26th annual INCOSE international symposium
Edinburgh, UK
July 18 - 21, 2016

Benchmarking the Content of Master's Degrees in Systems Engineering in 2013

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PURPOSE/PROBLEM

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1. To document the MDTS benchmarking study.
2. To provide an educational example of the stages of the early research in the Scientific Method that takes place prior to developing the hypothesis.

OBJECTIVES/GOALS

- Highlights benchmarks of the MDTS degree against the sampled Masters' degrees from learning institution websites.
- Covers the first stage of the Scientific Method, in which observations are made, sorted and analyzed before a hypothesis is developed.
- Proposes criteria to be used for benchmarking degrees from other institutions.

METHODS/DESCRIPTION

1. Select the sample. (213 SE Masters programs in 2013)

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	Degree	Institution
1	MEng in Systems Engineering	Penn State University (Malvern, PA)
2	MEng in Systems Engineering	Stevens Institute of Technology (Hoboken, NJ)
3	MSc in Systems Engineering	Missouri University of Science and Technology (Rolla, MO)
4	MSc (Major in Systems Engineering)	Southern Methodist University (Dallas, TX)
5	MSc in Systems Engineering	University of Maryland – Institute for Systems Research (College park, MD)
6	MSc in Systems Engineering	Worcester Polytechnic Institute (Worcester, MA)
7	MSc in Industrial and Systems Engineering (MISE)	University of Michigan (Dearborn, MI)
8	MISE	University of Southern California – Viterbi School of Engineering (Los Angeles, CA)
9	Professional Master's in Applied Systems Engineering	Georgia Tech (Atlanta, GA)
10	MSc in Engineering and Management	MIT System Design and Management Program (Boston, MA)

METHODS/DESCRIPTION (CONTINUED)

1. Determine the benchmarking criteria.
   a. Types of knowledge taught in the required courses (Pure, Applied, Domain)
   b. Ability to understand, solve, and manage technological problems
   c. Product layers of complexity and process (lifecycle) states (Hitchins-Kasser-Massie Framework (HKMF))
   d. Competency Model Maturity Framework (CMMF)
   e. 1) The 'A' and 'B' system engineering paradigms
      2) Problem-based and process-based paradigms.
2. Document the observations of each degree using criteria.
3. Analyze the resulting data.
4. Summarize the observations.

DATA/RESULTS

Degree/Knowledge	1 MESE	2 MESE	3 MScSE	4 MScSE	5 MScSE	6 MScSE	7 MISE	8 MISE	9 PMAS	10 MScEM	11 MDTS
Pure systems engineering	0.50	0	0	0.10	0	0	0.10	0	0.25	0.09	0.10
Applied systems engineering	0.42	0.40	0.50	0.80	0.40	0.60	0	0	0.55	0.22	0.40
Domain systems	0	0	0	0	0	0	0.10	0	0	0	0.30
Management	0.08	0.10	0.10	0	0.20	0.20	0.10	0.20	0.10	0.31	0
Total	**1.00**	**0.50**	**0.60**	**0.90**	**0.60**	**0.80**	**0.30**	**0.20**	**0.90**	**0.62**	**0.80**

Areas for Further Research

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- Collect more representative and accurate information
- Develop a hypothesis' appropriate for further research
- Repeat the survey with a much wider sample
- Evaluate the Graduate Reference Curriculum for Systems Engineering (GRCSE®) against the benchmarks.
- Examining the pedagogy of systems engineering courses to address the question "is the knowledge being taught in the most effective way?"

CONCLUSIONS

- Indicated that the MDTS degree, a dual degree, should drop three of the four applied SE courses and replace them with three additional Defence domain systems courses.
- Effective methodology for the preliminary research activities in early stages of the Scientific Method
- Effective basis for further research into the content of degrees in systems engineering.
- Developed a useful set of benchmarking criteria for the knowledge content of degrees.