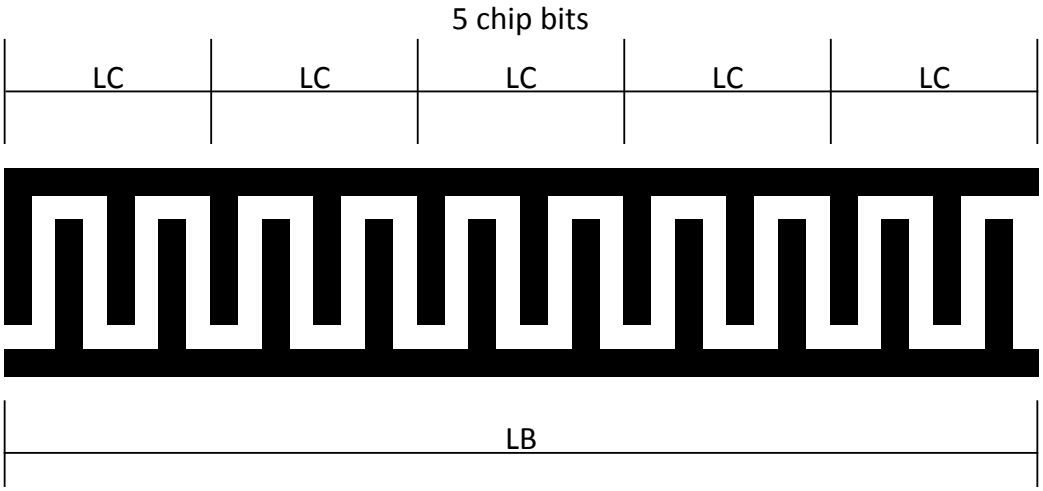

Figure 4. Coded IDT length relative to bit length, chip number and chip length

Equations 6 further defines the wavelength of the piezoelectric substrate, which is based on the acoustic velocity (v) of the SAW substrate and the frequency (f) of the RF signal being encrypted by the SAW correlator. Figure 5 illustrates the physical relationships of Equations 5 and 6.

$$\lambda_{SAW} = \frac{v}{f} \quad (6)$$

Figure 5. IDT finger width and inter-IDT spacing relationships

Calculating the number of IDT fingers in each chip (Fchip) is also necessary to calculate using Equation 7,

$$F_{chip} \approx \left(\frac{L_C}{W}\right) \cdot 0.5 \qquad (7)$$

This equation assumes that the chip length is filled with equally dimensioned IDT fingers and inter-IDT gaps. This assumption is not always necessary, but will be used in this design.

The IDT finger's apodization (overlap) can either be held constant or it can vary (Campbell, 1989). In this design, constant apodization (A) will be used for simplicity and can be calculated as proportional to IDT finger length (L) with Equation 8,

$$A = 0.75 \bullet L$$

Furthermore, with constant apodization, the finger length must be held constant as well and can be proportional to finger width (Campbell, 1989) as seen by Equation 9,

$$L = W \bullet 10$$

Another design consideration of a SAW correlator is the input/output IDT. This IDT serves the dual purpose as input for the RF signal and output for the encrypted signal. This paper proposes connecting the input/output IDT to a 2.45 GHz Tx/Rx antenna for wireless data transmission of WiFi data. The dimensions of this IDT may simply be a four-finger design, as shown in Figure 6, with dimensions identical to those of the coded IDT chips as calculated by Equations 5, 6, 8 and 9 (Campbell, 1989).

The final dimension of a SAW correlator to calculate is the distance between the input/output IDT and the coded IDT. This is dimension is critical and is dependent on the wavelength of the acoustic waves (λSAW) propagating between these IDTs. To ensure resonance, the input/output IDTs must be spaced so that the waves arrive at the coded IDT at the correct phase (0° phase angle). Equation 10 illustrates this relationship between the wavelength and the spacing between the IDTs (d) to achieve resonance and proper phase angle of the signal (Morgan, 2007),

$$d = \frac{\left(\left[n+\left(\frac{\Delta\phi}{\pi}\right)\right]\lambda_{SAW}\right)}{2} \qquad (10)$$

where ($\Delta\phi$) is is the phase angle offset desired by the BPSK scheme.

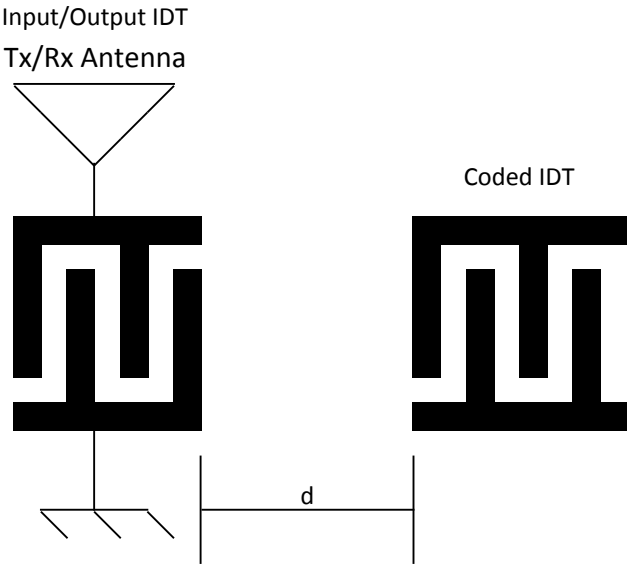

Figure 6. Input/Output IDT design and distance from coded IDT

PSAW Correlator Design

SAW correlators can be designed as either passive or dynamic. For a correlator to be dynamic, it must exhibit an ability to frequently re-arrange the coded IDT fingers as required by the communication system's encryption protocol. By inserting RF switches (i.e. BJTs or FETs) between the bus strips above and below the coded IDT fingers they can be dynamically rearranged as needed, as illustrated by Figure 7. It is important to note that in this design it is crucial that the RF switches be ganged according to chips so that all fingers associated with a single chip change arrangement together. Furthermore, the last finger of each chip can be permanently connected to the ground bus to mark a consistent end of each chip (Campbell, 1989).

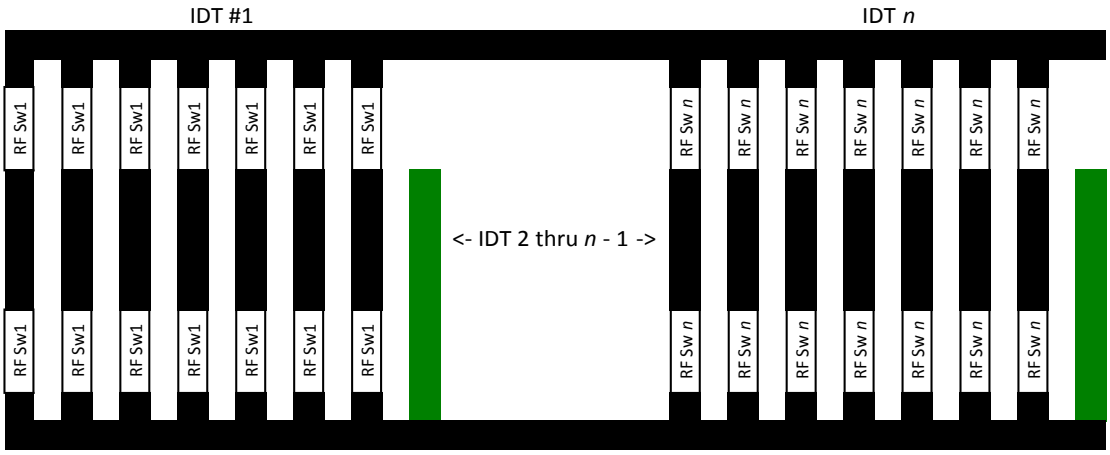

Figure 7. Coded IDT with RF switches enabling dynamic fingers re-arrangement

Proposed SAW Correlator Design

The purpose of this paper is to present a design solution to security issues related to IEEE 802.11 networks operating in the 2.45 GHz and 5.8 GHz frequency bands. To that end, this research proposed a PSAW design capable of operation in the 2.45 GHz band. This frequency band is chosen due to exponentially increasing limitations of SAW devices above 3 GHz (Morgan, 2007). Also, the proposed design will use a coded IDT with an 11-bit Barker BPSK code sequence, as is currently prevalent in IEEE 802.11 security protocols (Agilent Technologies, 2007). This 11-bit Barker code sequence will also have a maximum of 2,048 possible permutations (211 = 2,048).

As illustrated in Figure 1, the design will make use of one Tx PSAW correlator and one Rx PSAW correlator at each end of the transmission link. The Tx PSAW correlator will be used to encode a data bit stream before it is transmitted to the Rx PSAW correlator. This receiving correlator will have an identical, but reverse-oriented, coded IDT configuration for auto-correlation decoding of the data bit stream. It is proposed that the cipher key (IDT arrangement) of the Tx and Rx fingers be changed after a random number of data frames are sent. This random number will range from 0 – 10 and will be initiated by the Tx correlator and indicated to the Rx correlator by an 11-bit data stream piggybacked with the last transmitted frame sent. This 11-bit data stream will indicate the next 11-bit Barker code sequence that will be used by the Tx correlator. When the Rx correlator receives this cipher-change code it will send an ACK frame back to the Tx correlator, similar to a SSL cipher change confirmation procedure. Additionally, the Tx and Rx correlators will use timers to guard against lost or damaged cipher-change ACK frames. Once the cipher-change sequence is completed, both correlators will change their respective RF switches to the new cipher key configuration and resume encrypted data transfer.

The final parameters that must be clarified for the proposed PSAW correlator pair design is 1) substrate material, 2) the dimensions of the input/output IDTs, and 3) the dimensions of the coded IDTs. The proposed piezoelectric substrate will be ST-Quartz, based on its prevalence and suitability to pulse compression of bit streams per Table 1. Related to the last two parameters, Appendix A presents the dimensions of the proposed PSAW correlator pair design. The design dimensions depicted in this appendix are based on Equations 1 – 10 and presented in Appendix B.

Conclusion

Summary

This paper has presented an example of current security issues related to WiFi networks and proposed an encryption scheme to solve this problem. A brief review of acoustic surface waves, SAW transducers, PSAW devices and BPSK encoding were presented in order to lay a foundation for the proposed design solution of a PSAW correlator pair equipped with an 11-bit Barker code sequence for WiFi BPSK encryption applications. The critical parameters necessary in the design of this correlator pair were presented, including the selected substrate material, relevant equations, and the proposed design. At this stage of the author's research the design herein is only a proposed design. Further investigation is necessary to completely implement this design, as stated below.

Recommendations and Further Investigations

At this stage of the research, it is recommended that a more detailed investigation be made into the circuit requirements of the RF switches for dynamically re-arranging the coded IDT chips. This aspect of the design was not included in the research herein, but is necessary to implement the proposed design. This is recommended as a point of further investigation.

Additionally, it is recommended that the specific cipher-change protocol necessary for the proposed PSAW correlators be further investigated. This protocol is vitally important to the functionality of the proposed design. If this step of the data encryption process is flawed, the Rx PSAW correlator could lose the cipher key. This loss would be catastrophic and would inhibit accurate auto-correlation of the transmitted data.

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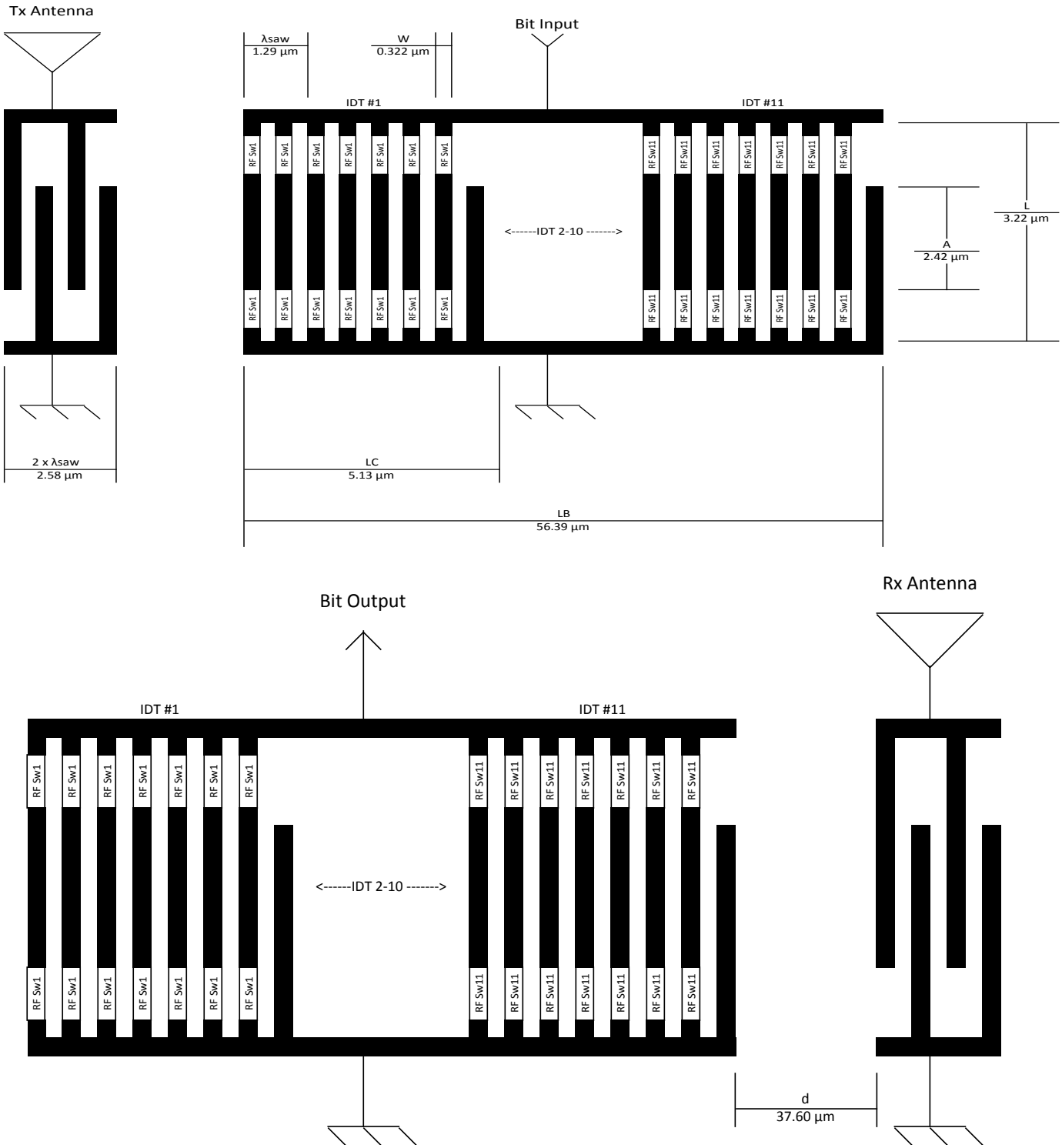
Appendix A: PSAW Correlator Design



Appendix B: PSAW Correlator Design Calculations

Terms	Value	Units
Frequency (f)	2.45E+09	Hz
SAW Velocity ST Quartz (v)	3.16E+03	m/s
Speed of Light (c)	300.00E+06	m/s
No. Barker chips (j)	11.00	-
Bit Rate (bps)	56.00E+06	bps

Calculations

Bit Period (τB)	#bits	bps	τB	Units
τB = #bits/bps	1.00	56.00E+06	**17.86E-09**	**s**

Wavelength SAW	v	f	λsaw	Units
λsaw = v/f	3.16E+03	2.45E+09	**1.29E-06**	**m**

IDT Finger Width	λsaw	-	W	Units
W = λsaw/4	1.29E-06	-	**322.24E-09**	**m**

Total Length of Coded IDT	τB	v	LT	Units
LT = v*τB	17.86E-09	3.16E+03	**56.39E-06**	**m**

Distance Between IDT	Δϕ	λsaw	d	Units
d = ([1+(Δϕ/π)]λsaw)/2)	180.00	1.29E-06	**37.59E-06**	**m**

Chip Period	τB	j	τC	Units
τC = τB/j	17.86E-09	11.00	**1.62E-09**	**s**

Chip Length	τC	v	LC	Units
LC = v*τC	1.62E-09	3.16E+03	**5.13E-06**	**m**

Number IDT Fingers per chip	LC	W	Fchip	Units
Fchip = (LC/W)*0.5	5.13E-06	322.24E-09	**8.00**	**-**

Finger Length	W	-	L	Units
L = W*10	322.24E-09	-	**3.22E-06**	**m**

Apodization Length	L	-	A	Units
A = 0.75*L	322.24E-09	-	**241.68E-09**	**m**

EECT Energy

Investigation on Temperature and Pressure Profiles in a Downdraft Gasifier Using Different Biomass Feedstock

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Introduction

Downdraft gasifiers produce syngas with a low percentage of tar (suitable for internal combustion engines) comparison to the other type of gasifiers. As a result, experimental studies have been conducted to analyze the quality of the produced gas, as well as gas flow rate in the gasifiers. Technically, feedstock, temperature profile and oxygen/air flow rate in the gasifiers are the major factors in syngas production. In the presence article, gas quality, temperature and pressure profiles in the reactor of a downdraft gasifier fed by wood chips and switchgrass mixture as feedstock are experimentally studied. The results can conduct the experiments to the best control points of pressure and temperature using various feedstocks in the gasifier. Furthermore, modification strategies can be suggested in the future to achieve the best results of production in terms of both gas quality and gas flow rate.

Theoretical Concept

Gasification is performed in four zones in a downdraft gasifier's reactor including drying, pyrolysis, combustion and reduction zones. In the drying process, the biomass fuels lose a portion of their water component during a physical reaction. The heat provided in the combustion zone reaches the drying zone in convection heat transfer form and re duces the moisture of the fuels. The fuels are turned to charcoal in the pyrolysis zone while losing their volatile components in the form of gas and vapor (oil/tar). These chemical reactions happen in the absence of oxygen, and the endothermic reactions produce H2, CO, CH4 and CO2 and vapors [1, 2]. However, H2 and hydrocarbons could react with the existing oxygen in the pyrolysis zone and release H2O, CO and CO2 as well as heat during the reactions [3]. A series of oxidation reactions are existed in the combustion zone (a reach zoon of oxygen, usually, provided by an air flow inducted to the system) to provide the heat needed for pyrolysis and reduction zones . The main products of the reactions are H2O and CO2 which are produced in a temperature between 800 C and 900 C. the rate of the chemical reactions are depended on the biomass feedstock, pyrolysis

reactions and oxygen controlling methods. The following reactions happen in the combustion zone (complete or partial oxidation reactions) [4]:

1. *C + ½ 02 ⟶ CO + Heat (-111MJ/kmol)*
2. *H2 + ½ 02 ⟶ H20 + Heat (-242MJ/kmol)*
3. *CO + 02 ⟶ C02 + Heat (-283 MJ/kmol)*

In reduction zone of gasification, syngas is derived during the reduction reactions between the H2O and the CO2 produced in the combustion zone and the charcoal in the reduction zone in the absence of oxygen. Heat is absorbed in H2, and CO production (endothermic reactions) while it is released in CH4 production (exothermic reaction). The following reactions happened in the reduction zone:

1. *C + C02 + Heat ⟶ (+172 MJ/kmol) ⟶ 2 CO*
2. *C + H20 + Heat ⟶ (+131 MJ/kmol) ⟶ H2 + CO*
3. *C + 2H2 ⟶ CH4 + Heat (-75 MJ/kmol)*

Experimental setup

A lab-scale downdraft gasifier (Figure 1) is used to analyze temperature and pressure profiles and syngas component using various type of feedstock. 50% of wood chips and 50% switch grass pellets mixture are used as a feedstock. Table (1) shows the physical properties of the feedstock and their HHV (High Heating Value). There are two temperature sensors (Thermo coble) which are installed in the combustion and the reduction zones (the distance between the sensors is approximately 1 foot). In addition, three pressure sensors are considered for the setup including two sensors for the combustion and the reduction zones and one sensor for the second filter. All the sensors including temperature and pressure ones are connected to a digital board which shows the values on its monitor. A USB port transfers the data sent by the sensors to a computer. Then, the temperature and pressure curves versus the time of the experiment are plotted in the computer. Then, the samples are sent to a material lab in which the syngas components and their quantity are identified by a Gas Chronographer (GC).

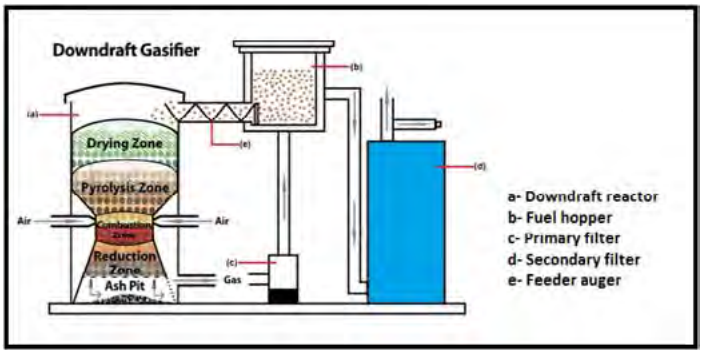

Figure 1. Schematic of the downdraft gasifier with the components

Table 1. Feedstock properties

Biomass	Density (kg/L)	Moisture %	HHV (Btu/lb)
Wood chips	0.77	4.19	7680.89
Switch g rass	0.68	12.70	7525.62

Experiment's results

Temperatures values reported by sensors in the reactor are shown in the figure (4). The red curve illustrates the top of the reduction zone (or combustion zone to some extent) while the black curve represents the bottom of the reduction zone. The temperature curves are plotted versus the time of the experiment to study the temperature profiles from start-up to shut down. It should be considered that the figure 4 is selected among the experiments that had almost the same profiles.

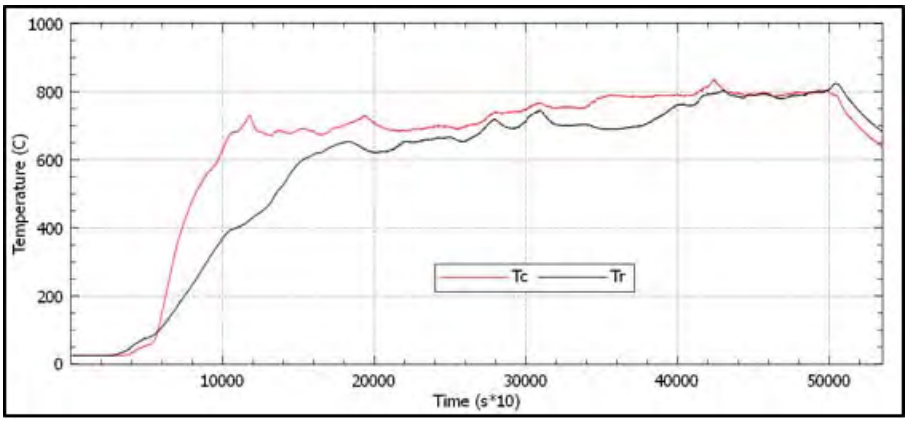

Figure 4. Temperature profiles in the combustion zone (Tc) and reduction zone (Tr) versus time (50% wood chips- 50% switch grass mixture)

Figure 5 shows the pressure profiles (In WG) versus time of the experiment. Red, black and blue curves represent the pressures (In WG) for top and bottom of the reduction zone as well as a secondary filter respectively.

