
AC 2011-1008: TRENDS IN MANUFACTURING EDUCATION PROGRAMS: 2011 REPORT

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TRENDS IN MANUFACTURING EDUCATION PROGRAMS - 2011 REPORT: A Dynamic Framework for Development

Abstract

Following up on its 2009 research, the National Center for Manufacturing Education (NCME) continues to explore trends in manufacturing education programs. This paper presents a compilation of results from the “Question(s) of the Week” framework designed to preface the 2011 study and move the trends report towards an ongoing, dynamic source of relevant information for engineering technology educators engaged in the design and delivery of manufacturing education.

Introduction

The National Center for Manufacturing Education (NCME) housed at Sinclair Community College, Dayton, Ohio published Trends in Manufacturing Programs¹ in 2009. The NCME acknowledges support from the National Science Foundation (DUE 0802305 - Manufacturing an Engineering Resource Center: An NSF National Center of Excellence) and looks forward to the release of the 2011 Report. Results for these reports builds on earlier work including; The State of Manufacturing Engineering Technology Education² and Reinventing Manufacturing Engineering: Refocusing and Exploring Future Opportunities for Students³ as shown in Figure 1. This earlier research provided insights regarding the health of post-secondary manufacturing programs and factors influencing these programs.

Manufacturing Education Trends Reports Recent History

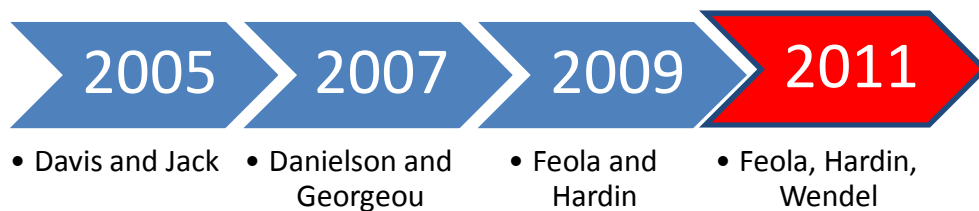


Figure 1.

Working in conjunction with the Society of Manufacturing Engineers (SME); SME Manufacturing Education & Research (MER) Community; and the American Society for Engineering Education (ASEE) Manufacturing Division, the objective of the 2011 NCME study is to continue and expand on earlier efforts. Additionally, the development process for the report is being reviewed to incorporate a dynamic framework that will lead towards sustainability for report production. The 2011 study will provide analysis of industry needs in manufacturing education and aims to foster communication among education programs and other groups interested in strengthening the manufacturing sector of the US economy. This paper outlines an approach intended to gain better insights from manufacturing educators for the production of the report to create a more useful work with the potential to provide updated information on an ongoing basis.

Trends - 2009

Trends In Manufacturing Education Programs - 2009 followed an approach similar to prior work. **Program Curriculum** was added as a new category which included six related questions. Other minor changes were incorporated to further explore industry influences, expectations for graduates, and program strengths and concerns.

Data and trends analysis were reported under the following category headings:

- Section 1: Participating Schools
- Section 2: Program Enrollment
- Section 3: Program Graduates
- Section 4: Industry Expectations
- Section 5: Program Curriculum
- Section 6: Program Faculty and Staff
- Section 7: Labs and Resources
- Section 8: Professional Societies – SME Student Chapters

Trends – 2011 Development

Development efforts for the 2011 Trends in Manufacturing Education Programs report aim to incorporate improvement insights from various constituents. Insights received resulted in suggestions for using a *Dynamic Framework* to solicit ideas for further expanding the Program Curriculum category, rearrangement of the category headings, improving relevancy and improving the overall quality of the report in a productive fashion.

A primary recommendation provided by the National Visiting Committee for the Manufacturing and Engineering Technologies Education (METEOnline.org) resource center was to make more effective use of the ETD Listserv. A Dynamic Framework was developed to gather information from constituents and provide ongoing feedback using a “Question(s) of the Week” approach. Beginning in October, 2010 a weekly question was posted to the ETD Listserv.