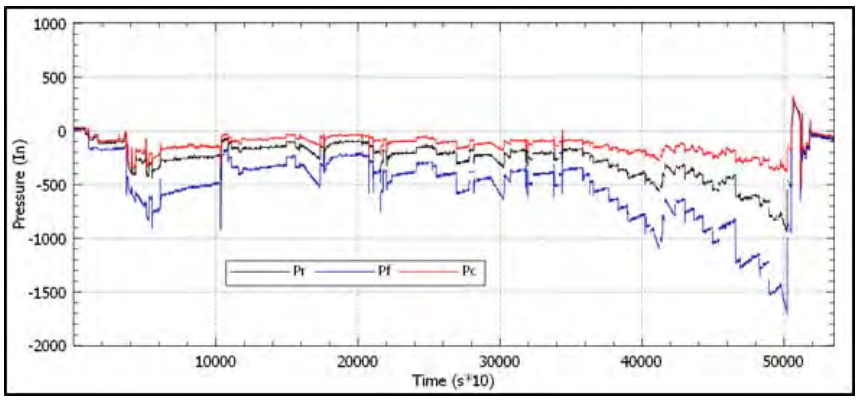

Figure 5. Pressure profiles in the combustion zone (Pc), reduction zone (Pr) and the second filter (Pf) versus time (50% wood chips- 50% switch grass mixture)

Samples of produced syngas are analyzed by the gas chronographer (GC), and the results are shown in figure 6. The data are sorted according to the temperature in which each sample is collected. Normally, the samples are collected from 650 C to 900 C with 50C temperature difference in each experiment. Figure 6 shows the result of the GC for eight successful experiments.

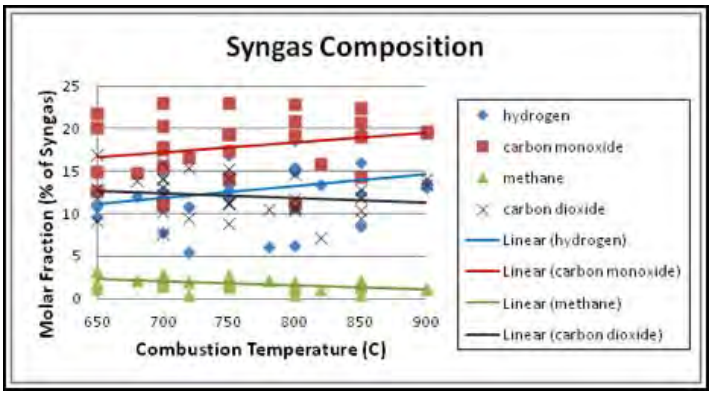

Figure 6. Molar fraction of H2, CO, CH4 and CO2 in the Syngas produced from 50% wood chips- 50% switch grass mixture during three experiments

After each three experiments, the reactor is opened and checked in order to analyze the feedstock conditions, as well as char composition . Figure 7 and eight show the result of the inspections through the gasifier including feedstock and char conditions.

Figure 7. a) Formation of fine at the entrance of the reactor. b) Un-uniform mixture inside the reactor (char and feedstock)

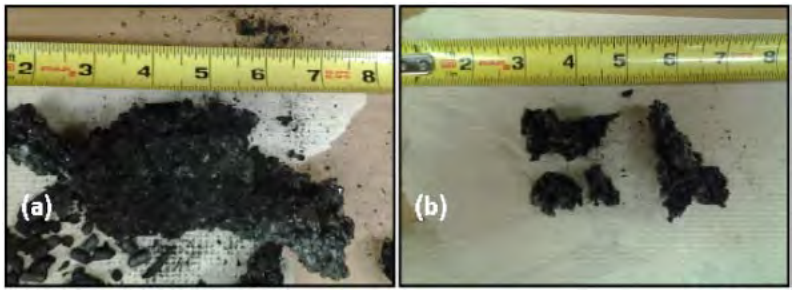

Figure 8 .a) Large clinkers found in the reduction zone. b) Small clinkers found in the combustion zone

Experiment's Analysis

Temperature profile inside the reactor is the major factor for gasification procedure in order to control the gasification's performance. By looking at the temperature profiles in Figure 4, we can divide the curves into two separate segments. In the first part, the temperatures rise dramatically which takes almost 30 minutes. Then in the second part, the temperature curves are stables and almost close to each other which represent a steady gas production. The pressure profiles are used to both controls the pressure ratios mentioned by the gasifier's manufacture and to estimate the Equivalent Ration (ER) inducted through the reactor. Figure (6) shows the percentage of each gas in the syngas sample versus the combustion temperature. H2 and CO are produced from endothermic reactions in the reduction zone. Thus, increasing the temperature in the reduction zone leads to provide more H2 and CO during the reactions. This fact could be observed in the H2, and CO curves plotted in the Figure (6). On the other hand, CH4 and CO2 are derived from exothermic reactions in the combustion and the reduction zones. Therefore, the CH4 and CO2 curves illustrate the concentration reduction caused by increasing the temperature value.

The efficiency of a downdraft gasifier would be decreased having high percentage of fines (instead of pellets) in the reactor [3]. Thus, the durability of the fuel pellets is an important factor in the gasification process. Lignin content and moisture value are the remarkable factors in the pellet 's durability [5, 6]. Moreover, Clinkers are the mineral components in the plant cell walls of the cellulosic biomass fuels which are remained after burning the entire char and hydrocarbons in the reactor. High percentage of lignite in the fuels means more and large clinkers which are remained in the reactor [7]. Unsuitable factors such as the formation of fine and clinker, as well as un-uniform mixture, can be detected using the temperature and pressure analysis. Temperature and pressure profiles have shown unstable condition during the experiments. For example, sometimes the temperature of the reduction zone exceeded the temperature of the combustion zone which is not a normal situation. Figure (7-a) shows the output of the auger that feeds the reactor. It shows that the auger has separated the mixture and turned the switch grass pellets into fines during the feeding procedure. The result of this separation could be seen in the Figure (7-b) which is captured from the top of the reactor. The difference between geometrical features of the Wood chips and the Switch Grass pellets is the main reason of having a non-uniform mixture with

a high level of fines. Figure (8-a) shows the large clinkers found at the top of the reduction zone which cover the entrance of the zone and reduce the mass flow rate of the gas produced in the combustion zone.

Conclusion

Due to the fact that the reason of the experiments is to find a new and local feedstock for EIU's Renewable Energy Center, the results of the experiments are compared to the gas compositions using 100% wood chips (current feedstock) in previews experiments. Figure (9) shows the syngas compositions in an average combustion zone's temperature of 750 C.

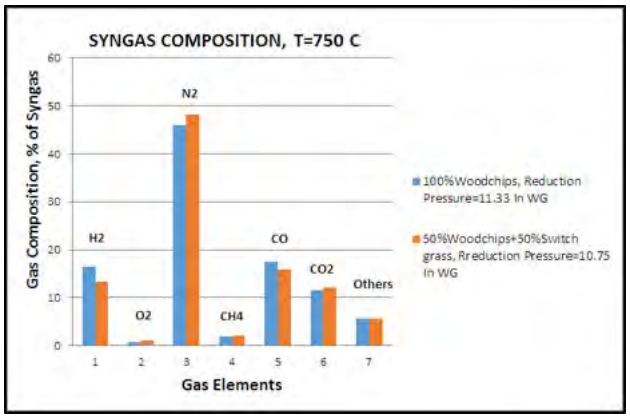

Figure 9. Syngas composition (average) in T (Combustion Zone) =750 C

According to Figure (9), the percentage of H2, CO and CH4 as the main elements are similar to each other in the same target temperature (750 C in this case). Thus, we can almost have same syngas compositions from 100%wood chips and 50%wood chips /50%switch grass without changing the temperature control point in the downdraft gasifier. In addition, by comparing the average pressures and the bulk densities of the feedstock, we can see that a higher bulk density need a higher flow rate inducted through the gasifier in order to reach a same temperature target in the downdraft gasification process. Moreover, the observations during the experiments have shown that the chance of clinker formation using switch grass is higher than using wood chips in the downdraft gasifier. Furthermore, as it is mentioned before, dust formation caused by switch grass feedstock has negative effects on overall efficiency of the gasification. In summary, all the factors such as temperature and pressure control points, clinkers and dust formation as should be considered in order to choose the best biomass sources as feedstock for a gasification plant. In addition, conversion efficiency and cost are other major factors which should be studied before selecting a feedstock in an industrial application.

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Management

An Investigation of Quality Climate and its Association with Implementation of Quality Management System

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Introduction

Quality management and continuous improvement are paramount for businesses to survive and thrive in today's competitive landscape (Goetsch & Davis, 2003; Abdullah et al., 2009). One effective approach to operationalize quality processes and continuous improvement goals is a formalized quality management system (Khanna et al., 2010; Mosher et al., 2013). Quality management systems are embodiments of the organization's policies, procedures, plans, resources, processes and delegation of responsibility and authority designed to achieve customer satisfaction within the boundaries of organizational objectives (Goetsch & Davis, 2003). While these systems are being used extensively across many industries, the ideas are relatively new to the bulk commodity handling and processing industries (Hurburgh & Lawrence, 2003). Although factors such as globalization and legislation have been external drivers for the adoption of quality management systems in these industries, internal benefits have also been noted as a result of these systems (Laux, 2007; Laux & Hurburgh, 2010).

Implementation of quality management systems is driven by the organization's vision, goals and objectives and is tailored to each organization's specific culture, values, strengths and weaknesses (Goetsch & Davis, 2003). These implementations are resource-intensive and time- consuming. A complete implementation cycle of quality management systems requires at least twelve months and in some cases may require several additional months (Yousef & Aspinwall, 2000; Goetsch & Davis, 2003). For this reason, an evaluation strategy is required to determine the impact of implementation and to measure continuous improvement actions within the organization (Fitzpatrick et al., 2004; Laux & Hurburgh, 2010).

Operational measures of quality management were first proposed by Saraph et al. (1989). Follow-up studies identified several "soft" and "hard" indicators to measure the success of quality management systems (Lewis et al., 2006a). Hard factors of quality are well-defined and easily quantifiable measures such as product reliability, durability and serviceability Alternatively, soft factors deal with behavioral aspects and are more complex and difficult to measure (Black & Porter, 1996). One such soft factor is quality climate, a measure of employees' shared perceptions of the importance of quality policies and procedures relative to other business goals (Mosher et al., 2013). While some soft factors and their impact on organizational performance have been investigated (Gadenne & Sharma, 2009; Fotopoulos et al., 2009; Abdullah et al.,2009 ;Khanna et al., 2010), little research has

focused on the potential constructs of quality climate. The structure and antecedents of quality climate can be measured through a survey instrument, similar to the measurement of safety climate (Mosher et al., 2013; Guldenmund, 2007). Employee perceptions are an important component of workplace climate (Lunning & Marcelis, 2007), yet little previous research has examined antecedents to quality or to develop a valid and reliable survey instrument to measure quality climate. This is especially true in the bulk commodity industry, where changes in customer expectations and legislation have prompted new demands for quality performance (Thakur & Hurburgh, 2009).

Accordingly, the purpose of this study is to identify the various employee-related organizational characteristics and constructs that influence the effectiveness of quality management systems. The findings of this study will be used to develop and validate a survey instrument for measuring the quality climate in the bulk commodity handling and processing industry.

Quality Management Systems in Bulk Commodity Handling and Processing Industry

The use of quality management systems that encompasses statistical data, teamwork, continuous improvement, customer satisfaction, and employee involvement concepts, gained wide acceptance in the United States in the late 1980's and early 1990's (Goetsch & Davis, 2003). However, these ideas have been slow to reach the bulk commodity handling and processing industry, which is facing challenges facilitated by globalization, changes in customer demands and increased legislation (Hurburgh & Lawrence, 2003). Previous research conducted in a bulk commodity handling and processing facility showed positive impact of quality management systems on operational efficiency, demonstrating an enhanced ability to meet both customer specification and comply with legal requirements, while instituting only a minimum increase in transaction costs (Laux 2007; Laux & Hurburgh, 2010).

Quality management systems are also being used to create traceability systems that are increasingly the norm for bulk commodity industries dealing with food and feed in all developed countries (Dabbene & Gay, 2011; Laux & Hurburgh, 2010). Meeting these traceability requirements has been a major challenge for bulk commodity handlers due in part to the practice of blending loads from multiple sources before processing (Bailey et al., 2002). The main objective of a traceability system is to precisely log and locate a product along the supply chain (Dabbene & Gay, 2011). Implementing quality management systems has led to greater inventory and process control for bulk handling firms, thus allowing firms to successfully track and trace raw material through their supply chain (Hurburgh & Sullivan, 2004; Thakur & Hurburgh, 2009).

Implementing Quality Management Systems

The implementation of a quality management system is a multi-phase process usually consisting of preparation, planning and execution phases (Goetsch & Davis, 2003). Each phase has many steps implemented over several months (Hurburgh & Hansen, 2002). Successful implementations require commitment from top management, the creation of organization-wide steering committee, and the planning, promotion and establishment of infrastructure to support deployment and continual improvement (Goetsch & Davis, 2003).

A high level of both time and resources must be invested to develop and implement a quality management system, therefore, an assessment of the program's efficiency is necessary (Mosher et al., 2009). An effective evaluation plan is important to determine the effectiveness of the implementation and to facilitate continuous improvement within the organization (Fitzpatrick et al., 2004; Laux & Hurburgh, 2010).

"Hard" and "Soft" factors of Quality Management Systems

Defining and measuring quality is a complex task (Chen & Chen, 2009; Wankhade & Dabade, 2010). In addition, the criteria to quantify and measure quality management systems vary greatly in the research literature, based in part on the author. One of the first studies to systematically measure the components of quality management was conducted by Saraph et al. (1989). This preliminary study identified 78 operational criteria's for measuring the effectiveness of organizational quality management programs. Numerous follow-up studies have since evaluated quality management systems across several industries. For example, Joseph et al. (1999) identified 150 measures of quality management for a manufacturing- based business. Chen & Chen (2009) proposed measures for operational quality improvements in the bio-technology industry, while Brah et al. (2000) identified factors critical to quality management implementation in the service industry and Kafetzopoulos et al.'s. (2014) study measured quality-related attributes in the food processing industry.

The various criteria for measuring quality were categorized by Chen & Chen (2009) into five dimensions-: leaders, employees, customers, information technology and operating processes. For practical purposes these different criteria can be classified into "hard factors" and "soft factors" (Gadenne & Sharma, 2009).

Hard factors are indicators that are used to control production and work process flow (Wilkinson et al., 1998; Evans & Lindsay, 2002). Process controls, just-in-time measures, defect rates, and other process indicators are examples of hard factors (Lewis et al. 2006a). The key distinguishing feature of hard factors is that they are well defined and generally have a straightforward method of measurement (Lewis et al. 2006a; Gadenne & Sharma, 2009). Because of the consistency and ease of measurability, hard quality factors are both the preferred and more commonly used measure of quality systems implementation (Lewis et al. 2006b).

Soft factors focus on behavioral and human aspects of quality management systems. Leadership, teamwork, empowerment, human resource utilization, customer satisfaction, quality culture and social responsibility are a few commonly cited examples of soft factors (Saraph et al., 1989; Flynn et al., 1995; Ahire et al., 1996; Brah et al., 2000; Kaynak , 2003; Lewis et al., 2006a; Gadenne & Sharma, 2009). Unlike hard factors these soft factors may not be well defined and can also be intangible and difficult to measure (Gadenne & Sharma, 2009). Hence, studies on the measurement of soft quality factors have not been common, due in part to the challenges of quantifying such factors.

Measuring Effectiveness in Bulk Commodity Handling and Processing Industry

The effectiveness of quality management in the processing industry is a function of product quality and human behavior (Luning & Marcelis, 2007). Product quality is achieved by controlling production activities such as heating, storing, and transporting, while human behavior is influenced by managerial decision-making activities (Luning & Marcelis, 2009).

Little previous research has attempted to measure the effectiveness of quality management system in bulk commodity industry. Hurburgh (2002) proposed impartial third party audit and certification for validating quality management system. However, these audits occur infrequently and are expensive relative to the information gained on efficiency. Mosher et al (2009) suggested mock recall as a possible tool to internally evaluate a quality management system for a processing firm. Thakur et al (2011) suggest an indirect method to study and analyze the various processes with the help of data recorded from all grain lot activities. Both mock recall and electronic records require consistent data records, which are not always in place in the bulk processing environment.

However, none of these studies measured the effectiveness of quality management systems in a process-based system nor were the human factors measured as proposed by Luning and Marcelis (2007). For this reason, there is a need for an instrument that measures effectiveness of quality management based on human and behavioral aspects while taking into account the unique needs and challenges of process-based industries.

Quality Climate

Quality problems occurring due to employee behavior are difficult to detect unlike those associated with mechanical and production aspects (Luria, 2008). Facet specific climate such as safety climate are positively correlated with safety behaviors (Neal at al., 2000; Zohar, 2002; Cooper & Phillips, 2004; Keren et al.,2009). Hence quality climate that measures employees shared perception of importance of quality policies, procedures and policies relative to other business goals (Mosher et al , 2013), impacts employee quality behaviors (Luria, 2008).

While some facet specific climates have been investigated like safety (Zohar 1980; 2002; Zohar & Luria 2004, 2005), service (Schneider et al.,1998 ; Dietz et al., 2004) little research has explored the concept of quality

climate (Luria, 2008; Mosher et al., 2013). Moreover, no research has explored the constructs of quality climate and validated a survey instrument to measure quality climate especially in the bulk commodity handling and processing industry.

Methodology

The purpose of this study was to identify the employee related organizational characteristics that impact the effectiveness of quality management systems. To determine the various employee related dimensions, a review of quality literature was undertaken. The review focused on soft human factors that impacted quality management systems and continuous improvements. The perception of these organizational characteristics by employees forms the quality climate of that organization.

Studies that were selected discussed quality management and critical factors explicitly. All studies selected measured some employee-related characteristics and all used or developed a quantitative survey instrument to measure these critical factors. The pilot study suggested that most previous studies investigating critical success factors were conducted in manufacturing environments. Additionally, the number of critical success factors identified has increased over time (Hietschold et al., 2014). Human-based critical factors identified in quality literature as influential toward a positive climate of quality can be classified into the following broad dimensions.

Top management commitment and leadership

Top management commitment and leadership's impact on successful implementation of quality programs cannot be under-estimated and is a consistent theme in the quality literature (Saraph et al., 1989; Flynn et al., 1995; Ahire et al., 1996; Brah et al., 2000; Kaynak, 2003). Implementing quality systems requires an enterprise-wide management philosophy (Hietschold et al., 2014), hence leadership support and the involvement of senior executives is vital for success. Strong commitment and involvement of top management signifies greater emphasis on quality thus impacting working climate just as top management can positively or negatively influence organizational safety climate and safety behavior (Zohar 1980; 2002; Neal et al., 2000).

Employee involvement and empowerment

Employee involvement is defined as the ability of employees to have control of the tasks assigned to them (Lawler et al., 1992). Several researchers have emphasized the importance of employee involvement in implementing quality management systems. For example Reger et al. (1994) suggest that fundamental organizational change efforts such as quality management will be successful only when employees' cognitive resistance to beneficial changes is resolved. To realize the benefits of organizational change, employees must fully participate in all quality improvement activities, acquire new knowledge, and feel a sense of accomplishment (Zhang et al., 2000). Employee involvement will result in overcoming some of the cognitive hurdles, positively impacting the successful implementation of quality management systems (Das et al., 2008).

Education and training

The education and training of employees and the encouragement of skill improvement also can impact organizational climate (Chapman & Hyland, 1997). Ahire et al. (1996) suggested that knowledge of quality concepts, tools and techniques are essential for employees to understand and solve quality issues. Das et al. (2008) suggest that employees are valuable resource in implementing quality systems and hence their training and development should be viewed as a necessary investment. Training empowers employees and is thus a pre-condition for a higher degree of employee involvement (Hietschold et al., 2014). The consistent message in quality literature suggests training and development as a critical factor for success for quality management systems within a firm.

Rewards and recognition

Quality programs are generally perceived by employees as befitting the organization rather than themselves (Daily & Bishop, 2003). A good reward and recognition system is an important management tool to influence employee attitudes (Mohrman et al., 1996) and may in turn, increase their likelihood of involvement in quality programs. Employees need to feel that their personal quality goals are in sync with organizations quality goals (Zhang et al., 2000). Furthermore, employees tend to choose between maximizing organizational quality goals and their personal short term goals based on how they are rewarded (Sinclair & Zairi, 1995). For this reason, employee rewards and recognition is an important dimension for successful implementation of quality initiatives.

Communication

Effective communication of quality policy ensures a strong orientation of employees towards the quality goals and objectives of the organizations (Maletic et al., 2014). Regular interactions between management and employees on quality outcomes and continual improvements can also increase the opportunity for success of quality initiatives (Gatchalian, 1997). Another important component of communication is regular reporting of quality data. This activity is one of the most critical success factors and reflects a positive quality culture where employees, supervisors and management have a better understanding of quality issues and successes (Antony et al., 2002). Thus, the communication of quality principles is closely linked with positive quality outcomes.

Conclusions

The concepts of quality management are gaining popularity in the bulk commodity handling and processing industry. While critical success factors of quality management have been investigated, most of them have focused on hard factors and studies in a manufacturing industry environment (Hietschold et al., 2014). Very little work has explored the human factors in the bulk commodity handling and processing industry (Lunning & Marcelis, 2007; Mosher et al., 2013).

This study identified five critical dimensions of quality systems implementation based on a literature review. The findings of this study will be used to build, test, and validate a survey instrument for measuring quality climate in the bulk commodity handling and processing industry.

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Management

Impact of Ineffective Order Fulfillment on Customer Behavior: A Stochastic Approach

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Abstract

As online retailers increasingly face supply chain risks related to an order delivery glitch resulting in a late or delayed delivery of the ordered product, there exists the urgent need for more practical models to help managers grasp an overall picture of the negative impacts of an order delivery glitch on future customer purchase behavior with the retailer. Yet, despite the need, extant deterministic models about a delivery glitch in online retailing cannot provide nuanced insights into how to assess and mitigate the negative impacts of late order delivery. The reason for this is that the deterministic models do not account for the variability of the variables in the model. To overcome the shortcomings of the deterministic approach, the authors present a stochastic model based on a Monte Carlo simulation that allows the variables in a model to fluctuate within the realistic range of values. The multiple model outcomes of the simulation provide a better understanding of the effects of order delivery glitches on future customer purchase behavior.

Introduction

Supply chains require highly coordinated flows of goods, services, information, and cash within and across firms in a supply chain (Manuj & Mentzer, 2008). As the probability and the severity of supply chain risk that interrupts the smooth flow within a supply chain increase in today's globalized and highly competitive environment, research on supply chain risk management has grown in importance to provide firms with a quantitative and qualitative tool to identify, assess, manage, and mitigate risks associated in the supply chain process. In particular, many online retailers recently experience serious supply chain risks related to an order delivery glitch resulting in a late or delayed delivery of the ordered product (Rao, Griffis, & Goldsby, 2011). With limited face-to-face interaction with the consumer, the online retail industry faces further pressure to minimize service failures and to achieve competitive advantage through successful order fulfillment. However, as shown in Keaveney's (1995) finding that nearly 60% of customers who defected to a competitor did so because of a service failure, service failures in online retailing, particularly late delivery, have been noted as a severe problem which can seriously

reduce the customer's intent to make a repeat purchase or future purchases with the retailer. Against this backdrop, online retailers have the urgent need for realistic models to help managers grasp an overall picture of the negative impacts caused by late delivery of the ordered product. To respond to the need, the authors in this paper review the existing deterministic models that investigate the negative effects of an order delivery glitch on future customer order frequency and order value, and further present a more realistic and practical stochastic model that allows the variables in a model to fluctuate. The outcomes of the stochastic model will provide new insights into how to mitigate the negative effects of order glitches.

Literature Review

Williamson (1975) determined that the market price of a product is not the sole criterion contributing to purchase choice and that "transaction cost economics" played a critical role in the way customers evaluate all the costs associated with the transaction. Reichheld and Schefter (2000) determined that both the performance of the product and the order fulfillment performance are critical factors that drive customer satisfaction. Often times, no matter the platform in which the online retailers operate, whether it be within the business-to-business (B2B) platform or business-to-consumer (B2C) platform, they have little control over the product quality or performance, leaving order fulfillment as the main source in which the online retailer controls in the customer satisfaction process. Alba, Lynch, Weitz, Janiszewski, Lutz, and Wood (1997) determined that online retail success is contingent upon how effectively they are able to deliver products to customers.

In addition, there have been numerous studies that addressed the effect of successful order fulfillment or effective service experience on customer satisfaction. Harris, Greval, Mohr, and Bernhardt (2006) determined that increased satisfaction in a service transaction leads to an increase intention towards maintaining loyalty with the service company. Adversely, when customers' expectations are not met, customers experience dissatisfaction and negative disconfirmation which leads to reduced intent for repeat purchases (McCollough, Berry, & Yadav, 2000). This leads customer to enact distributive justice. Rohm and Swaminathan (2004) studied the impact of retailers that achieve world-class order fulfillment on customer satisfaction and loyalty, and found a positive correlation. De Koster (2003) argued that order fulfillment is the most critical operation for Internet retailers and that those online retailers who outperform the competition in this regard have much to gain (Grewal, Iyer, & Levy, 2004).

Research has shown that the effectiveness with which online retailers fulfill orders is a significant determinant of customer satisfaction and retention (Lee & Whang, 2001; Boyer & Hult, 2005). Whereas Rabinovich and Bailey (2004) studied the link between successful order fulfillment and customer behavior, Rao et al. (2011) addressed the effect of ineffective order fulfillment, referred to as order fulfillment glitches, and its impact on future customer purchase behavior. Rao et al. (2011) concluded that customers who experienced an order delivery glitch had a post-glitch order frequency lower than their pre-glitch frequency, and that customers who experienced an order delivery glitch had a post-glitch order value lower than the pre-glitch order value.

Additionally, the magnitude of decrease in post-glitch order frequency from its pre-glitch level is positively related with glitch magnitude (operationalized as the number of days delivered late) (Rao et al., 2011). It was also determined that that the magnitude of decrease in post-glitch order size (measured by US$) from its pre-glitch level is positively related with glitch magnitude (Rao et al., 2011).

Prediction model of order fulfillment-impacted customer behavior

As a way of explaining a general approach on how the existing models can be improved, the authors used the research conducted by Rao et al. (2011) to formulate a prediction model to estimate customer behaviors impacted by order fulfillment performance. It measures the impact of the magnitude of a delivery glitch has on 1) a customer's order frequency and 2) order value (US$). The following section describes this prediction model in detail.

Rao et al. (2011) studied 237 customers who experienced a delivery glitch over a 24 month period when purchasing from an online retailer specializing in the printed material industry (educational books, magazines, etc.). The study collected data from the customer's purchase behavior 12 months prior to experiencing a delivery glitch (late delivery), followed by the 12 months after they experienced the delivery glitch. They utilized a control group made up of customers that did not experience a delivery glitch while shopping during the same time period. From this work, we extracted the following regression models to predict the order frequency and order size, respectively, as shown below.

$$\text{Order frequency} = 7.965 - 0.495\,X1 + 0.009\,X2 + 0.021\,X3 \quad \text{(Eq. 1)}$$

$$\text{Order size} = 40.91 - 0.411\,X1 + 0.108\,X2 + 0.041\,X3 \quad \text{(Eq. 2)}$$

In Eq. 1, the constant 7.965 is the customer's average order frequency per year. And for every day an order is delivered late (X1), there is a reduction of 0.495 in the order frequency. The coefficient value of 0.009 was determined as the impact the customer's past order history (X2) has on the order frequency, and 0.021 serves as the effect of the value (US$) of the glitched (late) order (X3) has upon the order frequency. The unit of the order frequency is in the number of orders per year.

In Eq. 2, the constant value of 40.91 refers to the average order value (US$) per customer purchase order. And there will be a reduction of 0.411 for every day the delivery is late (X1). The coefficient 0.108 is the impact that the customer's past purchase history (X2) has on the order size, and 0.041 is the effect of the order size (US$) of the late delivery (X3) has upon the order size. The unit of the order size is in the order value (US$) per customer purchase order.

Deterministic approach of the existing models

As Manuj and Mentzer (2008) noted, "probabilities and consequences of risks need to be estimated with reasonable accuracy to gain maximum benefits… hence future research (in supply chain) should develop tools

and techniques to assign probabilities to the event…"(p. 149). This is particularly true for the models reviewed earlier in the literature section, including the Rao's model. The Rao's model, for example, predicts the changes in order frequency and the order size deterministically. This means that the regression models are not capable of incorporating the variability of the variables. To illustrate this, a case of the total order value calculation is presented in Table 1.

Table 1. Total Order Value Calculation Based on Order Glitches

	Order Frequency Model (# of Orders/ Year)	4.905	
b0	Customer's Average Order Frequency (# of orders/year)	7.965	
b1	Coefficient for 'Glitch Magnitude' Variable (X1)	-0.495	
X1	'Glitch Magnitude' (# of days late on delivery)	7	days
b2	Coefficient for 'Customer Purchase History' Variable (X2)	0.009	
X2	'Customer Purchase History' (# of orders)	10	orders
b3	Coefficient for 'Glitched Order Value'	0.021	
X3	'Glitched Order Value' ($/order)	15	$/ order
	Order Size Model ($/ Order)	39.728	
b0	Customer's Average Order Size ($/order)	40.91	
b1	Coefficient for 'Glitch Magnitude' Variable (X1)	-0.411	
X1	'Glitch Magnitude' (# of days late on delivery)	7	days
b2	Coefficient for 'Customer Purchase History' Variable (X2)	0.108	
X2	'Customer Purchase History' (# of orders)	10	orders
b3	Coefficient for 'Glitched Order Value'	0.041	
X3	'Glitched Order Value' ($/order)	15	$/ order
	Total Order Value Model ($/ Year)	194.9	

The case is based on the following data to estimate the order frequency and the order size: 7 days of the late delivery (X1); 10 orders of the customer purchase history (X2); and $15/order of the glitched order value (X3). Using these values and the regression models in Eq. 1 and Eq. 2, the order frequency is estimated to be 4.9 orders/ year and the order size to be $39.7/ order. Therefore, in case where there is a 7-day order glitch, the models predict the total order value to be $194.9/ year (= 4.9 orders/ year * $39.7/ order). Without the order glitch, the total order value would have been $325.8/ year (= 7.9 orders/ year * $40.9/ order). This implies the reduction of $130.9 in the total order value due to the order glitch. However, the regression models did use the average deterministic values for the variables. In particular, the glitch magnitude variable (X1) may have the mostly likely value at 7 days but it should represent all the possible range of values around it. Most likely it is a distribution of the number of days late on delivery as shown in Figure 1, for example. The distribution shows

the realistic spread of the glitch magnitude where any value between the minimum and the maximum can be chosen according to its probability. It is this random nature of the variables that the Rao's regression and other similar models do not account for.

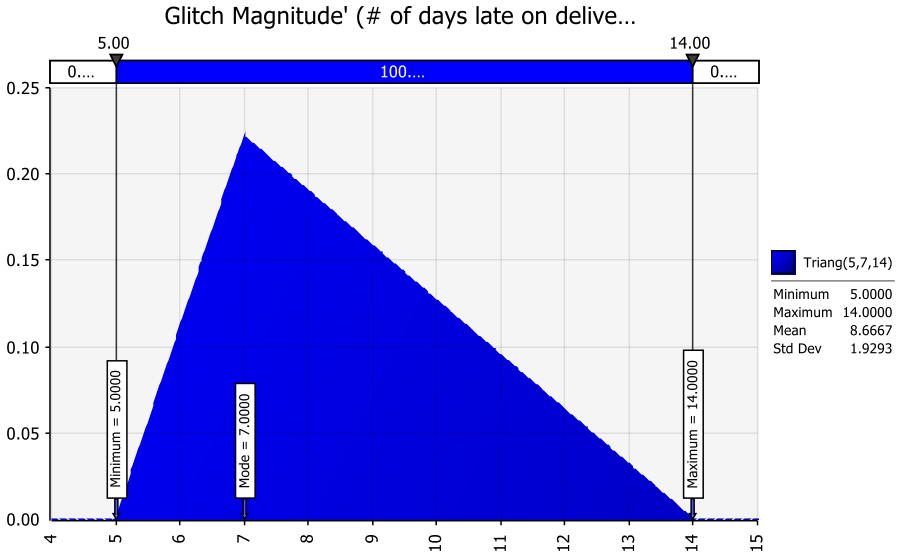

Figure 1. Input Distribution (Triangular) for the 'Glitch Magnitude' Variable

Stochastic approach: Monte Carlo simulation

To overcome the shortcomings of the deterministic approach of the existing prediction models such as the Rao's, the authors present a practical alternative methodology called a Monte Carlo (MC) simulation in this paper. It is a stochastic method that allows the variables in a model to fluctuate according to their natural distributional characteristics and present multiple model output instances with their varying degree of probabilities. As a result, a MC simulation provides an overall picture of the model outcome for decision makers to use in quantifying the risks instead of one single outcome value.

As an example of how the MC simulation would complement the existing prediction models, the case presented in the earlier section was revisited using the @Risk Monte Carlo simulation software by Palisade. It allows the variables to take on their distributions as inputs instead of deterministic average values. For example, the simulation defined the distribution of the glitch magnitude shown in Figure 1 (and the distribution of other variables) and randomly chose the values, ran the model, and recorded the output of this particular instance as a scenario. Eventually it compiled a great number of such scenarios (i.e., simulation iterations) and presented the distribution of the total order value as an outcome as shown in Figure 2.

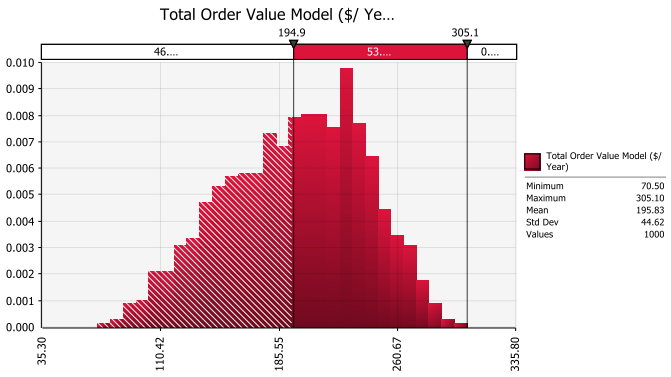

Figure 2. Probability of Achieving the Deterministic Total Order Value at $194.9

As shown in the figure, the model outcome is not one single prediction on the total order value ($194.9/ year) as in the previous section but it reports the range of possible total order values based on the 1,000 iterations of simulation. In addition, the simulation includes the probability related to a range of outcome values. Specifically, from the figure, a manager can estimate that there is about 46% chance that the total order value could be lower than $194.9/ year (recall that the Rao's deterministic regression model estimated the total order value to be $194.9 with 100% certainty).

As an additional illustration, Figure 3 below shows a simulation outcome used by a manager who wants to increase the confidence level of the predicting the total order value outcome. At the 95% confidence level, the manager now realizes that he or she anticipates the total order value could go down as low as $118.3/ year.

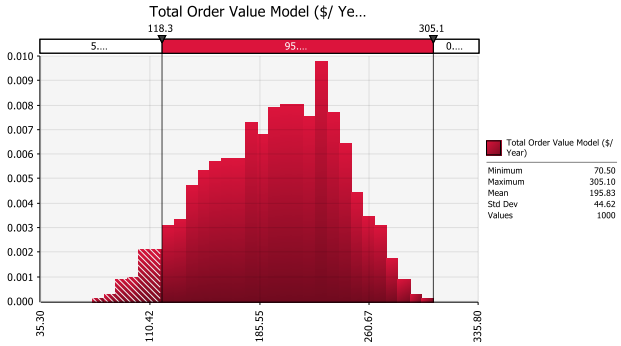

Figure 3. Probabilistic Total Order Value ($118.3) at 95% Confidence

If the manager assumes a much higher variation of the glitch magnitude variable as shown in Figure 4, the simulation presents its impacts on the total order value as shown in Figures 5 and 6.

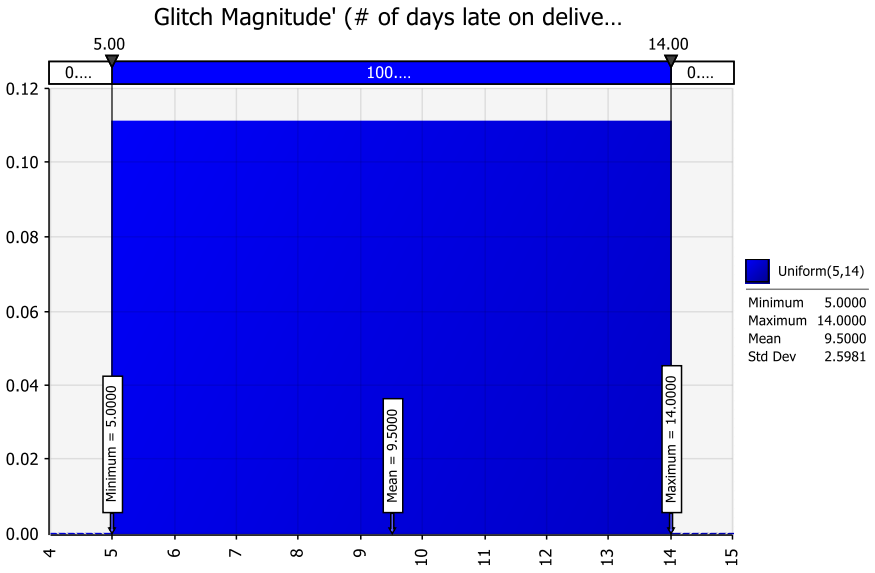

Figure 4. Input Distribution (Uniform) for the 'Glitch Magnitude' Variable

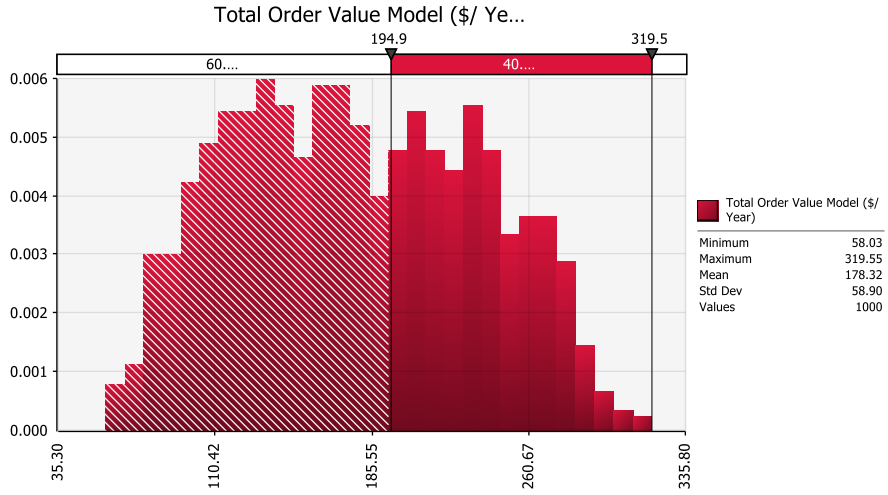

Figure 5. Probability of Achieving the Deterministic Total Order Value at $194.9

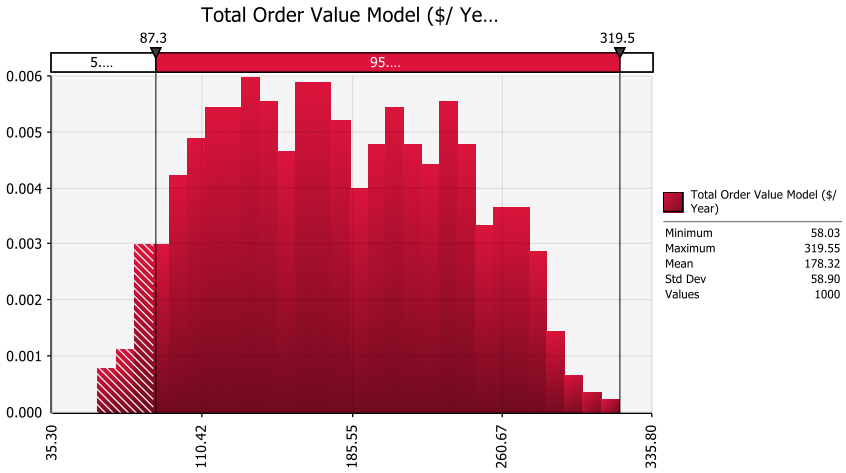

Figure 6. Probabilistic Total Order Value ($87.3) at 95% Confidence

Figure 4 shows a uniform distribution using the same range as the triangular distribution of Figure 1 but it represents much higher uncertainty. As a result, as shown in Figure 5, now the manager faces much higher chance (60%) that the total order value could be lower than $194.9/ year. At the 95% confidence level, the manager has to expect that the total order value could go down as low as $87.3/ year as shown in Figure 6. Therefore, the simulation makes it possible for the manager to realize that reducing the variation of the glitch magnitude is as much important as reducing its average value. With only the deterministic model, this conclusion would not be easily understood.

Conclusion and Limitation

In the online retailing industry where successful order delivery fulfillment is one of the key sources of competitive advantage, managers need a more practical model to simultaneously demonstrate the outcomes of the delivery glitch magnitude that varies within all possible range of values according to each value's probability. To respond to the need, the stochastic model based on a MC simulation in this research provides new insights into how to effectively mitigate the negative effects of the delivery glitch magnitude. The findings of the stochastic model suggest that in order to effectively reduce the negative impacts of the delivery glitch magnitude on customer purchase behavior with the retailer, online retailing managers should pay more attention to lowering the variation of the glitch magnitude. In other words, managers can curtail substantial amount of the negative impacts of the delivery glitch magnitude by improving consistency, reliability, and certainty of order delivery. Although the results of our stochastic model provide more nuanced understanding, future researchers can extend the stochastic model in an attempt to obtain the whole picture of the negative effects of the delivery glitch. For example, the results in the paper are based on the realistic assumption that the delivery glitch magnitude variable mainly fluctuates between 5 and 14 days. However, given that customers may be quite

sensitive to whether or not the order is delivered on time, allowing the delivery glitch magnitude to vary between 1 and 5 days and examining the subsequent effects could provide interesting insights to online retail managers.

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Manufacturing

A Study of Temperature and Humidity Effects on Desktop 3D Printers

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Abstract

The objective of this study is to experiment using the additive manufacturing process and to study the dimensional accuracy of the parts produced by open source 3D printing. The parts produced in this study are made for various temperature and humidity levels that could be experienced in the environment where a 3D printer may be used. The technique used for sample creation utilizes an open source MOST RepRap Prusa Mendel 3D printer (MOST RepRap build, 2013). The samples produced at various temperature and humidity conditions were measured for dimensional accuracy. Results show that the error in sample volume decreases as humidity is increased. Based on the results recommendations such as strategic cooling of parts could result in greater dimensional accuracy.

Introduction

3D printing has gained in popularity during the recent years at an accelerated rate especially due to the affordability of the open source hardware and software available to the public. The Replicating Rapid Prototype (RepRap) 3D printer (See Appendix 1) can be obtained for as little as $500 in purchased components taking within 2-3 days to assemble and commission, which has made 3D printing accessible to high schools and individuals rather than solely industry or higher education (RepRap, 2013) (Wittbrodt et al., 2013). Numerous resources are available for how to construct, operate and how to configure the open source software, although little research has been undertaken to analyze what preprocessing settings are optimal for producing accurate parts in differing environmental conditions.

These RepRap desktop printers are mobile enough to use in various environmental conditions needing only a power source, which could be from an alternative energy source in the middle of a jungle or desert. In more practical situations the 3D printers can be operated in an office, classroom, or large auditorium during all seasons of the year subjected to varying degrees of temperature and humidity. Most commercial 3D printers hold the plastic material in humidity controlled enclosures and the printing chamber is temperature and humidity regulated to ensure part dimensional accuracy. The RepRap 3D printers are completely open to the environment where in most areas of the country temperature and humidity is low during the winter compared to summer.

These environmental fluctuations can cause the 3D printer to either fail altogether or the plastic material may solidify at a varied rate causing part inaccuracies. This study can assist in preprocessing settings for a given temperature and humidity level in order to achieve parts with high dimensional accuracy.

The concept of Rapid prototyping originated in the 1980's with the growth in Computer Aided Design and Manufacturing. This technology is different from the conventional subtractive machining operations such as milling, turning etc. and instead uses the concept of layer by layer addition of material in order to make the desired part. As stated by Pratt et al., 2002 the additive manufacturing process has the following advantages:

1. It is an option that a Design Engineer has before he starts the creation of the actual model. It is helpful in creating a prototype and then testing it before actually manufacturing the original part.
2. With recent advances in the field of additive manufacturing, it is now possible to manufacture one off and small batch production parts.

There are various additive manufacturing processes available in the market today such as Laminated Object Manufacturing, Photopolymer Solidification, Powder Solidification and Fused Deposition Modeling. During the course of this project one such Fused Deposition Modeling technique will be analyzed using open source 3D printers.