The purpose of the ETD Listserv is “to allow members of the Engineering Technology Division (ETD) of the American Society for Engineering Education (ASEE) to post notices pertinent to engineering technology matters, such as job openings, grant opportunities, chances to be a NSF Reviewer, an ABET Evaluator, notices about professional meetings, opportunities to present papers, and ask questions.”⁴

User statistics as of January 15, 2011 for the Listserv include:

| | |
|--|------|
| ▪ ETD Listserv Members (Institutions Represented 1025) | 4071 |
| ▪ Members at 4-YR COLLEGES (Institutions 381) | 2685 |
| ▪ Members at 2-YR COLLEGES (Institutions 345) | 1035 |
| ▪ Members at ORGANIZATIONS, CORPORATIONS, & GOVERNMENT AGENCIES (Institutions 299) | 351 |

Source: ETD Listserv Post by Walt Buchanan 01/15/2011

Dynamic Framework – “Question(s) of the Week”

The ETD Listserv is used by members regularly to ask questions pertinent to the Listserv. Responses are typically compiled and reported back to the membership. Many questions and subsequent responses posted on the Listserv are very informative but may not be of immediate use for an individual member at the time of the post. It was thought the “Question(s) of the Week” format could solicit pertinent input, provide ongoing feedback and then be compiled into a more useful collection of results that could evolve into ongoing Trends Report information.

Questions were developed to better understand the needs of NCME constituents, serve as the topic of this ASEE paper, and improve the relevancy and quality of the Trends Report 2011 scheduled to be published in the summer of 2011. Weekly Questions developed were:

- 1) *How familiar are you with the METEC Clearinghouse?*
- 2) *What type of educational materials would be of most use to you?*
- 3) *Where do you go to search for materials to learn more about your discipline?*
- 4) *For what type of content would you like to have pre-designed instructional materials? And why?*

Ongoing Feedback –

Results from responses to the questions above were compiled and reported back to the Listserv membership. The individual questions and a results summary for four (4) subsequent weeks are provided:

- 1) *How familiar are you with the METEC Clearinghouse?*

A couple of mouse clicks from 128 respondents provided the following:

Results Summary:

67% of respondents were 'Not at all Familiar' or only 'Slightly Familiar' with METEC

What is METEC? [Manufacturing & Engineering Technologies Education Clearinghouse](#)

An electronic clearinghouse for easy distribution of exemplary educational materials for all technology disciplines. We strive to improve technician education nationally by disseminating model programs, educational strategies, instructional curricula, best practices, and classroom materials. We serve as a source of materials, support services, and professional development opportunities for educators and industry professionals.

- 2) *What type of educational materials would be of most use to you?*

A couple of mouse clicks from 105 respondents provided the following:

Results Summary:

The number one response was
 "PowerPoints for use in classroom" 32.7%

followed closely by
 "Videos to use in class" 29.6%

- 3) *Where do you go to search for materials to learn more about your discipline?*

A couple of mouse clicks from 85 respondents provided the following:

Results Summary:

The top three responses (multiple allowed) were –

| | |
|--|--------------|
| Google | 73.8% |
| Professional Association Web Site | 46.4% |
| Books | 46.4% |

4) *For what type of content would you like to have pre-designed instructional materials? And why?*

Results Summary:

Responses were all over the map but were very evenly divided in three quickly identified broad categories

- 1) Discipline
- 2) Instructional Format / Teaching Methods
- 3) Media Type

Results from ETD Listserv “Question(s) of the Week” were used to guide the expansion of the Program Curriculum section of the 2011 Trends Report survey material.

Rearrangement of the category headings –

A rearrangement of category headings for the 2011 Trends Report was suggested to better align with the educational process for Manufacturing Education Programs across the U.S. Programs must first understand the needs and expectations of industry. Then participating schools can improve program curriculum and enroll students. For students to successfully complete program outcomes critical inputs to the learning process are required including contributions by faculty & staff, access to well equipped labs and other needed resources, and collaboration with peers and professionals (SME Student Chapters and related professional societies). All of this leads to the desired output – Graduates.

Section 1: Industry Expectations

Section 2: Participating Schools

Section 3: Program Curriculum

Section 4: Program Enrollment

Section 5: Program Faculty and Staff

Section 6: Labs and Resources

Section 7: Professional Societies – SME Student Chapters

Section 8: Program Graduates

Improving Relevancy, Quality and Productivity –

The 2011 survey respondents will provide valuable data that explores program trends to help us better understand the health of our manufacturing education programs. For example, we intend to solicit open responses offered by schools to describe program strengths and challenges and keys to attracting new students, among other pertinent information. Manufacturing educators across the country are invited to use this report to gain insight and to benchmark their own programs.

To improve relevancy of the report a steering committee for report development will review questions utilized in the 2009 survey. It is expected that the length of the survey will remain approximately the same but some questions may be dropped and others added depending upon their perceived relevancy. Quality improvements will be made where readability can be improved. Additionally, efforts will expand to increase the number of survey respondents as well

as the number of respondents completing the entire survey, allowing for a better cross-section of manufacturing education programs to be represented in the results.