Fused Deposition Modeling

Fused Deposition Modeling (FDM) is an additive manufacturing technique developed by Stratasys founder Scott Crump 20 years ago (Stratasys, 2014). FDM is an advanced rapid prototyping technique that is commonly used to create prototypes from a concept.

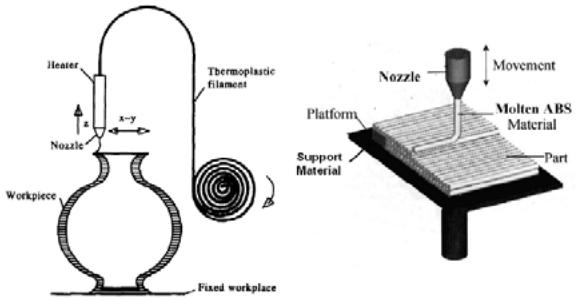

Figure 1. Fused Deposition Modeling (Yan, 1996)

During FDM the part is created layer by layer (See Figure 1). The printer extrudes a single bead of molten plastic and lays down these beads side by side following the G-code created. As the beads are extruded the printer completes one layer and then the extruder head moves upward in the Z direction to begin the next layer. The process continues until all the layers have been completed. The process of 3D printing in the course of the

project was performed in the following sequential order: (For Detail Software Settings, See Appendix 2).

1. First the part is modeled in the Siemens software NX 8.5. The part file produced is then saved in the stereo-lithography or the .stl format.
2. The second step involves the use of an open source software called "Cura" which is a slicing program used to create the various layers that the model is composed. The Cura software is used to generate machine operation G-code for the model that is saved as .gcode format.
3. After the G-code is generated it is sent to the open source software "Repitier" which is used for sending the G-code to the 3D printer. When the "PRINT" command is given in the Repitier software the nozzle and the print bed on the 3D printer are heated to create the required part.

Background

The process of investigating the dimensional accuracy of 3D printed parts involves setting the environmental conditions to a particular state and analyzing the dimensional data of the samples produced. The analysis is focused on the dimensions of 10mm size cubes which are produced with 100% fill setting in the Cura software. The parts created by 3D printing are analyzed for dimensions, volume and area of the top face which are compared to the original volume of 1000mm^3 and area of 100mm^2. Controlled temperature and humidity are achieved by placing the 3D printer in a temperature and humidity enclosure. The Thermotron Corporation SM16C environmental chamber equipped with a 2800 controller and a Do-It-Yourself (DIY) chamber are used (See Appendix 3-4).

An important variable in the 3D printing process is the creation of the part with an optimum print speed and amount of plastic extruding at all times. Since plastic has different volume in the melt stage than the solid stage the user should consider this aspect. During 3D printing it is important to calibrate the printer for dimensionally accurate results. This can be done using the number of extruder motor steps per mm of filament. In this study the printer has been calibrated to 1050 steps per mm for the extruder motor. In older versions of Cura the flow rate value cannot be changed in real time, so the "Print Speed" setting in Cura becomes an important parameter that needs to be varied.

Methodology

The following data gathering methodology was used:

1. The 3D printer is placed inside the environmental chamber.
2. The chamber is programmed as per the required temperature and humidity values.
3. The 3D printer is started to produce the sample.
4. The 10mm cube sample is removed from the chamber.

5. After 24-48 hours allowing sufficient time to cool the sample is measured.
6. The data for the samples is recorded and comparisons are made between the sample and the standard volume of 1000mm3.

The process was first performed using 3mm PLA filament (Phase1) and then repeated using 1.75mm filament (Phase2). After the Phase1 of the study the Thermotron chamber became non-functional due to issues with the humidity sensor. The DIY chamber became the environmental chamber for the remainder of the project during Phase2 (See Appendix 3-4). Phase2 of the study focuses on obtaining samples over a wider temperature range.

Results

During Phase1 the following data was observed for temperatures of 19-27° Celsius:

Table 1 - 30 % humidity

Temperature	Dimension 1	Dimension 2	Dimension 3(Height)	correction	volume	Volume deviation	area	Area deviation
19	10.538	10.838	10.033	9.833	1123.04	123.0352291	114.211	14.210844
20	10.803	10.944	10.125	9.925	1173.41	173.4132176	118.228	18.228032
21	10.575	10.554	10.906	10.706	1194.88	194.8811363	111.609	11.60855
22	10.763	10.689	10.128	9.928	1142.17	142.1737791	115.046	15.045707
23	10.684	10.588	10.041	9.841	1113.24	113.2354915	113.122	13.122192
24	10.506	10.494	10.508	10.308	1136.46	136.4566289	110.25	10.249964
25	10.68	10.468	10.811	10.611	1186.29	186.2911246	111.798	11.79824
26	10.417	10.209	11.378	11.178	1188.75	188.7484762	106.347	6.347153
27	10.485	10.628	11.521	11.321	1261.55	261.5508802	111.435	11.43458

Table 2 - 40 % humidity

Temperature	Dimension 1	Dimension 2	Dimension 3(Height)	correction	volume	Volume deviation	area	Area deviation
19	10.672	10.471	10.572	10.372	1159.03	159.0348225	111.747	11.746512
20	10.467	10.603	10.667	10.467	1161.64	161.6444177	110.982	10.981601
21								
22								
23	10.481	10.955	10.533	10.333	1186.43	186.4283952	114.819	14.819355
24	10.792	10.625	10.193	9.993	1145.85	145.847345	114.665	14.665
25	10.62	10.773	10.26	10.06	1150.96	150.9571556	114.409	14.40926
26	10.828	10.738	10.626	10.426	1212.24	212.2421133	116.271	16.271064
27								

Table 3 - 50 % humidity

Temperature	Dimension 1	Dimension 2	Dimension 3(Height)	correction	volume	Volume deviation	area	Area deviation
19	10.969	11.354	10.115	9.915	1234.83	234.8341878	124.542	24.542026
20	10.669	10.953	10.307	10.107	1181.08	181.0793286	116.858	16.857557
21								
22	10.845	10.635	10.095	9.895	1141.26	141.2554096	115.337	15.336575
23	10.567	10.802	10.089	9.889	1128.78	128.7772745	114.145	14.144734
24	9.836	10.941	10.213	10.013	1077.56	77.55576379	107.616	7.615676
25								
26	10.774	10.545	10.129	9.929	1128.05	128.0518601	113.612	13.61183
27	10.663	10.852	10.096	9.896	1145.11	145.1144129	115.715	15.714876

Table 4 - 60 % humidity

Temperature	Dimension 1	Dimension 2	Dimension 3(Height)	correction	volume	Volume deviation	area	Area deviation
19	10.679	10.769	10.173	9.973	1146.92	146.9164519	115.002	15.002151
20								
21	10.898	10.634	10.224	10.024	1161.67	161.674664	115.889	15.889332
22	10.826	10.607	10.315	10.115	1161.52	161.5194289	114.831	14.831382
23								
24	11.071	10.988	10.326	10.126	1231.81	231.8091466	121.648	21.648148
25	10.838	11.19	10.029	9.829	1192.03	192.0337954	121.277	21.27722
26								
27	10.764	10.61	10.949	10.749	1227.6	227.600724	114.206	14.20604

❖ *The missing data values were due to the samples found to be faulty.*

During Phase2 the following data was observed for temperatures of 15-40º Celsius:

Table 5 - 30 % humidity

Temperature	Humidity	Dimension 1	Dimension 2	Height	Area	Area Deviation	Volume	Volume Deviation
15	30	10.044	10.046	10.35	100.902	0.902024	1044.34	44.3359484
16	30	9.706	9.74	9.957	94.53644	-5.46356	941.299	-58.700667
17	30	9.761	9.773	10.006	95.39425	-4.605747	954.515	-45.485104
18	30	9.922	9.851	9.951	97.74162	-2.258378	972.627	-27.373119
19	30	9.741	9.98	9.717	97.21518	-2.78482	944.64	-55.360096
20	30	9.795	9.765	9.823	95.64818	-4.351825	939.552	-60.447977
21	30	9.852	9.914	10.176	97.67273	-2.327272	993.918	-6.0823199
22	30	9.846	9.823	10.307	96.71726	-3.282742	996.865	-3.1352218
23	30	9.895	9.814	9.722	97.10953	-2.89047	944.099	-55.901149
24	30	9.834	9.917	9.861	97.52378	-2.476222	961.682	-38.318025
25	30	9.852	9.74	9.851	95.95848	-4.04152	945.287	-54.713014
26	30	9.755	9.76	9.889	95.2088	-4.7912	941.52	-58.480177
27	30	9.798	9.843	9.832	96.44171	-3.558286	948.215	-51.785068
28	30	9.73	9.741	9.845	94.77993	-5.22007	933.108	-66.891589
29	30	9.745	9.718	9.968	94.70191	-5.29809	943.989	-56.011361
30	30	9.668	9.702	9.838	93.79894	-6.201064	922.794	-77.206068
31	30	9.694	9.717	9.784	94.1966	-5.803402	921.62	-78.380485
32	30	9.738	9.689	9.785	94.35148	-5.648518	923.229	-76.770749
33	30	9.751	9.696	9.918	94.5457	-5.454304	937.704	-62.295787
34	30	9.826	9.714	9.899	95.44976	-4.550236	944.857	-55.142786
35	30	9.715	9.739	9.895	94.61439	-5.385615	936.209	-63.79066
36	30	9.834	9.733	9.996	95.71432	-4.285678	956.76	-43.239637
37	30	9.83	9.804	9.944	96.37332	-3.62668	958.336	-41.663706
38	30	9.791	9.776	9.484	95.71682	-4.283184	907.778	-92.221717
39	30	9.891	9.844	9.525	97.367	-2.632996	927.421	-72.579287
40	30	9.686	9.985	10.142	96.71471	-3.28529	980.881	-19.119411

Table 6 - 40 % humidity

Temperature	Humidity	Dimension 1	Dimension 2	Height	Area	Area Deviation	Volume	Volume Deviation
15	40	9.85	9.85	10.123	97.0225	-2.9775	982.159	-17.841233
16	40	9.79	9.764	9.873	95.58956	-4.41044	943.756	-56.244274
17	40	9.79	9.722	9.876	95.17838	-4.82162	939.982	-60.018319
18	40	9.927	9.796	9.857	97.24489	-2.755108	958.543	-41.4571
19	40	9.927	9.82	9.809	97.48314	-2.51686	956.212	-43.78788
20	40	9.725	9.864	9.812	95.9274	-4.0726	941.24	-58.760351
21	40	9.772	9.885	9.843	96.59622	-3.40378	950.797	-49.203407
22	40	10.049	10.092	9.001	101.4145	1.414508	912.832	-87.168013
23	40	9.84	9.911	10.209	97.52424	-2.47576	995.625	-4.3750338
24	40	9.92	9.962	10.195	98.82304	-1.17696	1007.5	7.5008928
25	40	10.011	9.937	10.164	99.47931	-0.520693	1011.11	11.1076763
26	40	9.743	9.741	9.867	94.90656	-5.093437	936.443	-63.556943
27	40	9.809	9.75	9.952	95.63775	-4.36225	951.787	-48.213112
28	40	9.873	9.816	9.586	96.91337	-3.086632	929.012	-70.988454
29	40	9.653	9.611	9.711	92.77498	-7.225017	900.938	-99.06214
30	40	9.807	9.785	9.645	95.9615	-4.038505	925.549	-74.451381
31	40	9.786	9.704	10.354	94.96334	-5.036656	983.25	-16.749536
32	40	9.695	9.712	9.937	94.15784	-5.84216	935.646	-64.353544
33	40	9.79	9.799	9.737	95.93221	-4.06779	934.092	-65.908071
34	40	9.844	9.83	9.67	96.76652	-3.23348	935.732	-64.267752
35	40	9.871	9.813	9.657	96.86412	-3.135877	935.417	-64.583164
36	40	9.874	9.781	9.715	96.57759	-3.422406	938.251	-61.748674
37	40	9.912	9.802	9.899	97.15742	-2.842576	961.761	-38.23866
38	40	9.737	9.893	9.646	96.32814	-3.671859	929.181	-70.818752
39	40	9.86	9.818	9.598	96.80548	-3.19452	929.139	-70.861003
40	40	9.762	9.785	9.938	95.52117	-4.47883	949.289	-50.710613

Table 7 - 50 % humidity

Temperature	Humidity	Dimension 1	Dimension 2	Height	Area	Area Deviation	Volume	Volume Deviation
15	50	9.714	9.843	9.984	95.6149	-4.385098	954.619	-45.380818
16	50	9.653	9.783	9.898	94.4353	-5.564701	934.721	-65.27941
17	50	9.788	9.877	10.051	96.67608	-3.323924	971.691	-28.30876
18	50	9.841	9.955	9.556	97.96716	-2.032845	936.174	-63.825867
19	50	9.834	9.805	9.631	96.42237	-3.57763	928.644	-71.356155
20	50	9.766	9.747	9.935	95.1892	-4.810798	945.705	-54.295278
21	50	9.846	9.758	10.019	96.07727	-3.922732	962.598	-37.401852
22	50	9.858	9.939	9.292	97.97866	-2.021338	910.418	-89.582273
23	50	9.919	9.974	10.259	98.93211	-1.067894	1014.94	14.9444755
24	50	9.873	9.907	10.383	97.81181	-2.188189	1015.58	15.5800336
25	50	9.903	9.846	10.136	97.50494	-2.495062	988.31	-11.689948
26	50	9.759	9.757	9.856	95.21856	-4.781437	938.474	-61.525843
27	50	9.946	9.851	9.324	97.97805	-2.021954	913.547	-86.452699
28	50	9.689	9.657	10.369	93.56667	-6.433327	970.193	-29.807168
29	50	9.682	9.693	9.663	93.84763	-6.152374	906.85	-93.15039
30	50	9.89	9.633	9.719	95.27037	-4.72963	925.933	-74.067274
31	50	9.851	9.757	9.823	96.11621	-3.883793	944.15	-55.850499
32	50	9.66	9.701	9.907	93.71166	-6.28834	928.401	-71.598584
33	50	9.717	9.744	9.947	94.68245	-5.317552	941.806	-58.19369
34	50	9.755	9.747	9.953	95.08199	-4.918015	946.351	-53.649003
35	50	9.683	9.664	10.024	93.57651	-6.423488	938.011	-61.989044
36	50	9.769	9.803	9.978	95.76551	-4.234493	955.548	-44.451771
37	50	9.755	9.648	9.933	94.11624	-5.88376	934.857	-65.143388
38	50	9.737	9.867	9.667	96.07498	-3.925021	928.757	-71.243178
39	50	9.92	9.955	9.698	98.7536	-1.2464	957.712	-42.287587
40	50	9.725	9.965	9.562	96.90963	-3.090375	926.65	-73.350166

Table 8 - 60 % humidity

Temperature	Humidity	Dimension 1	Dimension 2	Height	Area	Area Deviation	Volume	Volume Deviation
15	60	9.762	9.877	9.971	96.41927	-3.580726	961.397	-38.603419
16	60	9.691	9.743	9.954	94.41941	-5.580587	939.851	-60.149163
17	60	9.807	9.749	9.983	95.60844	-4.391557	954.459	-45.540914
18	60	9.835	9.73	9.675	95.69455	-4.30545	925.845	-74.155229
19	60	9.998	9.763	9.644	97.61047	-2.389526	941.355	-58.644589
20	60	9.977	10.039	9.554	100.1591	0.159103	956.92	-43.07993
21	60	9.843	9.752	9.862	95.98894	-4.011064	946.643	-53.357113
22	60	9.825	9.761	9.948	95.90183	-4.098175	954.031	-45.968645
23	60	9.887	9.825	10.163	97.13978	-2.860225	987.232	-12.768467
24	60	9.832	9.923	10.183	97.56294	-2.437064	993.483	-6.5166227
25	60	9.78	9.792	9.908	95.76576	-4.23424	948.847	-51.15285
26	60	9.807	9.828	9.366	96.3832	-3.616804	902.725	-97.274986
27	60	9.93	9.91	9.346	98.4063	-1.5937	919.705	-80.29472
28	60	9.884	9.839	9.527	97.24868	-2.751324	926.488	-73.511864
29	60	9.728	9.799	9.651	95.32467	-4.675328	919.978	-80.021591
30	60	9.719	9.691	10.113	94.18683	-5.813171	952.511	-47.488598
31	60	9.75	9.86	10.007	96.135	-3.865	962.023	-37.977055
32	60	9.641	9.765	9.997	94.14437	-5.855635	941.161	-58.838783
33	60	9.805	9.831	9.924	96.39296	-3.607045	956.604	-43.396315
34	60	9.822	9.826	9.948	96.51097	-3.489028	960.091	-39.908851
35	60	9.64	9.707	9.865	93.57548	-6.42452	923.122	-76.87789
36	60	9.799	9.781	9.968	95.84402	-4.155981	955.373	-44.626819
37	60	9.666	9.675	9.973	93.51855	-6.48145	932.66	-67.339501
38	60	9.7	9.993	9.799	96.9321	-3.0679	949.838	-50.162352
39	60	9.729	9.643	9.833	93.81675	-6.183253	922.5	-77.499927
40	60	9.715	9.672	9.813	93.96348	-6.03652	922.064	-77.936371

Analysis Phase1

The analysis of the data of the project is done to study the variation in parameters of volume and cross sectional area of the sample cube. To perform the analysis the data was analyzed for constant humidity with varied temperature. Since the most samples were produced for 30% RH, the analysis was restricted to these samples. During the analysis the following trends were observed:

The overall trend indicates that the dimensional accuracy is increasing as the temperature increases from the 19° to 27° Celsius.

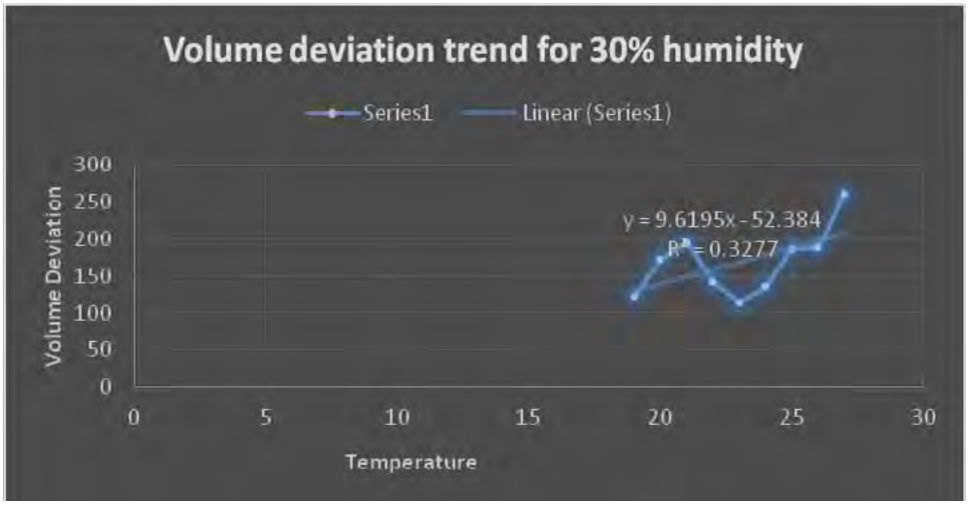

Figure 2. Variation in Volume with Temperature

The trend indicates that there was an increase in the volume due to the height dimension of the samples at the high end of the temperature range.

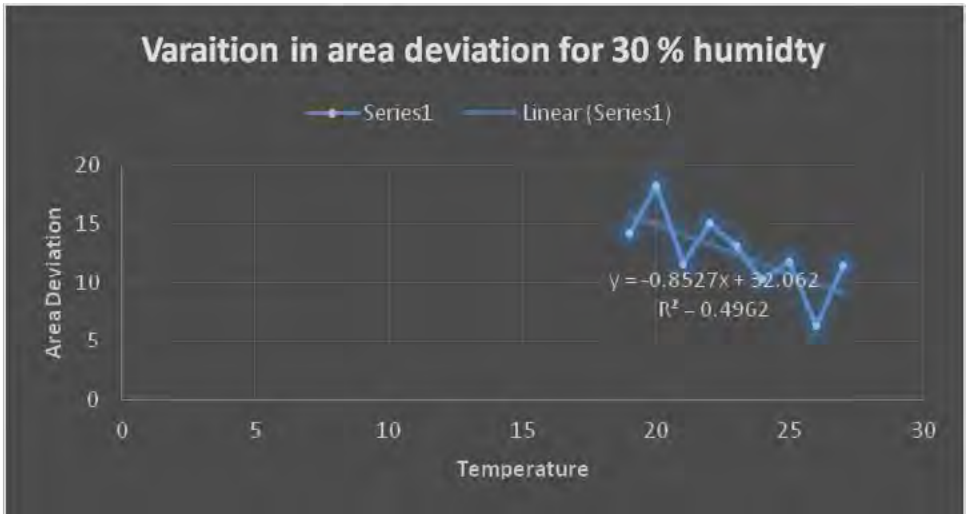

Figure 3. Variation in Area with Temperature

A reverse trend was observed for deviation in cross sectional area as indicated in the area deviation graph. This was due to the decrease in the dimension 1 and 2 with the increase in temperature.

Analysis Phase2

For Phase2 of the study further investigation of the samples is done by creating samples in the DIY chamber that had a MOST RepRap Prusa Mendel with a nozzle diameter of 0.25mm extruding 1.75mm filament. The following

is analysis of variation in area and volume at the humidity levels of 30%, 40%, 50% and 60% at increasing temperatures from 15° to 40° Celsius. The samples in Phase2 provided a more comprehensive set of data to analyze.

The following trends are observed for the humidity level of 30%:

The area deviation for the samples shows a trend consistent with the Phase1 results that a decreasing trend is observed. More importantly since dimensional accuracy is critical, the band in which area deviation lies at 30% humidity illustrates that the area deviation varied from 0.902 mm2 to -6.201 mm2 (See Figure 4).

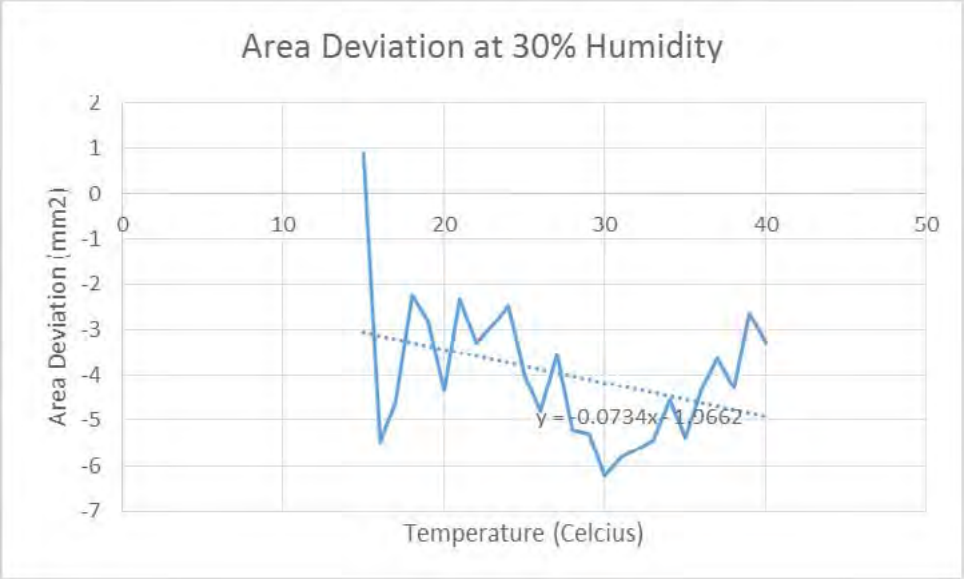

Figure 4. 30% Humidity - Variation in Area with Temperature

Hence the percentage of error in the crossectional area could be computed as (0.902+6.201)/100 * 100 = 7.103 % error in area. This was the maximum error that could be found in samples produced by 3D printing when samples were made at 30% humidity.

Similarly the volume deviation trend could also be studied which as observed in the graph has a decreasing trend. The error range in the volume of a sample = 44.336+92.221 = 136.557 mm3. Thus percentage error in a sample created at 30% humidity level = 136.557/1000*100 = 13.65%.

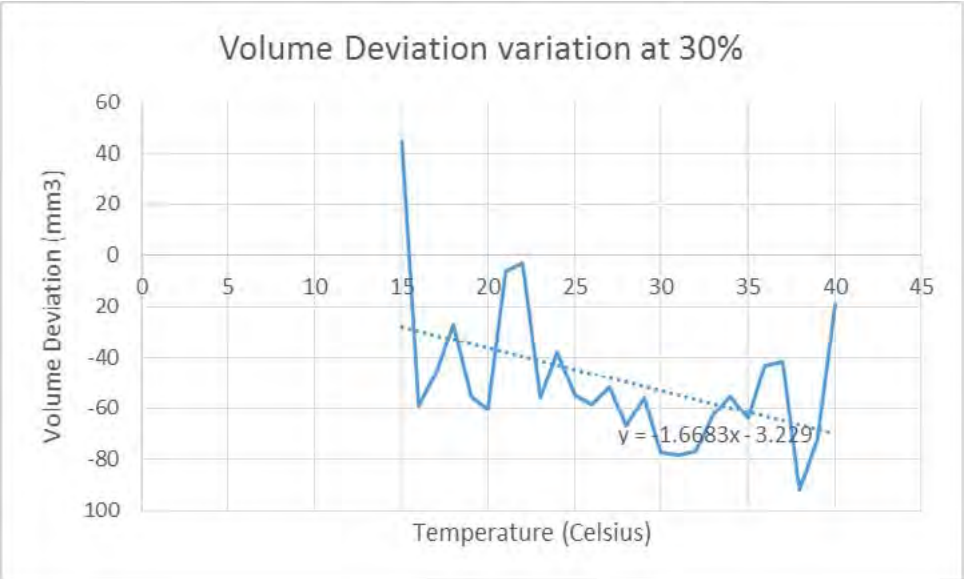

Figure 5. 30% Humidity - Variation in Volume with Temperature

The following trends are observed for the humidity level of 40%:

For the humidity level of 40% a similar decreasing trend in the cross sectional area was observed. The Area Deviation lies between 1.414 mm2 to -7.225mm2. The range in which the Area deviation lies = 1.414+7.225 = 8.369 mm2. The percentage error in cross sectional area in a sample created at 40% humidity = (1.414+7.225)/100*100= 8.369%.

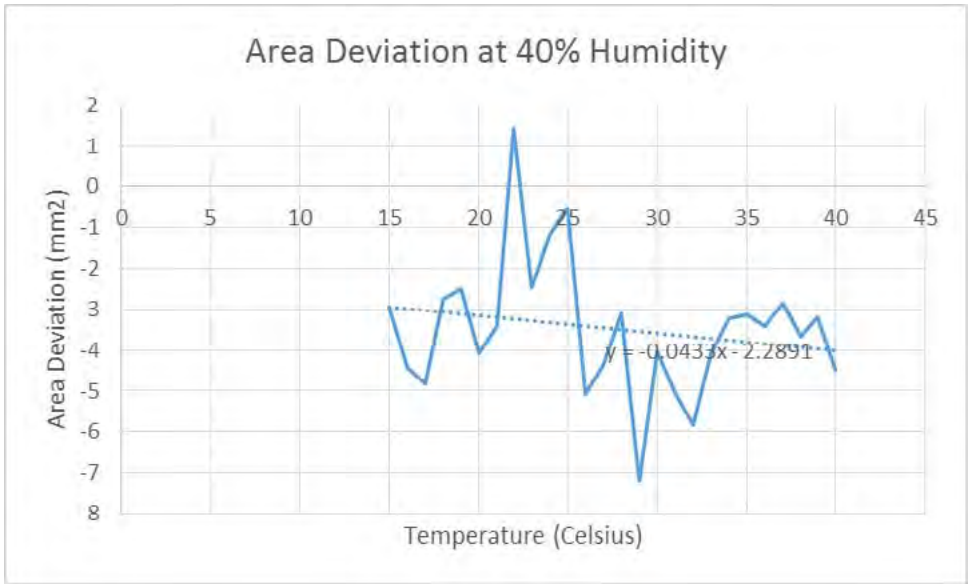

Figure 6. 40% Humidity - Variation in Area with Temperature

Similarly the volume deviation has a decreasing trend as observed in the trend for 40% humidity level. The error observed in the volume was in the range of 11.017 mm3 to -99.062 mm3. The error percentage in the volume = (11.017+99.062)/1000*100 = 11.08%.

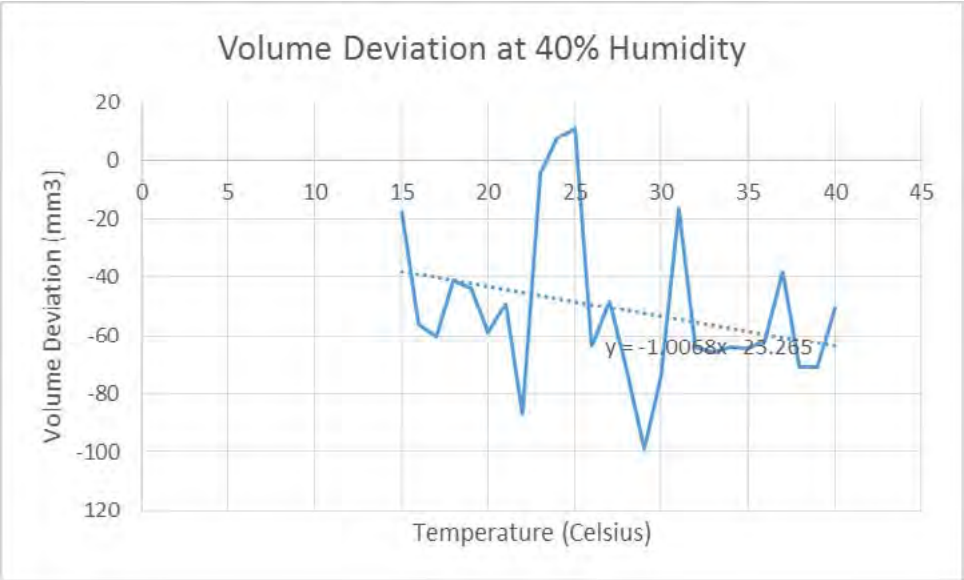

Figure 7. 40% Humidity - Variation in Volume with Temperature

The following trends are observed for the humidity level of 50%:

The area deviation as observed earlier displays a decreasing trend. The area deviation is in the range of -1.067mm2 to -6.433mm2. Hence the percentage error in area = 5.366%

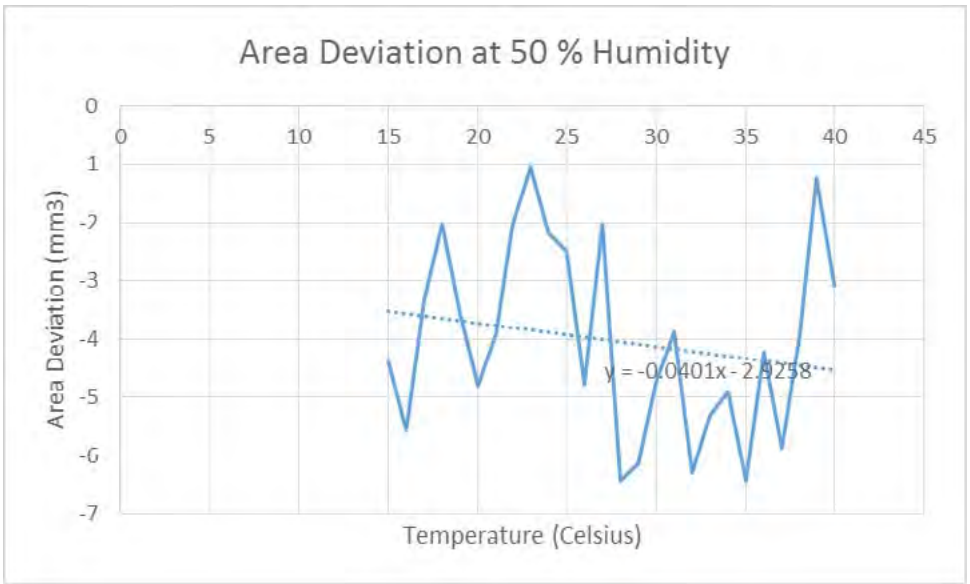

Figure 8. 50% Humidity - Variation in Area with Temperature

The volume deviation again shows a decreasing trend. The volume deviation is in the range of 15.58 mm3 to -93.15 mm3. Thus the percentage of error in volume = (15.58+93.15)/1000*100 = 10.87%.

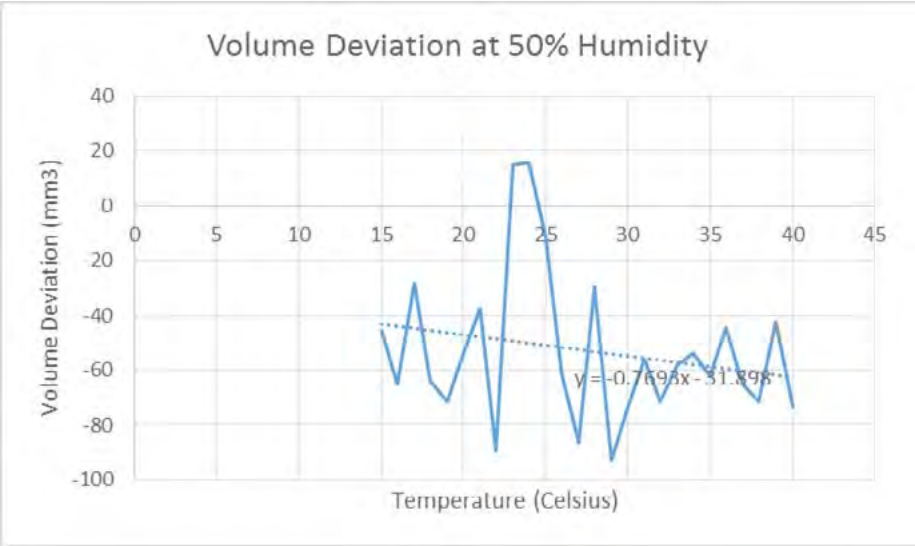

Figure 9. 50% Humidity - Variation in Volume with Temperature

The following trends are observed for the humidity level of 60%:

The area deviation also showed a decreasing trend. The range in which the error in cross sectional area lies is in a range of 0.159 mm2 and -6.481 mm2. The percentage error in cross sectional area at 60% humidity = (0.159+6.481)*100/100 = 6.641%.

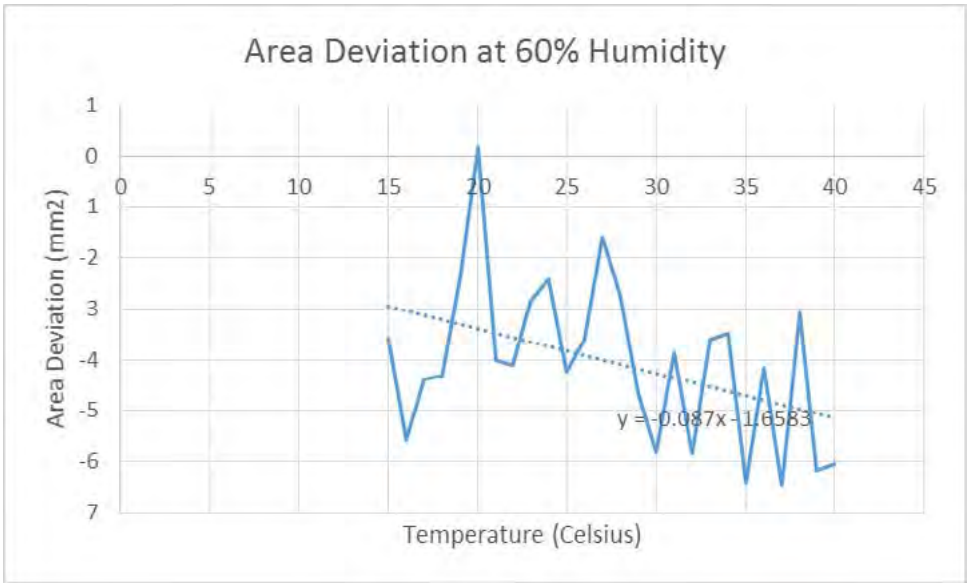

Figure 10. 60% Humidity - Variation in Area with Temperature

The volume deviation or the error in volume lies in the range of -6.516 mm3 to -97.275 mm3. The percentage error in the volume of the sample produced by 3D printing = 9.07%

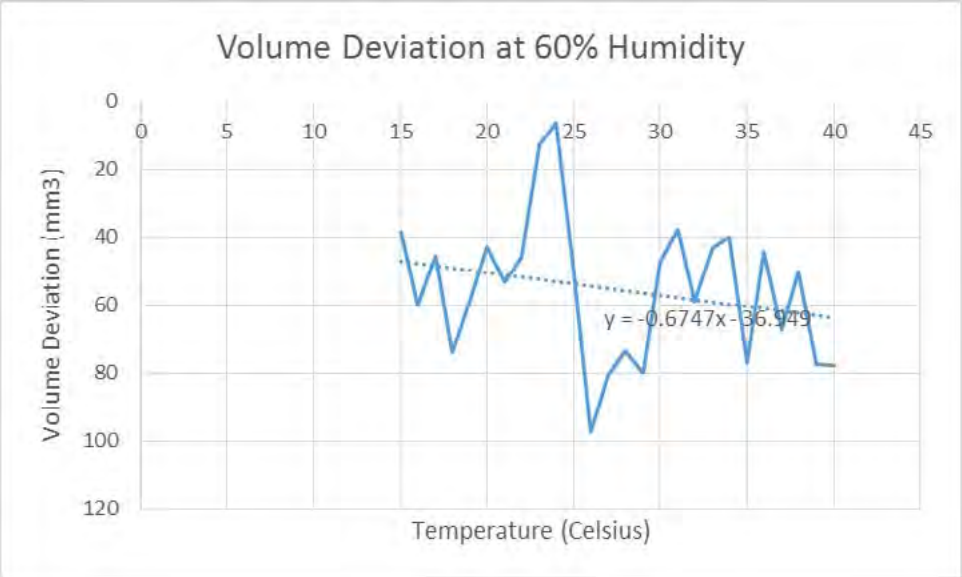

Figure 11. 60% Humidity - Variation in Volume with Temperature

Table 5. Percent Error - Variation in Area and Volume with Temperature

	Percentage error in Area	Percentage error in Volume
30% Humidity	7.103%	13.65%
40% Humidity	8.369%	11.08%
50% Humidity	5.366%	10.08%
60% Humidity	6.641%	9.07%

Based on the trends observed in phase2 the deviation from the calibrated area of 100mm2 and volume of 1000mm3 decreases as the temperature rises. This is true at all levels of humidity from 30% to 60%. The least percent error in area and volume occurs with samples produced at 50% and 60% humidity.

Discussion

During the analysis certain variations in the data were observed. Further investigation of the literature gives reason for the following factors that account for these variations. The plastic extruded from the nozzle cools slowly inside the chamber and the plastic absorbs moisture while cooling. The absorption of moisture is due to the hydrophilic nature of PLA as indicated by Ndazi and Karlsson, 2011. This is due to the presence of the polar oxygen linkages. Since plastics have a tendency to shrink, by increasing the humidity the volume of the part can be increased in such a manner that the error in volume decreases.

The phenomenon of thermal expansion of plastic while samples are produced by 3D printing clearly is indicated by an increasing trend in terms of volume as the temperature increases. The reason for the increased volume is the increasing size as the samples are progressively being produced for increasing temperatures. Like all materials plastics undergo thermal expansion, but in case of plastics the amount of expansion is almost negligible thus contribution of thermal expansion is the least.

Temperature and humidity control due to the experimental equipment such as the Thermotron chamber and DIY chamber are not consistent when it comes to maintaining a specific temperature and humidity level. The fluctuations in these temperature and humidity levels affect the flow of the plastic that is extruded through the nozzle. This is clearly visible in most of the data trends that were observed because the dimension values show significant fluctuations in the values.

Cooling issues are the major reason for the inaccuracy of the sample increasing in height. If the data is observed carefully just for 30% humidity the sample cross sectional area is decreasing, but the height of the sample is increasing. Different shrinkage across the sample exists because the difference in the shrinkage of the plastic layers. For example in the case of the samples created, the beads in the interior of the sample cool later in contrast to the beads at the periphery that cool first. This will result in the formation of voids inside the sample. This phenomenon was clearly visible in the increase in the height of the sample at 30% RH with increase in temperature. The samples made inside a chamber have cooling issues due to air not being circulated inside the chamber because it was observed that in the Thermotron chamber the samples have a bulge at the back.

Recommendations

In view of the issues experienced during the data collection process, the following recommendations are advised.

1. Additional Cooling Fans - In order to address the problem of cooling in the chambers further experiments were conducted by placing an additional fan facing the bulge. The fan directed to bulge would greatly reduce it. Thus the samples would have greater dimensional accuracy just by placing extra cooling fans. The extra fans could be added parallel to the "x" axis of the 3D printer in order to tackle the bulge produced at the back of the samples.
2. Better equipment to control temperature and humidity - The use of a better temperature and humidity controls would help in greatly reduce the fluctuations in the environmental conditions. This would ensure uniformity of the samples and would prevent the introduction of unwanted errors in the parts produced by 3D printing.
3. Fan mount for better circulation in the DIY chamber - The use of a fan at the top of the DIY chamber would help improve the air circulation. A fixture for the fans could be manufactured by 3D printing.

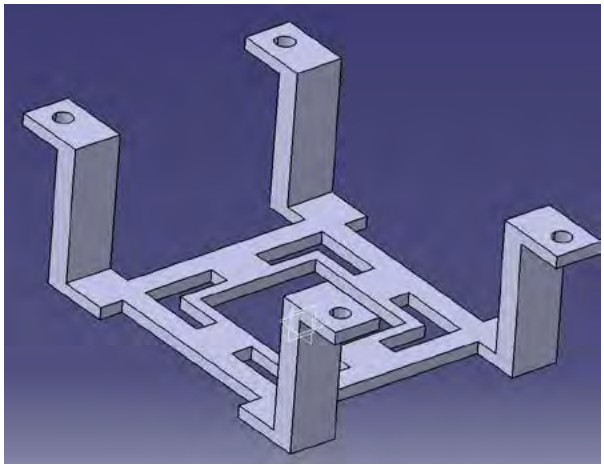

Illustration 1. Fan Mount

The L shaped slots are made to accommodate the fans of different sizes that are available. By the implementation of the above recommendations there would be a considerable decrease in the error in the sample dimensions. The implementation of this innovation would also help in improving the efficiency in the environmental chamber.

Conclusions

The process of creating 3D Printed parts offer a valuable insight on plastic properties. The project also helped in learning about the environmental control chambers and offered the opportunity to design a DIY environmental chamber. During the analysis of the samples the emphasis was mainly on the effect of temperature and humidity, however there are other parameters that could be investigated such as the layer thickness, the flow rate etc. For example, samples created at room temperature of 21° Celsius and at 30% RH with an increased flow rate have better dimensional accuracy than samples created at 100% flow rate. It could be concluded from the results that shrinkage exists in majority of the samples created by 3D printing which is a characteristic of plastic materials. However the major issue addressed was that the error in sample volume decreases as humidity is increased.

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Appendix 1- 3D Printer

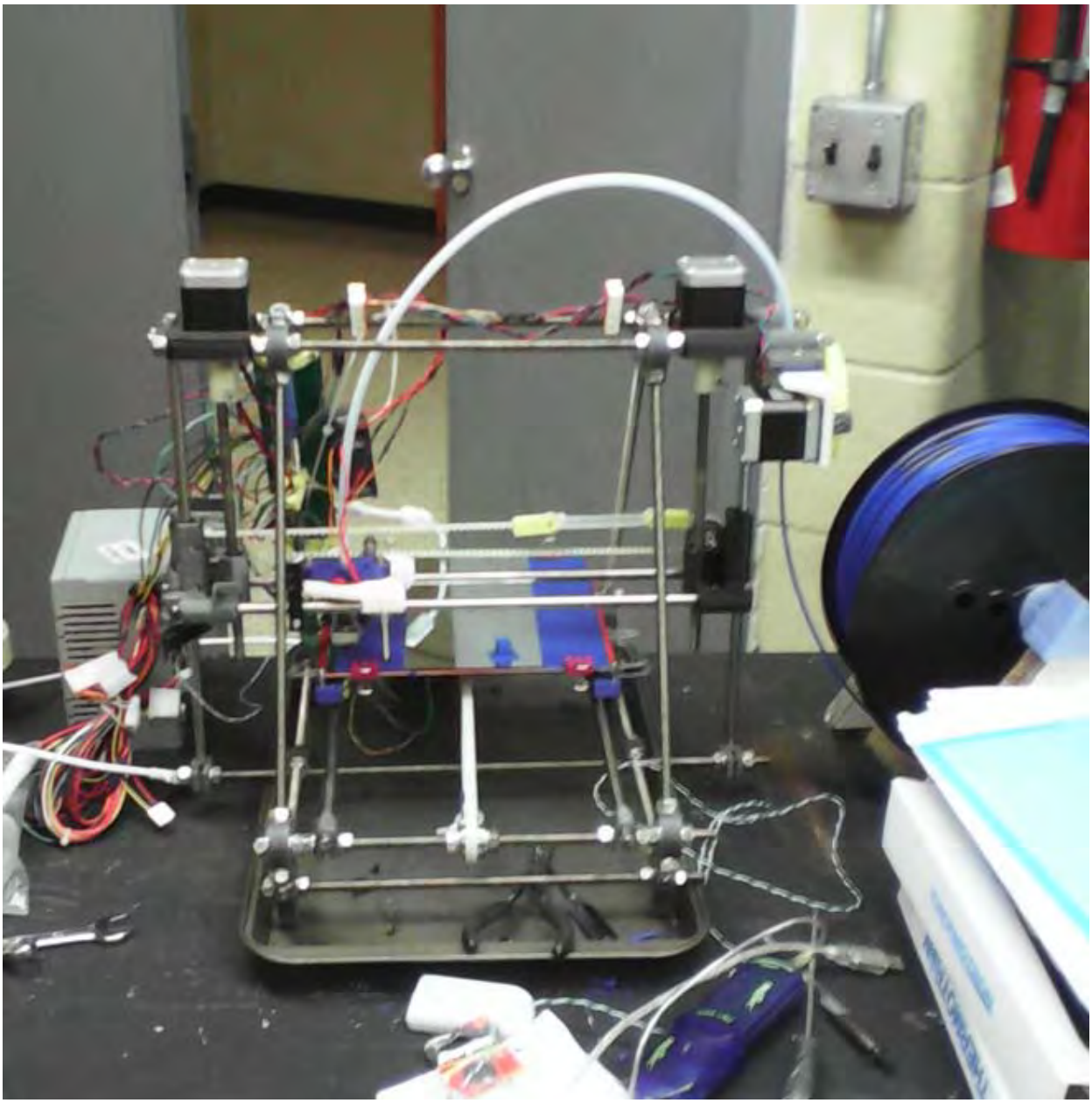

Illustration 2. The MOST RepRap Prusa Mendel

A brief description of the 3D printer parts is as follows:

Nozzle- It is an Aluminum part where the plastic PLA is heated prior to being extruded through an orifice.