Lastly, it is expected that the 2011 report will begin to incorporate a direction for future work being developed by the SME Center for Education and Manufacturing Education & Research Community. U.S. Manufacturers are among the most innovative, and thus productive in the world. A recent comparison on International Manufacturing Productivity⁵ published by the U.S. Department of Labor (Figure - 2) indicates a 7.7% increase in U.S. manufacturing productivity in 2009. This occurred at a time when 12 of the 19 countries compared registered a productivity decrease.

It appears that U.S. manufacturers are poised for a strong return when the current economy makes a turn towards improvement. Manufacturers will need skilled engineers and technicians to continue this trend.

Manufacturing educators should also engage in providing productivity improvements. One means of improving and enhancing manufacturing education would be to advance manufacturing education in other program curricula wherever possible. The SME Center for Education and Manufacturing Education & Research Community are currently developing a “Four Pillars” initiative to do just that.

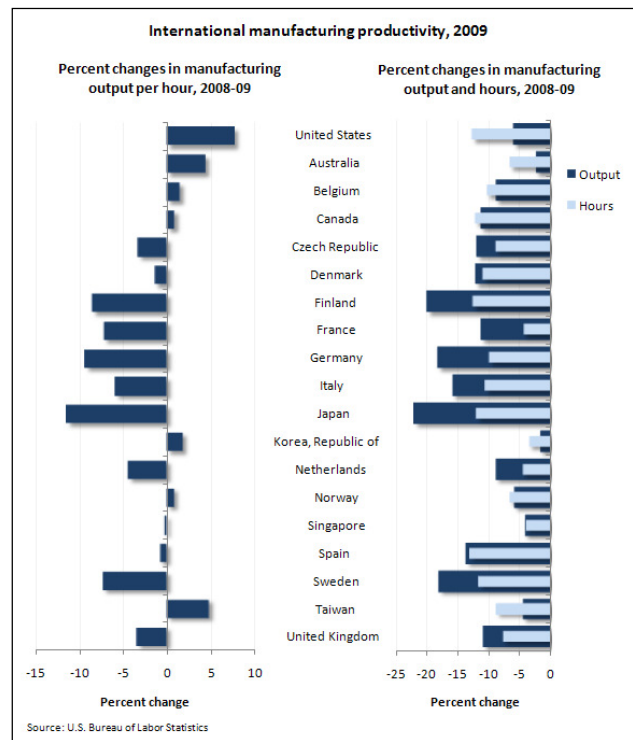


Figure 2.

Four Pillars of Manufacturing Education -

ABET – Engineering Accreditation Commission Manufacturing programs encompass four primary components in their program criteria:

- Materials and manufacturing processes
- Process, assembly and product engineering
- Manufacturing competitiveness
- Manufacturing systems design

ABET Manufacturing and similarly named programs provide for attainment of required competencies in these areas at a very high level. Programs in other disciplines do not have room in their respective programs but many engineering and technology programs would like to include components of these four pillars into related programs (e.g. mechanical, electrical, industrial, management, etc.) The extent to which manufacturing educators can provide resources to those in other programs will effectively increase the productivity of manufacturing educators and manufacturing education programs. Questions to determine how the *Four Pillars* fit into related curricula are an important, new component of the Manufacturing Education Program Trends 2011 Report.

Conclusions –

- A Dynamic Framework – **“Question(s) of the Week”** was very effective
 - Use of the ETD Listserv provided a significant number of responses
- Ongoing Feedback –
 - Listserv members appreciate the timely feedback
 - Several notations that a compilation over time would also be useful
 - Consider moving to a “Question of the Month” format to maintain response rate
- Rearrangement of Headings –
 - Improves logic and hopefully the readability of the final report
- Relevancy, Quality and Productivity –
 - Confusing or redundant questions to be dropped
 - Goal of a higher number of completed survey returned to improve quality
 - Incorporate “Four Pillars” components to engage related programs
- Four Pillars –
 - Enhance the teaching of manufacturing principles and practices in all engineering and engineering technology programs
 - Collaborative effort across professional societies increases productivity

Bibliography -

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- ¹ Trends in Manufacturing Education Programs – 2009, Feola, Hardin, NCME
 - ² Danielson and Georgeou, 2007, ASEE
 - ³ Davis and Jack, 2005, ASEE
 - ⁴ ETD Listserv - <http://etidweb.tamu.edu/listserv.php>
 - ⁵ http://www.bls.gov/opub/ted/2010/ted_20101228.htm, December 28, 2010