Bowden Cable- It is the flexible tube which has the filament moving back and forth through it.

Hobbed Bolt – The bolt has teeth cut on it and its purpose is to push the filament into the extruder.

Drive Gear – It is a gear that is attached to the Hobbed bolt and is used to transmit drive from the DC motor to the Hobbed bolt.

Limit Switch- There are 3 limit switches used in the machine which are used to control the motion that is produced by the 4 stepper motors.

Belt Drives- They are 2 in number and are used to control the motion of the Bed that is the y axis movement and the Extruder movement which is the x axis movement.

M8 Bolts – The printer consists of 2 M8 bolts which are connected to the 2 stepper motors for the vertical motion of the extruder. Then 6 other M 8 bolts are used for the assembly of the printer.

Controller- The Arduino controller was used for the printer and this controller controls the heating element situated below the bed, the nozzle temperature, the x axis, y axis and z axis movements.

Bed- The bed is made out of glass and has a heating element situated below it which controls the bed temperature. The bed is kept at an elevated temperature for the plastic to adhere to it.

Appendix 2 – Software

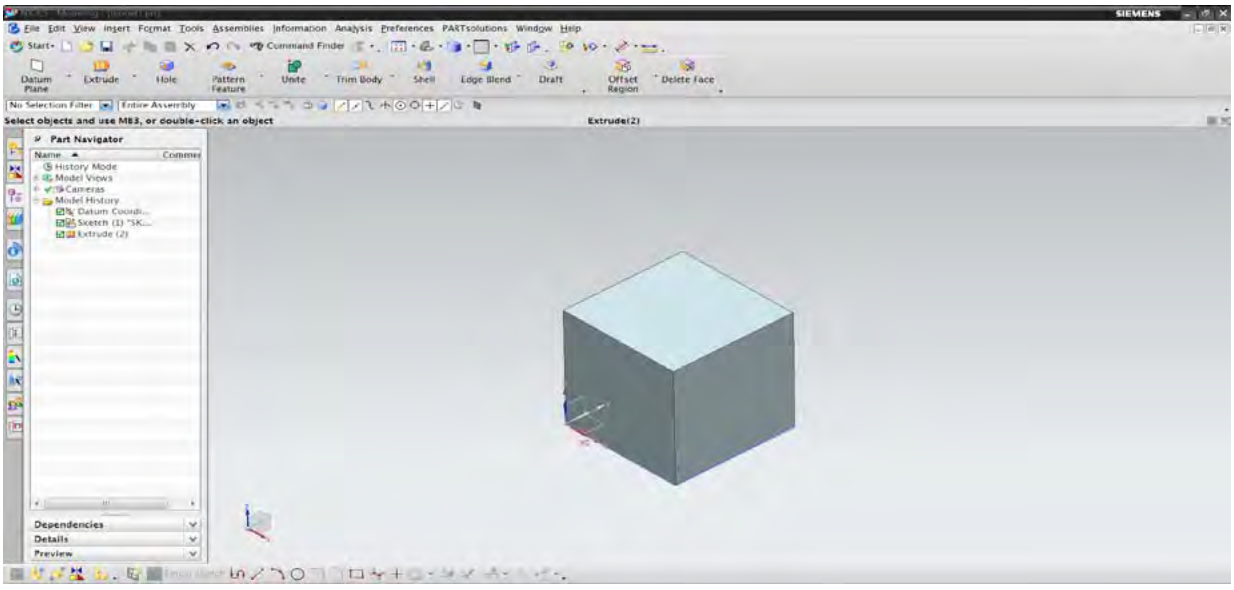

Illustration 3. Siemens NX8.5 Software - Sample Cube

A 3D solid model is created in the CAD software and exported in the .stl format. The cube was used as the shape for calibration, because it consists of sharp edges making it easier to detect dimensional irregularity.

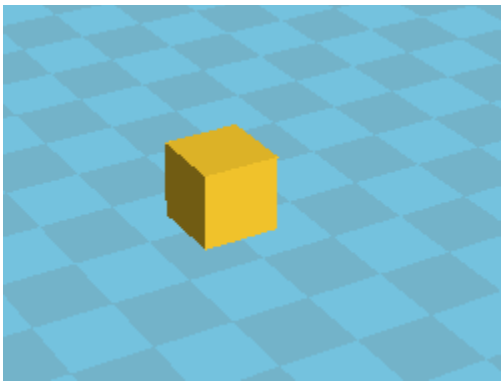

Illustration 4. Cura Software - Sample Cube

The following parameters are set in CURA:

1. The print speed is 50mm/s and the filament flow is 100 percent.

2. For the purpose of creating solid cubes the fill density is 100 percent, because otherwise there are voids inside the sample which would cause a change in the dimension values.

3. As per the user convenience the remaining parameters can be chosen keeping in mind that too high a retraction speed could leave marks on the part as the extruder completes printing the final layer. The retraction distance is an important parameter as the retraction distance is the distance the extruder is away from the part when the operation is completed. A retraction distance of at least 15mm is recommended.

4. Filament Diameter should also be checked with the material being used and verified as the volume calculations in the printer, which determine the flow rate would go wrong if a wrong value of the filament diameter is used. For this project the filament diameter setting is 2.89mm and 1.75mm.

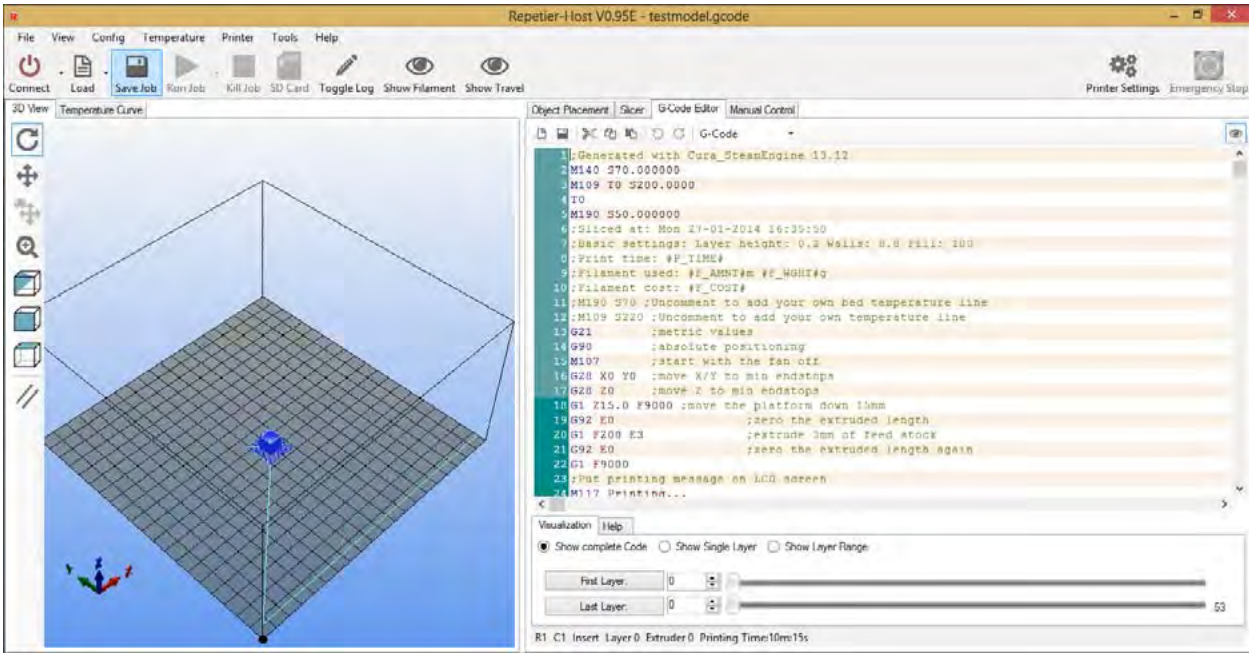

Illustration 5. Repitier Software - Sample Cube

The printer operation can briefly be described as follows:

1. The Repetier software command M105 is sent to the Controller and the connection is established between the software and the printer.

2. The G-codes are sent one by one in a sequential order to the printer and initially the bed is heated, for this project 50º Celsius was used.

3. The G-code for heating extruder is set for this project at 185º Celsius as it is the melting point of Poly Lactic Acid.

4. Once the temperature of the bed and the extruder equal the set point values, the printer starts to extrude the plastic and the plastic is laid down on the bed.

5. The first operation is the creation of the raft which is a net shaped structure that acts as an adhesive to the bed and prevents the part from moving during the printing operation.

6. The first layer has a thickness value of 0.5mm and the subsequent layers have a thickness value of 0.25mm each.

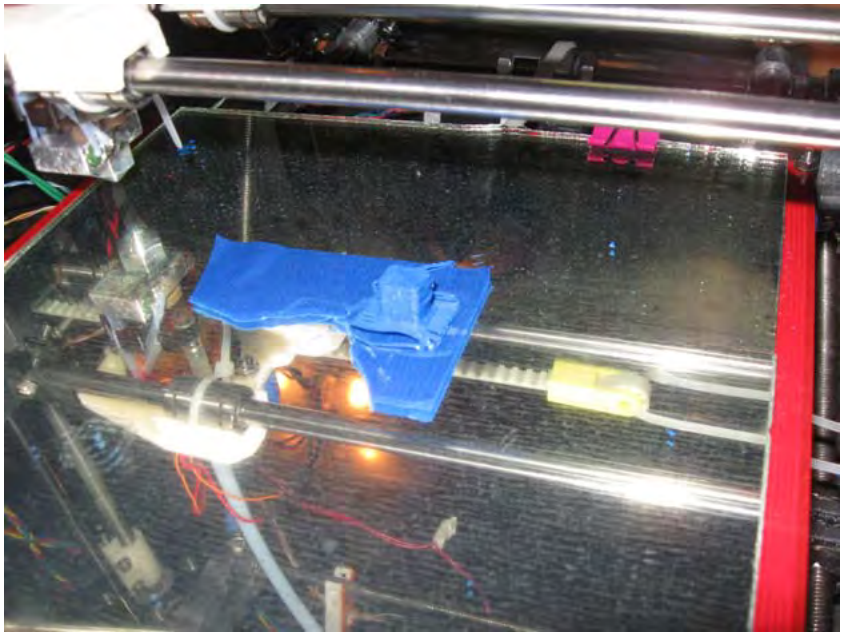

Illustration 6. 3D Printed - Sample Cube

Appendix 3 - Thermotron Chamber

1. Thermotron SM16 Chamber - This was the insulated 16 cubic foot chamber that was used to maintain the specific temperature and humidity for the print operation.

Illustration 7. Thermotron SM16

2. S2800 Controller - The instrument consists of 2 thermocouples. The dry bulb thermocouple measures the temperature whereas the wet bulb thermocouple was used to measure the humidity level. The programming to maintain a given temperature and humidity level was done using the S2800 controller.

3. Omega Logger – This instrument tracks the temperature and humidity values inside the Thermotron chamber. Using the 2800 controller the Thermotron chamber did not stabilize at a particular temperature and humidity level, hence it was necessary to make sure that printing was performed at the temperature and humidity level shown by the Omega Logger.

4. Micrometer - This instrument is used to measure the dimensions of each sample cube. The dimensions obtained were used to obtain the cross sectional area of the part obtained. Also the dimensions were used to check for Volume.

Appendix 4 - DIY Chamber

Since the Thermotron chamber has many maintenance and spare part issues a similar chamber was created to continue with the ongoing testing. For the purpose of creating a similar chamber a donated dishwasher was used. The internal components of the dishwasher were removed completely and the following equipment was installed.

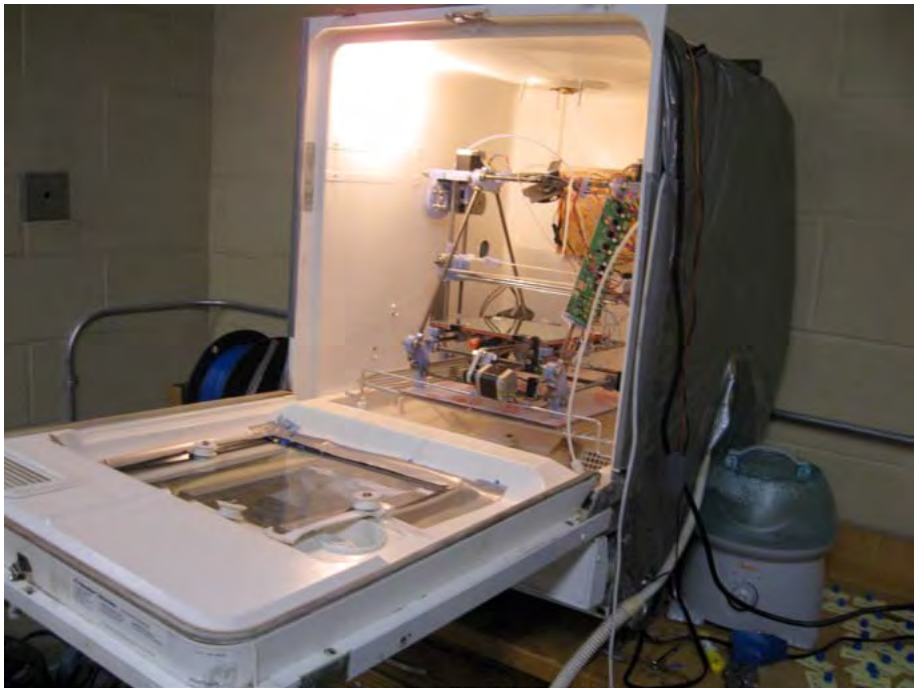

Illustration 8. DIY Environmental Chamber

1. Fans - The chamber contains fans to serve the purpose of air circulation to prevent parts of the chamber from having high temperature and humidity and to maintain temperature and humidity parameters uniform throughout the chamber. Also, to cool the samples, as it was noticed that the samples produced by 3D printing had a bulge on one side. This was because of non-uniform shrinkage in plastics.

2. 12 Watt Light Bulb - The purpose of this bulb was to illuminate the chamber so that the observer outside can look at the sample being made, but also added heat.

3. Humidifier - This was used to supply humid air to the chamber.

4. Humidity Controller - The controller works in conjunction with the Humidifier and maintains the humidity level inside the chamber.

5. Air Conditioner - The purpose of the Air Conditioner is to cool the chamber to 15^{o} Celsius. The current capacity of the system is cooling the chamber to 13.5^{o} Celsius. A flexible hose was attached at the outlet of the air conditioner which allowed air to be blown directly into the chamber.

Manufacturing

Perceptions of Manufacturing Management Knowledge and the Four Pillars Topical Track: Manufacturing

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Selected after Peer Review as the "Best ATMAE 2014 Conference Proceedings Paper"

Introduction

In June 2011, a group of manufacturing educators in cooperation with the Society of Manufacturing Engineers (SME) developed Curriculum 2015, a four-year strategic plan to reverse negative trends in manufacturing education and improve manufacturing competitiveness. Within this effort, the Four Pillars of Manufacturing Engineering were formally introduced and supported by the Society of Manufacturing Engineers (SME), the Association of Technology, Management, and Applied Engineering, (ATMAE), and the Accreditation Board for Engineering and Technology (ABET). The Four Pillars consist of foundational areas that represent the SME Certified Manufacturing Engineer Body of Knowledge. It embodies the fundamental knowledge practiced by manufacturing professionals and is the recommended content for academic programs related to manufacturing. One of its foundational areas is manufacturing management.

Management curriculum is what distinguishes four-year manufacturing programs from two-year programs across ATMAE accredited programs. It also distinguishes the discipline from traditional engineering programs. The required knowledge and competencies for an entry-level manufacturing manager are important. Hence, these competencies and knowledge sets should be well understood and agreed-upon by ATMAE accredited manufacturing program faculty and students.

Manufacturing education should provide excellent training and prepare students for entry-level positions in industry. The interests of students and faculty in manufacturing education strongly affect how well they are prepared to meet the challenges in industry. This research sought to capture the perceptions of an ATMAE accredited manufacturing program. Alumni, students and faculty of the program were surveyed regarding the Four Pillars manufacturing foundational areas and the knowledge required for entry level manufacturing managers. Specifically, the research addressed the following:

- What fundamental knowledge is most important for an entry-level manufacturing manager?
- What fundamental knowledge is comprehensively covered in manufacturing education programs?

- Is the manufacturing management knowledge specified by the Four Pillars model congruent with what is being taught and what is perceived as important for an entry-level manufacturing manager?

Literature Review

According to the Manufacturing Institute (2010), manufacturing is critical to economic security since it pays wages higher on average than other industries, creates the highest number of jobs directly and indirectly, and contributes to more than 50 percent of total U.S. exports. The critical nature of manufacturing to economic security infers that it is critical to national security as well given that a vibrant and innovative manufacturing base underpins defense and homeland security. Advocates of manufacturing promote competency-based education and industry-education partnerships to ensure that schools teach the latest skills required by industry. Efforts are now starting at making manufacturing attractive to talented skilled workers.

The shortage of skilled workers to fill positions in manufacturing indicates that manufacturing is facing a crisis. The reduction in investments, interest, and support for Science, Technology, Engineering, and Mathematics (STEM) fields have also had a negative impact. The existence of a skills gap between what manufacturers want and the available skills in the workforce has been a hindrance to hiring and has created an inability to fill job openings even during the recession (Morrison et al., 2011). However, a renewed interest in reviving manufacturing competiveness as a way to turn around current economic conditions has provided opportunities for manufacturing education. Recommendations include equipping students with strong STEM foundations, consistent manufacturing curricula, and faculty development (Society of Manufacturing Engineers, 2012).

According to Mott, Jack, Raju, & Stratton (2011) manufacturing program developers should incorporate the concept of the Four Pillars in designing curricula and provide a means of communicating the nature of academic preparation and performance to students, employers, and any other entity. The authors suggested that the Four Pillars could prove useful in addressing the gaps in existing programs, as it would require the development of materials for use in classrooms, laboratories, and design projects in order to be disseminated appropriately.

Manufacturing Knowledge and Skills

Sullivan (2012) conducted a study to understand what skills manufacturers seek most in hiring college graduates. The researcher found a shift in focus from the traditional skill set of engineering curricula to those that emphasize people skills and an understanding of cross-functional relationships between disciplines. The study also showed that manufacturers are increasingly placing an emphasis on outside certifications in an attempt to reduce in-house training costs. Overall, manufacturers look toward academic institutions to provide employees with a suitable combination of human skills, work experience, and technical competence. However, the needs of industry are not only about new graduates, but also about the need to maintain the skills and competencies of experienced engineers and technologists. New manufacturing technologies should be investigated to ascertain how they could influence future education and training (Raju, 2010).

Hamidizadeh & Farsijani (2008) explored how traditional factors of production such as land, labor, and capital are increasingly becoming restraining forces rather than driving forces as necessary elements for attaining competitive manufacturing. In their opinion, a focus on knowledge management as a driver of manufacturing operations would prove more useful in transforming the culture of organizations. It is important to develop the personal knowledge and social capabilities of employees in order to improve their innovative and creative capabilities towards the achievement of world-class manufacturing practices.

Lahidji and Albayyari (2002) asserted that globalization and rapid improvements in technology are indicators of the need for knowledgeable and competent workers. Accordingly, industries desire engineers whose appreciation of manufacturing will enable them apply their knowledge productively. The competencies acquired in manufacturing engineering programs should emphasize knowledge and skills that help graduates work effectively in a diverse workforce. Programs should emphasize competencies such as human factors, ergonomics, ethics, engineering law, cultural diversity, technology, and environmental issues.

According to Rodriguez, de Ciurana, and Elias (2005), industry-university cooperation provides benefits for both parties such as the integration of multiple heterogeneous manufacturing technologies and the development of project management and communication skills. In addition, students have opportunities to cultivate an industrial frame of mind, while industry has the opportunity to train potential employees. Other forms of manufacturing curricula cited by researchers included learning laboratories as a complement to traditional teaching (Platts, 2004), supplemental hands-on activities for classrooms, manufacturing systems training for high school faculty (Fonseca, Whitaker, Driver, & Boman, 2011), and the promotion of advanced manufacturing knowledge as a source of sustainable competitive advantage (Sanchez & Palacios, 2008).

Lowden, Hall, Elliot, & Lewin (2011) conducted research to assess the perceptions of employers and higher education institutions with regard to graduates' employable skills and knowledge. They discovered that all organizations expected graduates to exhibit technical and discipline-related competencies based on their acquired degrees. In addition, employers also expected graduates to have a wide range of skills such as teamwork, leadership, communication, critical thinking, and problem solving abilities. The researchers recommended the development of programs to promote and recognize experiential and work-related learning.

The applied learning aspect of technology management is a distinctive characteristic of ATMAE accredited manufacturing programs. Knowledge of manufacturing management and an understanding of the manufacturing competencies that are most important should be evident in students, alumni, and faculty of manufacturing programs. This research sought to capture that knowledge and the perceptions of an ATMAE accredited manufacturing program.

Research Method

A pilot survey instrument was created to capture the perceptions of faculty, students, and alumni associated with an ATMAE accredited advanced manufacturing program. Program faculty and alumni at the annual advisory board meeting conducted an initial review of the survey for face validity. The survey listed 32 items from the Four Pillars of Manufacturing Engineering model, of which 14 were the foundation items of manufacturing management. The other 18 items were selected from each of the other foundational areas of the model, except mathematics and science, as these are required for all majors in the college. Respondents were asked to rate each item twice using a Likert scale from 1 to 4. No accommodation for a "not applicable" response was given. However, respondents could choose to ignore the item. On the first question set, respondents ranked the degree they perceived the item's importance with 4 being very important and 1 being not important. In the second question set, the respondents ranked the degree they perceived the item was/is covered in the manufacturing program. A response of 4 indicated the item was covered comprehensively with 1 representing no coverage.

Once the instrument was validated, a graduate assistant converted the survey into the electronic survey software Qualtrics, an institutionally approved survey package. The population of participants was selected because of their expertise and involvement in manufacturing and manufacturing management. Invitations were sent in the spring semester via email to all current manufacturing students and faculty in the program. A second request was sent eight days later with a final request sent seven days thereafter. The invited students included both graduate and undergraduate levels. The total survey population was approximately 160 students, 9 faculty, and 12 alumni. The total number of survey responses was 52, a response rate of approximately 28%. All collected responses were anonymous. The data was compiled, sorted, and analyzed using descriptive statistics. A t-test was conducted to compare the means of the two question sets.

Findings

Figure 1 presents the summary of the survey results for the two question sets asked during the survey. The bar chart shows the mean values of the survey questions for 32 key knowledge topics selected from the manufacturing management area of SME Four Pillars model. The top five ratings for each survey are shown in boldface. A comparison of the mean difference between the responses for the question 1 set (importance) and question 2 set (coverage) was significant ($t(62) = 5.81$, $p < .001$) assuming equal variances.

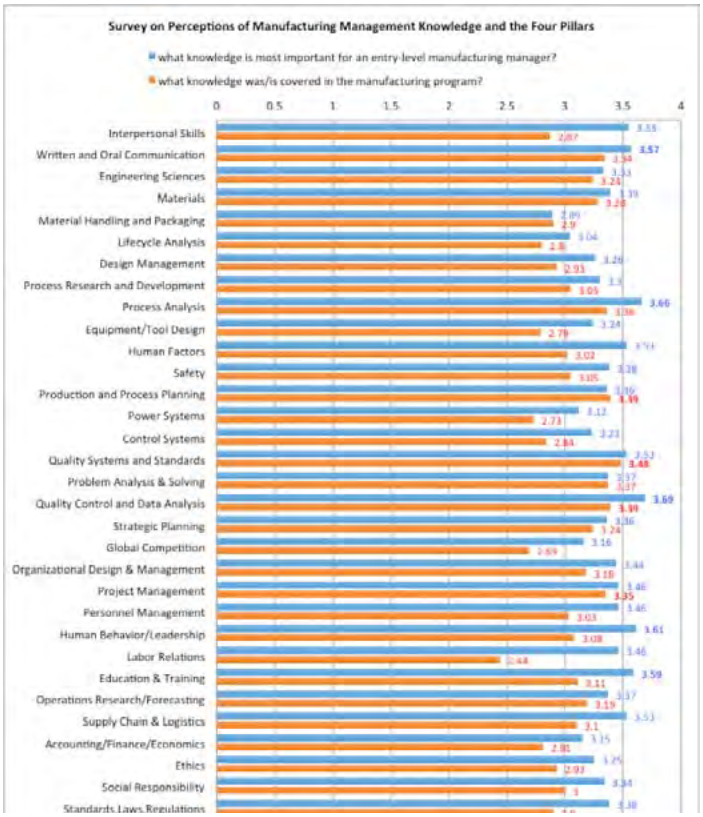

Figure 1. Bar chart showing the mean value of ratings for 32 Four Pillars key topics in response to the two questions sets

Question 1: Of the following, what knowledge is most important for an entry-level manufacturing manager? For each one, please indicate degree of importance on a scale of 1 to 4 (1 being "Not Important" to 4 being "Most Important")

Most of the respondents perceived the items (31 out of 32) to be important (ratings higher than 3) for an entry-level manufacturing manager position. The top five items perceived to be most important were quality control and data analysis (3.69), process analysis (3.66), leadership skills (3.61), education and training (3.59) and written/oral communication (3.57). Quality control was perceived to be the most important technical area for a managerial position. The other important technical areas were supply chain and logistics (3.53), quality systems and standards (3.53), and human factors/ergonomics (3.53). On the other hand, the least rated five items for question 1 (important knowledge for entry-level manufacturing manager) were material handling and packaging (2.89), life cycle analysis (3.04), power systems (3.12), accounting/finance/economics (3.15), and global competition (3.16).

Question 2: Of the following, what knowledge was/is covered in the manufacturing program? For each one, please indicate degree of coverage on a scale of 1 to 4 (1 being "Not Covered" to 4 being "Covered Comprehensively")

For the second survey question on how those items are or were covered in the manufacturing program curriculum, the survey results indicated that above-mentioned top five items are covered quite comprehensively. The survey results showed rankings higher than 3 for all five items: quality control and data analysis (3.39), process analysis (3.36), leadership skills (3.08), education and training (3.11) and written/oral communication (3.34). Thus, the program is perceived as covering the most important items adequately. The top six items perceived as covered most comprehensively were quality systems and standards (3.48), quality control and data analysis (3.39), production and process planning (3.39), problem analysis and solving (3.37), process analysis (3.36) and project management (3.35). Among all the 32 items, the least rated five items perceived as not covered in the current curriculum were labor relations (2.44), global competition (2.69), power systems (2.73), equipment and tool design (2.79), and life cycle analysis (2.8). However, according to the participants, not all of these five items are important. Among these five items, labor relations was rated the 12th most important (3.46) of the 32 items.

Conclusions

The survey results reveal that for an entry-level manufacturing manager, the professional or non-technical skills, such as leadership and communication skills are perceived to be as important as technical skills. Thus, a manufacturing manager needs various professional and/or non-technical skills in addition to technical skills. Therefore, manufacturing education programs should strongly consider including these skill sets in the curriculum or through extra-curricular activities. The most important items that were rated as not being covered comprehensively in the curriculum were human behavior/leadership, interpersonal skills, human factors, and labor relations.

Among the technical items, knowledge on quality control and data analysis and process analysis were perceived as most important for an entry-level manufacturing manager. This finding may also suggest that a majority of the manufacturing program graduates obtain entry-level positions related to these areas. The participants perceived that quality systems and standards, production and process planning are well covered in the manufacturing program. However, the survey results suggested that the program might need to evaluate the level of coverage for material handling and packaging and standards, laws, and regulations, which participants rated higher in importance compared to the perceived level of coverage. Revising other technical topics and/or related courses such as production and process planning may need to be given less emphasis and/or revised based on current perceptions.

A possible limitation of this survey was the higher values of standard deviation for almost each of the 32 items. It can be seen that the standard deviation ranges from 0.7 – 1.0 for the topics selected for the survey responses of both questions. For all the 32 items, the ratings range from 1 to 4 in response to both questions.

Future Research

The authors believe that this survey research could be very useful to similar manufacturing programs, i.e., manufacturing technology, manufacturing engineering technology etc., in other universities. Therefore, researchers should conduct a more comprehensive study among faculty and students of similar ATMAE accredited programs. In addition, ATMAE industry partners could be invited to participate. A revision of the survey content and process to suit a large number of participants would be appropriate. Future studies should also encourage comments to provide additional insight into perceptions. The comments would provide useful qualitative information for evaluating curriculum and the competencies needed by an entry-level manufacturing manager. The results and findings of a more comprehensive study should be disseminated to all the participating institutions and ATMAE leadership, including the boards of accreditation and certification for consideration.

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Appendices

Table A1

What knowledge is most important for an entry-level manufacturing manager?

Topic	Mean	SD	Responses
Quality Control and Data Analysis	3.69	0.74	32
Process Analysis	3.66	0.79	32
Human Behavior/Leadership	3.61	0.83	28
Education & Training	3.59	0.71	32
Written and Oral Communication	3.57	0.73	30
Interpersonal Skills	3.55	0.78	29
Human Factors	3.53	0.88	32
Quality Systems and Standards	3.53	0.78	30
Supply Chain & Logistics	3.53	0.75	40
Project Management	3.46	0.93	24
Personnel Management	3.46	0.88	28
Labor Relations	3.46	0.81	41
Organizational Design & Management	3.44	0.87	41
Materials	3.39	0.81	44
Safety	3.38	1.02	16
Standards, Laws, Regulations	3.38	0.85	34
Problem Analysis & Solving	3.37	0.9	19
Operations Research/Forecasting	3.37	0.72	43
Production and Process Planning	3.36	0.95	25
Strategic Planning	3.36	0.82	33
Social Responsibility	3.34	0.83	32
Engineering Sciences	3.33	0.81	39
Process Research and Development	3.3	0.88	37
Design Management	3.26	0.98	38
Ethics	3.25	0.99	24
Equipment/Tool Design	3.24	0.82	42
Control Systems	3.23	0.93	39
Global Competition	3.16	0.93	45
Accounting/Finance/Economics	3.15	0.92	46
Power Systems	3.12	0.94	42
Lifecycle Analysis	3.04	0.95	45
Material Handling and Packaging	2.89	0.86	45

Table A2
What knowledge was/is covered in the manufacturing program?

Topic	Mean	SD	Responses
Quality Systems and Standards	3.48	0.87	33
Production and Process Planning	3.39	0.79	33
Quality Control and Data Analysis	3.39	0.88	28
Problem Analysis & Solving	3.37	0.94	35
Process Analysis	3.36	0.84	39
Project Management	3.35	0.85	26
Written and Oral Communication	3.34	0.71	44
Materials	3.28	0.91	46
Engineering Sciences	3.24	0.82	46
Strategic Planning	3.24	0.86	37
Operations Research/Forecasting	3.19	0.92	42
Organizational Design & Management	3.18	0.87	34
Education & Training	3.11	0.95	38
Supply Chain & Logistics	3.1	1.04	31
Human Behavior/Leadership	3.08	0.97	40
Process Research and Development	3.05	0.89	39
Safety	3.05	0.91	37
Personnel Management	3.03	1.07	35
Human Factors	3.02	0.95	42
Social Responsibility	3	0.83	45
Design Management	2.93	0.94	40
Ethics	2.93	0.96	41
Material Handling and Packaging	2.9	0.97	48
Standards, Laws, Regulations	2.9	0.97	39
Interpersonal Skills	2.87	0.92	47
Control Systems	2.84	1.01	37
Accounting/Finance/ Economics	2.81	1.01	43
Lifecycle Analysis	2.8	0.9	44
Equipment/Tool Design	2.79	1.06	47
Power Systems	2.73	1.05	41
Global Competition	2.69	0.97	48
Labor Relations	2.44	0.92	45

Safety

Use of Risk Mapping Tools to Identify Hazards in Bulk Material Handling

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Introduction

The identification, assessment, and mitigation of risk in complex systems are challenging tasks. Risk analysis is often used in complex systems to reduce the probability of negative events occurring in such systems, and to enhance the decisions made under uncertain conditions (Clemons & Simmons, 1998). The conventional risk analysis framework includes three sub-components: assessment of risk, management of risk, and communication of risk (Codex, 2007). Mapping the risk analysis process within a specific system allows for the identification of the most high-stakes hazards, allowing an efficient application of management and mitigation activities (Clemons & Simmons, 1998; Stamatelatos et al., 2002).

One example of a complex system is one which processes bulk materials such as grain. The bulk materials handling system is becoming more complex than previously, with evolving production practices, changing customer demands, and increased legislative requirements (Thakur, Wang, & Hurburgh, 2010). Little emphasis has been given in current and previous research on use of risk analysis in these systems (Kingman & Field, 2005). Therefore, the focus of this paper is to provide an overview of risk tools that can be used in the bulk materials environment, to discuss the ability of the risk tools to measure hazards quantitatively, and to recommend appropriate usage within the bulk materials handling industry. Implications for managers on the interpretation of information generated by risk analysis tools will conclude the paper.

Risk Analysis Framework

Most risk analysis tools are based on the assumption that risk is calculated by considering both the probability of exposure or occurrence to the hazard and the consequence or severity of the hazard. Fault Tree Analysis (FTA) and Event Tree Analysis (ETA) are two risk mapping tools that may be used to identify and assess the risks in a system. Both require the analyst to identify the events involved that may lead to a specific undesirable outcome or condition (Clemons & Simmons, 1998; Rausand & Hoyland, 2004). Fault tree analysis and event tree analysis use probability data derived from experimental means or as determined by expert panels (Stamatelatos et al., 2002; Vesely, Goldberg, Roberts, & Haasl, 1981). Probability data are used to quantitatively estimate the likelihood that events will occur and if they do occur, what the consequence of the event will be. Events with a high

probability of exposure, but a low severity are judged to be a low risk, while events with a high probability of exposure and a high severity are considered to be high-risk situations.

Once hazards are identified and assessed, risk assessment matrices can be used to provide guidance on the management of risk within a system (U.S. Department of Defense [U.S. DoD], 2012). Risk assessment matrices provide a repeatable method of identifying the impact of a given risk by providing a scale to judge the occurrence and consequence of an event. Experts normally determine categories within the matrix. A risk management team with extensive knowledge in the related field is often tapped to construct a risk assessment matrix (Clemons & Simmons, 1998; ioMosaic Corporation, 2009).

Using FTA and ETA provides an analyst or manager with the associated probability of occurrence for a given event. When the probability of an event is known, risk can be calculated by crossing the probability of occurrence with the consequences or benefits of that event. The calculation of risk by crossing the probability of occurrence with the consequence or benefit is a quantitative value that can be used for comparison of alternatives, such as a specific set of countermeasures to reduce the risk involved. For managerial decisions, the risk assessment matrix can be used to determine the acceptability of risks and whether action should be taken to reduce the risk of a given event.

Event Tree Analysis

Event tree analysis (ETA) is a technique used to visually identify and evaluate the causal pathway that follows an initiating event (Ericson, 2005). ETA is based on binary logic, where the event occurs or does not. Because there is no partial failure or success, ETA provides a valuable assessment of the probability of occurrence for negative events (The Institution of Engineering Technology, 2010). ETA evaluates all possible paths following an initiating event that leads to an outcome and its corresponding probability of occurrence (Ericson, 2005), with each "branch" illustrating the probability for one specific event pathway. The ETA output, which reflects the probability of occurrence, is then paired with information on the consequence of the occurrence to calculate risk involved in the system being investigated. Although ETA represents a very powerful and useful calculation, populating the "branches" with accurate probabilities can be a major challenge for analysts in that other analysis tools may need to be used to do so (Ericson, 2005; Rausand & Hoyland, 2004).

An example of an event tree in Figure 1 starts with the initiating event at the leftmost part of the event tree where branches stem from it in a success versus failure logic. Following the top tier successes to the success outcome A, there is a calculation required to quantify the probability of the outcome. Under success outcome A Equation 1 can be used to provide the probability for the success outcome A. To arrive at success outcome A the system is mapped so that events one through 4 must occur successfully to reach outcome A.

$$P(A)=(P(IE))\ (P(1s))\ (P(2s))\ (P(3s))\ (P(4s)), \quad (1)$$

where

P(A)=The probability of event A; P(IE)=The probability of the initiating event; P(Xs)=The probability of success event X.

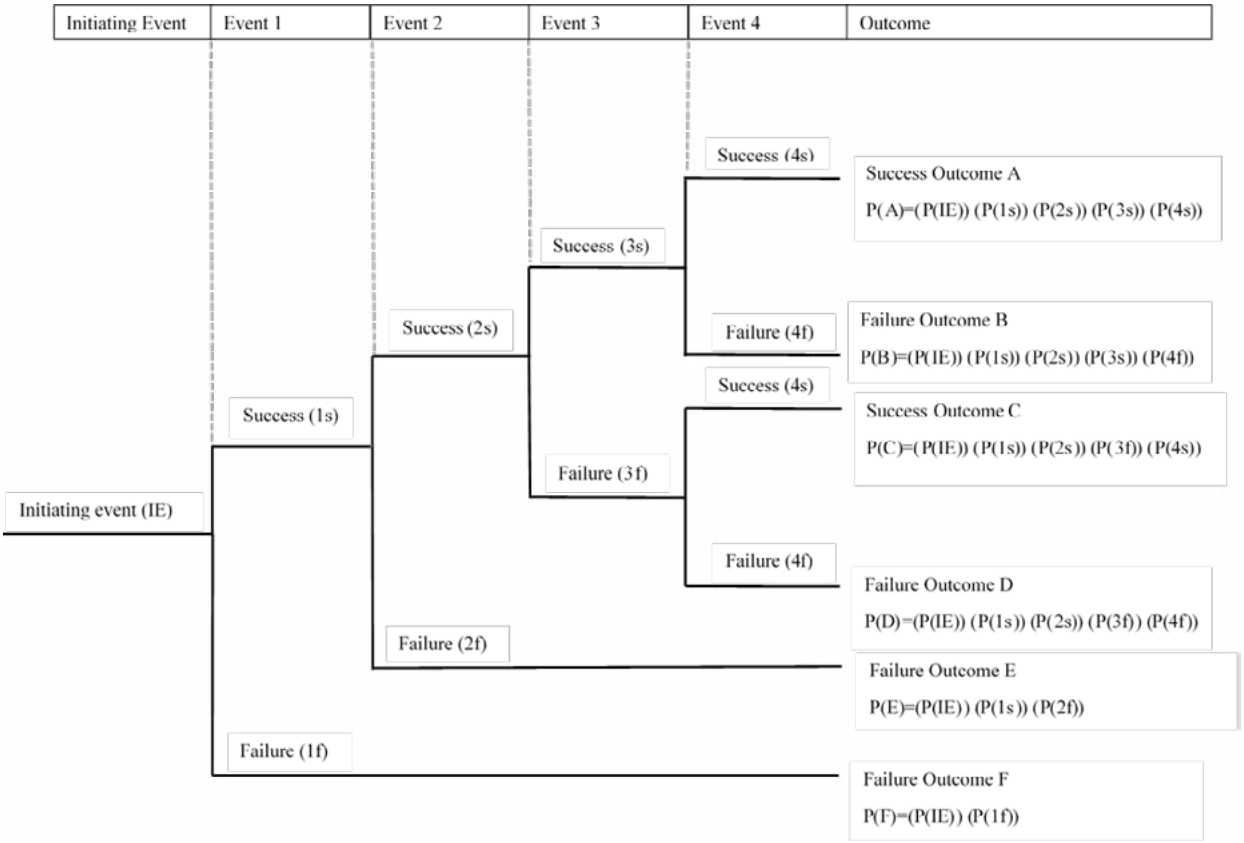


Figure 1 Example Event Tree

Observation of the failure outcome B shows that the path has changed only at event 4, which ultimately leads to a failed outcome. The calculation of failure outcome B follows the same procedure as for success outcome A except that the last quantity in the equation, P(4s), must now be changed to P(4f) to reflect the failure of event 4. This minor change in the process results in a system failure. To calculate the probability of failure in this case, the P(B) is calculated in Equation 2.

$$P(B)=(P(IE))\ (P(1s))\ (P(2s))\ (P(3s))\ (P(4f)), \quad (2)$$

where

P(B) = The probability of event B; P(IE) = The probability of the initiating event; P(Xs)=The probability of success event X; P(Xf)=The probability of failure event X.

Single point failures are critical to identify because there are no mitigating or intervening events to prevent the failure. A situation without any intermediate events to prevent the failure of the system if a single event occurs can be seen in the equation for outcome F. Equation 3 shows that there are fewer terms, resulting in a larger probability, given that in the multiplication of probabilities using decimals, the more terms in the equation the smaller the probability will be (Rausand & Hoyland, 2004).

$$P(F)=(P(IE))(P(1f)), \quad (3)$$

where

P(F)=The probability of event F; P(IE) = The probability of the initiating event; P(Xf)=The probability of failure event X.

Finally, to calculate the overall probability of failure and success for the system, failure outcomes and success outcomes are added together from their respective domains. Because event trees are binary, the outcomes are an "or" statement, meaning that no two or more outcomes can occur at the same time.

Event tree analysis has the potential to address existing difficulties of measuring the risk in the bulk materials supply chain. One advantage of ETA is that it will output both successes and failures generated from the initiating event, allowing the analyst to simultaneously operate in and compare both the success and failure domain (Clemons & Simmons, 1998; Ericson, 2005; Rausand & Hoyland, 2004).

In the bulk materials system, there is a demand for both a high quality and sustainable product (Thakur, Wang, & Hurburgh, 2009). In order to provide information on supply chain risks requested by selected customers, ETA can identify the successes and failures related to the quality and sustainability aspects in bulk materials handling. ETA can also identify where in the process the failures and successes are most likely to occur. When applied to the complex task of tracing and tracking bulk products, (Thakur et al., 2009), ETA allows complex systems to be modeled in a relatively straightforward manner. This allows analysts to examine each causal pathway for mitigation points (Ericson, 2005; Clemons & Simmons, 1998).

Finally, ETA allows for the insertion of potential mitigation strategies into the model to determine the effectiveness of the countermeasures on the risk before any investment is made in the mitigation method (Clemons & Simmons, 1998). This helps to balance the cost of managing quality and safety in a system with a very low profit margin.

As with most tools, there are limitations to ETA that may present difficulties when used with bulk materials handling. One limitation of ETA is that the initiating event and the causal pathway that follows must be known by

the analyst, which requires analysts to have training and experience in the context being studied (Ericson, 2005; Clemons & Simmons, 1998). Because of the complexity of the bulk materials system, (Golan et al., 2004; Thakur et al., 2009) it may be difficult to find analysts who both understand the system and are involved enough with its causal pathways to make valid probability estimates.

A lack of understating or experience with the system may result in difficulty identifying initiating events that would ultimately lead to an under-analyzed and incomplete assessment of the system. To address a system that has multiple initiating events, an event tree must be constructed for each event (Clemons & Simmons, 1998), a time-consuming process. Finally, ETA can only describe a failure or success; there are no partial successes or failures. For this reason, it is possible to overlook subtle dependencies within the system while modeling (Ericson, 2005). Expert knowledge of the system can limit the influence of these limitations on the final ETA, but it is a key consideration when using the process.

Fault Tree Analysis

Fault Tree Analysis (FTA) works in reverse of ETA, starting the logic system at a specific failure and working backward to find the contributing factors. FTA graphically displays a systematic description of how components of a system could align and lead to an undesirable outcome, termed "the top event" (The Institution of Engineering Technology, 2012). Fault trees are constructed from the failure (the top event) towards each basic causal event until the desired level of detail is reached or until the system events cannot be broken down any further (Lindhe, Rosen, Norberg, & Bergstedt, 2009).

Like the ETA, FTA is a binary system, but, unlike the success and failure branches used by ETAs, fault trees use logic gates. Examples of logic statements used in FTA are shown in Figure 2. Data used to populate an FTA may be qualitative, quantitative, or both, depending on the analyst's goal (Rausand & Hoyland, 2004). The output from a FTA can provide information to analysts that facilitate managerial decision-making regarding the priority of mitigation tasks (Stamatelatos et al., 2002).

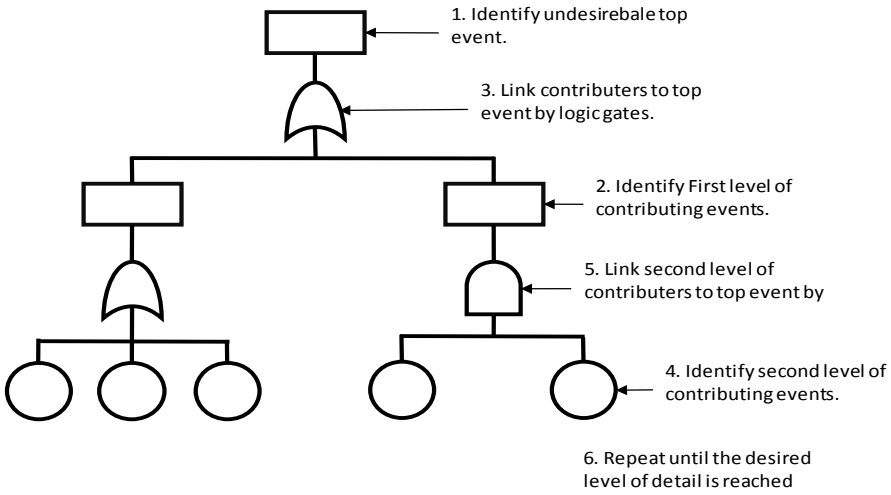
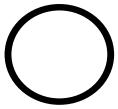


Figure 2. Example of a Fault Tree Analysis

Because fault trees are constructed with logic gates, specific symbols are used to identify different components of the tree. These are shown in Table 1 (Clemons & Simmons, 1998; Rausand & Hoyland). Figure 2 displays an example of a fault tree where the top event is the first item listed, followed by a logic gate (which can be an "and" or an "or" gate) and then proceeds to the first tier events. First tier events are events that happen just before the top event, likewise with second tier events that occur just before the first tier events and so on.

This path of logic gates and events will continue to repeat, branching out, until the desired level of detail or basic events, as defined in Table 1, have been reached. Just as with event trees, fault trees can also identify single point failures. A single point failure in fault tree will display a basic event connected directly to the top event with an "or" gate. Calculations in FTA are similar to those of ETA, but use additional algebra to compute probabilities as described by multiple authors (Clemons & Simmons, 1998; The Institution of Engineering Technology, 2012).

Table 1. Basic FTA Symbols

Symbol	Name	Description
	Event (Top or Intermediate)	Top Event- this is the main undesirable event under analysis. Intermediate Event- This describes a condition produced by proceeding events.
	Basic Event	An initiating fault or failure that cannot be developed further. These events are determined from the precision of the analysis.
	AND Gate	Output occur only if all connected inputs exist.
	Inclusive OR Gate	Output will occur if one or more of the connected inputs exist.

Fault tree analysis can have several advantages in process-based systems, such as the bulk materials supply chain. One advantage of FTA is that it can enable the analyst to assess both the probability of failure from several pathways as well as single point failures within a complex system (Clemons & Simmons, 1998). Similar to ETA, this assessment allows for the identification of potential system weaknesses while allowing the analyst to identify specific changes that could reduce system vulnerability (Clemons & Simmons, 1998; Rausand & Hoyland, 2004).

Fault tree analysis works well in complex systems, such as the bulk materials handling system, to identify vulnerabilities within the system. The structure of a fault tree also gives a good framework for analysts to understand a systems-related cause of failure, but the analysis is dependent on careful construction and good input data. If these are not in place, the analysis will be flawed (Rausand & Hoyland, 2004).

FTA has limitations similar to ETA relating to knowledge of the system. It is crucial to the success of FTA that these limitations are heeded by the analyst for a successful assessment of the system. One disadvantage of FTA is that it focuses on one main top event or failure, which can result in a troublesome assessment if the outcome or causal pathways leading to the event are not known (Clemons & Simmons, 1998; Stamatelatos et al., 2002).

As in ETA, bulk materials handling systems are complex (Golan et al., 2004; Thakur et al., 2009) and require analysts that are experienced and understand the system and its causal pathways as a whole to make valid

probability estimates. Because the fault tree leads from the top event to basic event components, good data such as the failure rate of each component must be accurate for the tree to be useful in calculating accurate risk (Clemons & Simmons, 1998; Rausand & Hoyland, 2004).

Some systems are understood very well and have extensive tracing and track while other systems are less precise (Golan et al., 2004). Populating FTA with data from thoroughly tracked systems would likely be more successful than in the systems that are not precisely tracked (Laux & Hurburgh, 2010; Mosher, Laux, & Hurburgh, 2009). In other words, if bad data or poor analyses are used in FTA, the outcome will be flawed and poor decisions may result. Finally, each event under each logic gate must be independent of one another and each event must be an immediate contributor to the next, as displayed in Figure 2 (Clemons & Simmons, 1998; Rausand & Hoyland, 2004). In a complex system such as bulk materials handling, system dependencies may not always follow a causal pathway, which can be problematic in estimating risk.

Risk Assessment Matrix

The third tool discussed is the risk assessment matrix. The risk assessment matrix (RAM) is a presentation of potential exposures or occurrence and potential severities or consequences that, when considered together, identify the level of risk for a given scenario. The matrix is used to conduct a subjective assessment from the data that an analyst or manager has available (Clemons & Simmons, 1998; U.S. DoD, 2012). The risk assessment matrix is derived from risk curves, which are a plotted curve of probability and severity. Defining distinct cut off points to develop categories of risk make the decision making process more clearly defined with pre-determined areas of risk acceptance. (Clemons & Simmons, 1998; U.S. DoD, 2012). Risk assessment matrices are a simple and straightforward way to define what is acceptable or not for a given scenario. It allows managers or analysts to make relatively quick decision choices based on pre-defined acceptable levels of risk in the RAM. Common matrix categories evaluate the likelihood of occurrence and consequence on areas such human injury, environmental damage, monetary loss, and work time lost as a result of the event (Clemons & Simmons, 1998; ioMosaic Corporation, 2009; U.S. DoD, 2012).

The first piece of a RAM is the probability levels with a subjective definition. Table 2 shows an example from Clemons and Simmons (1998). The second piece of a RAM is the level of severity for different targets. The levels of severity can be adjusted to fit specific applications so that the levels are not too broad or precise. Levels can range from catastrophic to negligible. Table 3 shows an example from Clemons and Simmons (1998). The two categorical levels of probability and severity are combined to form a matrix from which risk levels can be determined, as shown in Figure 3 (Clemons & Simmons, 1998).

Table 2. Example of Severity Levels for Multiple Targets

	Severity				
Category	Personnel Injury	Equipment Loss	Product Loss	Down Time	Environmental Effect
I Catastrophic	Death	Greater than 1 million dollars	Greater than 1 million dollars	More than 4 months	Long-term (more than 5 years) damage cost greater than 1 million dollars to correct
II Critical	Severe injury or illness	250 thousand to 1 million dollars	250 thousand to 1 million dollars	2 weeks to 4 months	Medium-term (1-5 years) damage cost between 250 thousand to 1 million dollars to correct
III Marginal	Minor injury or illness	1 thousand to 250 thousand dollars	1 thousand to 250 thousand dollars	1 day to 2 weeks	Short-term (1 Year) damage cost between 1 thousand to 250 thousand dollars to correct
IV Negligible	No Injury or illness	less than 1 thousand dollars	less than 1 thousand dollars	less than 1 day	Minor (readily repairable) damage cost less than 1 thousand dollars to correct

Table 3. Example of Probability Levels

	Probability	
Level	**Description**	**Definition**
A	Frequent	Likely to occur repeatedly in a system life cycle
B	Probable	Likely to occur multiple times in a system life cycle
C	Occasional	Likely to occur sometime in a system life cycle
D	Remote	Not likely to occur in a system life cycle, but possible
E	Improbable	probability of occurrence cannot be distinguished from zero
F	Impossible	Physically impossible to occur

		Probability					
		F Impossible	E Improbable	D Remote	C Occasional	B Probable	A Frequent
Severity Of Consequences	I Catastrophic				1		
	II Critical				2		
	III Marginal			3			
	IV Negligible						

1	Must suppress to a lower risk
2	Operation permissible for a short time with management signed waiver
3	Operation Permissible
Life Cycle	n years

Figure 3. Example Risk Assessment Matrix

One advantage of RAMs is that it can be used as a management tool with simple input data from an analyst. When using a RAM, a manager can decide which hazards generate the most risk within a system and make mitigation decisions accordingly (Clemons & Simmons, 1998; ioMosaic Corporation, 2009). Unlike FTA and ETA, RAM requires little experience to use. For this reason, it has the potential to prevent problems within the bulk materials handling system on a day-to-day basis, particularly when used with output data from experienced analysts.

Furthermore, the RAM is not specifically designed as a pre or post incident tool. Rather, it can be implemented during the design phase to reduce the risk in the system. It may even be implemented after a system is running to make decisions about mitigating the effects of current hazards (Clemons & Simmons, 1998; U.S. DoD, 2012). This allows bulk materials handing operations the flexibility to implement this before conducting business or during operation if the system has already been established.

An important limitation of RAMs is that this tool does not identify the actual hazards or probabilities, therefore, it must be used in combination with other risk mapping tools to be successful in analyzing a system (Clemons & Simmons, 1998; ioMosaic Corporation, 2009). Additionally, without the valid data on the probability of occurrence or severity, this tool alone will be completely subjective. Though the RAM alone is not powerful enough in bulk materials handling, in combination with other tools it becomes a flexible tool to efficiently make decisions based on predetermined action levels without any professional experience. This tool is most useful for managers who are overseeing day-to-day operations and may encounter a situation that requires an assessment of risk involved before proceeding.

Potential Impact of Risk Mapping

As the management of bulk materials becomes more challenging, tools such as fault tree analysis, event tree analysis, and risk assessment matrix can perform a valuable role in estimating and measuring risk in these systems. Computer systems allow massive calculations and provide data that was difficult if not impossible to access. The tools can also be used to support decision-making, loss prevention, and worker safety within the process-based industries. Their adaptability and relatively straightforward design warrants their further investigation as a risk management tool and for continuous improvement purposes. Both have a high likelihood of providing value for existing systems as well as future bulk handling systems.

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Teaching Innovations

Networking Alumni with Current Students to Create Unique internship Opportunities

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Introduction

When seeking job opportunities in the field of architecture and construction, preference is often given to those with related work experience over those that do not. Because of the educational benefit and the increase in employment opportunities, many programs now require an internship to earn a degree. Students seek to gain this experience during their college years, usually during their summer breaks. However, students are finding it difficult to obtain their first, quality, field-related position.

Field related work experience has become just as important on a graduating senior's resume as the degree they are earning. Programs, now requiring an 'internship' as part of the degree requirements, understand the invaluable experience they receive on the job; using the concepts they have been learning in the classroom. An internship experience gives relevance and direct application of those concepts. Putting concepts into action broadens and deepens the understanding and application of them. Hernandez states that 'from a career development perspective, internships provide unique opportunities to develop professional networks, practice competencies learned in the classroom, gain experience in different environments, and share lessons learned with others in the field.' (Hernandez, Bejarano, Reyes, Chavez, & Mata, 2014)

Problem

Based on data from the Census Bureau's Current Population Survey, the U.S. Department of Labor, and reported by Weissmann, in 2011 approximately 1.5 million, or 53.6 percent, bachelor's degree-holders under the age of 25 were jobless or underemployed. (Weissmann, 2012) Weissmann goes on to discuss the escalation of the problem with underemployed bachelor degree holders, which is approximately half of the 1.5 million, "…when college graduates take a low-paid, low-skilled job, they're probably displacing a less educated worker." Asserting that "for every underemployed college degree holder, there's a decent chance someone with just a high school diploma is out of work entirely." (Weissmann, 2012)

With this in mind, it is imperative that we as educators do what we can to increase the value of the students we are educating. The inclusion of a required internship benefits the student in both their academics and their employability. However, internships are not created equal. A strategy to increase the quality of the internship will in turn, increase the value of the student, their resume, and increase the student's chances for quality employment opportunities upon graduation.

University locations can sometimes become a disadvantage to the students seeking internships. If a university is located in a small town, often referred to as a 'college town', it can be difficult to find an adequate quantity of quality internship opportunities for students. A quality internship would place the student within the industry environment that they seek to join or a trade environment that they may seek to oversee in a supervisory capacity upon graduation. When these types of positions are limited in availability, students and professors often use less than optimal employment situations, such as retail sales in the student's discipline. Of course these less than optimal employment situations are not always due to the limited quantity of quality internships available. At times, they are a result of poor academic performance and become the only option for the student. Corporate America wants the best of the best students the university has to offer.

When the university is creating 'the best of the best' students, it is important to help those students find unique and challenging internship opportunities. The students may wish to seek the opportunity to intern under a famous architect or contractor, to intern with a prestigious company/corporation, or to intern in a dynamic, geographical location. But with escalating costs of education, these options for internships are seen as extravagant and unreachable by the financially challenged student.

The problem is housing. Internships are typically low paying positions, but on occasion can be unpaid. Students are often confined to locations where they have family, friends, or the university to assist with housing. This puts a student at a distinct disadvantage for traveling to larger cities, out of state, or even out of the country. One solution could be simply to have the student borrow more money to engage in an internship, similar to other summer programs. But perhaps there is a different solution.

Universities have a wealth of opportunity within its alumnus. Alumnus that have fond memories and a love for their alma mater and often donate money or come to sports activities to show their continued support for their university. Most universities have alumnus scattered all across the country and even the world. Currently, the primary relationship the university strives to maintain with its alumni is through donations and contributions toward special projects.

Proposal

An opportunity exists to expand the relationship between the alumnus and current students; to create a network of alumnus that have the desire and capability to provide a current student a place to stay for three months during the summer so that the student can engage in a quality internship. The creation of this network will open the doors for students to travel to other states, and possibly other countries. It also opens the door for students to apply for positions at prestigious companies, or with a renowned professional, or with companies utilizing emerging technologies unfamiliar to their home town. When the problem of housing is removed from the equation, a new world opens up to the student.

Investigation

To determine the university and alumni perception and feasibility of the proposal, focus was narrowed to one degree program within a departmental unit at a single university. To facilitate the research, under the guidance of a faculty mentor, a student in that program applied for and was awarded a Faculty-Undergraduate Student Engagement (FUSE) Grant in the fall of 2013. The objective of the FUSE grant is to determine the feasibility of creating a connection between the alumni of the program and current students of the same program, with the objective of creating opportunities nationwide for current students to engage in internships. The alumni of the program will be surveyed to determine their ability and willingness to house a current student for a summer and assist in locating internship opportunities in their area of the country.

Research was conducted on similar programs within the university, and national organizations to aid in developing how the proposal may function. The university's General Counsel was also contacted to determine the university's legal concerns with the proposal. To connect with the alumni from the program, the alumni office assisted with a direct email and a postcard directing 256 alumni to an on-line survey.

When consulting with the General Counsel of the university, Ms. Wilkins stated that with the establishment of minimum requirements and background checks for both the student and the host alumni, in conjunction with a liability disclaimer, she believed the program to be very doable and a great opportunity for students. A possible issue for the host alumni's Home Owner's Policy could arise if they are receiving money for the student to stay in their home. She also suggested that this proposal could be more than a single department wants to manage, and perhaps the proposal should piggy back with the Study Away program. (Wilkins, 2014)

Mr. Jerry Barnaby is the Director of the Study Away program at the university. He stated that there need to be minimum requirements established for both the current student and the family hosting that student. When asked about additional things to consider when developing this proposal, he included: students should not pay directly to the family, so a method of payment to and from the university would need to be established;

create a typical cost and what that will cover, all other costs are the responsibility of the student; safety and liability agreements for both parties will need to be created; and transportation for the student to and from their internship employment needs to be addressed. He also suggested using the minimum standards and requirements for the Study Away program as a starting point for the development of the proposal. (Barnaby, 2014)

The Study Away program at the university has a set of standard minimum requirements that students must meet: proof of health insurance for the duration of the internship, be a current university student eligible to register for courses, must be 18 years of age or older (regardless of parental consent), minimum GPA (typically 2.0), good academic standing, approval of Judicial Affairs, permission of instructor, and complete the Study Away agreement. (Western Kentucky University, Study Away)

The university also participates with The National Student Exchange (NSE). NSE's eligibility statement begins by stating 'NSE participation is a privilege, not a right.' (National Student Exchange, 1999-2014) There are three levels of requirements that a student must meet to participate in NSE: national, additional requirements set by the student's home campus, and additional requirements set by the institution the student wishes to attend. The national requirements include: full-time enrollment at the home campus; minimum home campus cumulative gpa of 2.5 (4.0 scale); good academic standing as defined by the home institution; no incomplete grades from previous terms; no current or pending probationary status due to academic dishonesty or misconduct; no outstanding financial obligations to your home institution; no current or pending probationary or disciplinary action for violation of codes of student conduct; and no probation, parole, or any pending legal judgments (civil or criminal). (National Student Exchange, 1999-2014) The requirements for the application process at the home campus being studied include: FERPA Statement; Program of Study Statement; Budget Worksheet; Parent/Guardian Acknowledgment; reference from faculty or staff; reference from advisor, and a third reference to address the value of NSE for the student beyond the college environment, preferably from a family member, family friend, employer, or former teacher; and a Language Proficiency Report for those Exchanging with Puerto Rico. (Western Kentucky University, National Student Exchange, 2014)

Requirements for the students vary between programs and institutions. But requirements and safeguards must be established for the host alumni as well. Organizations such as AdoptUSKids have requirements that the host family must meet to qualify for fostering or adopting children. Some of the requirements that would be beneficial to the proposed program are: must be at least 21 years old; parents can be married or single; parents should be financially stable and have an income sufficient to meet their family's needs; must be able to provide a safe, secure, and healthy home for a child; parents must be in good physical and mental health; the home must meet requirements for housing safety and space. (Adoption Exchange Association, 2002-2014) In addition, the prospective host family must complete an Adoption Home Study. This study includes various

types of information, including but not limited to: an interview with the applicant and all family members; a mixture of relative and non-relative personal references; onsite home visits to determine safety and conformity with local building codes; recent health examinations; checks of criminal records and child abuse and neglect records. (Child Welfare Information Gateway, 2012) The final Home Study Report contains the following types of information: Background checks, references, family background, education/employment, relationships, daily life routines, parenting experiences, neighborhood descriptions, religion/belief system, feelings about/readiness for adoption, and the approval/recommendation. (Child Welfare Information Gateway, 2012)

A survey was developed to receive data from the alumnus of the program to determine their support and capability to participate in the proposed program. Postcards, with a beautiful picture of the building in which the alumni spent a majority of their time when obtaining their degree and a brief statement of the proposal, were mailed to 256 alumni. In addition, the imagery and statements were used in an email to the same group of 256 alumni. Both the post card and the email provided a link to a survey. Of the 256 alumni, only 14 completed the survey. Of those 14 responses, 5 different states were represented.

The survey focused on three sets of questions: mentorship, internship, and homestay. Only 46% of the responders had a mentor in their field of study, beyond their professors. 50% stated that they would be interested in becoming mentors of current students, but all have a primary concern of the time commitment. When asked 'What would influence you to participate in a mentoring program,' one alumni response was "flexibility in the program and some degree of say-so in selecting the student with whom I'm pared up." When asked about assisting with internship opportunities, 45% were in a position to be able to assist, and 55% had contacts in the industry. When asked about assisting in providing a homestay, 75% responded no, 25% responded undecided. When asked if they knew of another individual in their family that could provide a homestay if they could not, only 8% said yes. The primary concerns in assisting with homestay: 56% time commitment, 11% confidentiality, 33% cost, 44% safety, 33% other reasons, and 22% undecided. Other reasons included: 'not enough living space', and 'disabled wife. It wouldn't work out'. Interestingly enough, when asked 'Would you have liked to fulfil your internship outside of your home town,' 58% said yes. And when asked 'Did alumni assist you in finding internship opportunities,' 83% said no.

Outcome

The requirements studied in regards to the student were quite applicable and appropriate. However, the requirements studied in regards to the host alumni were established to protect children and can some can be used to protect the institutions students. When determining the final requirements for an alumnus to participate in the proposal, the student's safety and the student's parent's piece of mind are paramount. Minimally, the alumni should apply to participate, and the application should include: references; education/employment; background checks; statement of home size; space analysis and occupant status (for determining safety and

conformity with local building codes); declaration that the student will have their own room with a bed, access to bathing facilities, and food preparation. Because the alumnus are spread around the country and world, a home visit, although valuable, is cost prohibitive and not an option. Some of the other requirements that have been discussed are not relevant because those agencies are focused on protecting under aged children for long periods of time, whereas this program is paring adults at different life stages together for a limited, three month summer internship.

Based on the support and encouragement received from the university, this proposal has great potential. Unfortunately, the responses from the alumni surveyed were not as positive as anticipated. However, if advice is taken from both General Council and the Study Away Director, the survey simply needs to expand beyond one degree program, and perhaps beyond one department.

Conclusion

In one article, a recent college graduate stated, "If colleges don't step up their own professional-networking services for graduates, then higher education's role as a key job-searching hub could decline." (Young, 2013) This graduate went on to say, "Colleges say they have an alumni network, but I don't think they instill as much thought and effort as these kings of new groups." (Young, 2013) These new groups he is referring to are networking events held by companies that have emerged to help young professionals find employment opportunities.

Hall's research revealed that the educational institutions primary concern is to convert the social capital of the alumni network into sources of monetary donations. However, the individual alumni are seeking to use their alumni network as leverage for upward employment opportunities. (Hall, 2011) Combining the value of the alumni network of the university and the alumni to encompass both their needs could improve the quality of both agendas. For instance, if alumnus are engaged in their institution's alumni network and this engagement leads to an opportunity to advance their employment/career, they may feel more open to contribute to the institution that continues to support their success long after graduation. Vice versa, the institution may be increasing and expanding valuable monetary contributions from its alumnus.

By getting the alumni invested in the success and quality of emerging graduates, we can begin to create a better network between these participating alumni. They will see the university investing in its alumni, utilizing them as a valuable resource for knowledge and opportunity, not just for monetary contributions. Alumni will also see a value in increasing the quality of the graduating students, for that increases the reputation of the institution from which they emerged.

Currently, the university alumni are an untapped resource in regards to assisting current students with mentoring, internship opportunities, and housing options. The future of this proposal is to expand to include

more degrees, and more alumni from within the college. Once it is determined what office might house this proposed program, a final set of minimum standards and requirements must be set and shared with the alumni. Before the expanded group of alumni is surveyed, a web site with all the data to answer alumni concerns should be created and provided for them. When the proposal becomes more established, positive feedback from an alumni survey should follow. With new data and growing support from within the university, external grants to implement the proposal would be paramount.

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