AC 2011-1162: COMPARING PERCEPTIONS OF COMPETENCY KNOWLEDGE DEVELOPMENT IN SYSTEMS ENGINEERING CURRICULUM: A CASE STUDY

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Comparing Perceptions of Competency Knowledge Development in Systems Engineering Curriculum: A Case Study

Abstract

According to the Systems Engineering (SE) Division of the National Defense Industrial Association, one of the top five systems engineering issues for the Department of the Defense (DoD) is: "The quantity and quality of systems engineering expertise is insufficient to meet the demands of the government and defense industry."[1] The growing gap between the numbers of existing versus needed systems engineering experts has caused numerous institutions to develop systems engineering competency models to guide workforce development. Academia has responded by incorporating existing systems engineering competency models into the curriculum development process for establishing learning objectives, identifying gaps in existing course content, and validating student progress. However, based on the outcomes of two recent surveys, varying perceptions of systems engineering competencies presents a new challenge to the curriculum development and validation process. This paper summarizes related findings from an analysis of surveys distributed to instructors and students of 27 online courses in systems engineering and related topics in the Spring 2010 semester. The surveys were administered in support of doctoral research.[2] These findings indicate that instructor and student perceptions of the type of systems engineering competencies addressed within the course differ, even within the same class. Detailed comparisons involving eight competencies that are grouped into 1) Concepts and Architecture and 2) System Design are provided as examples. The paper provides a summary of the online pedagogy used by the each instructor to teach and discuss the course content in the classes researched and summarizes related research data on student age, gender, and years of professional and systems engineering experience. The paper concludes with recommendations for future research and a summary of observations based on the findings.

Introduction

The growing shortfall of experienced scientists and engineers in the domestic and global workforce is well known.[3-7] Science and engineering domains need engineers that possess higher levels of proficiency (eg. expert) in a certain set of competencies (knowledge, skills and behaviors), including systems engineering. In response to this shortfall, government, industry and academia have joined together to collaboratively identify and develop the training and educational programs required to support needed systems engineering workforce development.[8-11] Institutions have put additional focus on workforce competency development by identifying critical systems engineering competencies;[12] by developing frameworks or models to document these competencies;[13-16] and by applying competency-based training and curriculum development approaches.[10,17-21] However, outcomes from two recent surveys on the development of systems engineering competency knowledge in remote online education, indicate that varying perceptions of systems engineering competencies exist in academia and across industry and government. Instructor and student responses collected as part of the research survey[2] indicate that there is a wide variation in the respondents' perceptions of which systems engineering competencies are being addressed in the curriculum, even within the same course.

For the doctoral-based research study[2], 21 instructors and 348 students that participated in 27 online Spring 2010 semester-based systems engineering and related classes were sent surveys that asked them select the type of systems engineering competency knowledge addressed in their recently completed online course(s). Responses were received from 100% of the instructors and 25% of the students. The instructor survey requested instructors to select from a list of 37 systems engineering competencies to identify which competencies were addressed in their course; and to select from six competency knowledge levels to identify what level of knowledge proficiency the instructor expected successful students to achieve upon completing the course. Similarly, the student survey asked each student to select from the same list of 37 systems engineering competencies to identify which competencies were addressed in the course; and to select from the same six competency knowledge levels to identify what level of knowledge proficiency the student had in the selected competency before starting the course, and again upon completing the course. In each case the instructor and students were selecting from a list of systems engineering competencies based on a government/industry model developed initially in the space industry and vetted through NASA, space centers, and collaborating companies and universities.[10,12,20] A summary of the space industry competency model and definitions of proficiency levels and each systems engineering competency were provided to the respondents.

The next several sections provide background information describing the online pedagogy used by the instructor to deliver and discuss the course content remotely through the use of the university's learning management, web conferencing, and instant messaging systems. This is followed by a section that describes the research methodology by way of describing the type of courses investigated; the number of courses, instructors and students in the population; the type of information requested in the surveys; and the definitions and scales used on the survey related to the research summarized in this paper. Findings are then presented.

This paper reviews and discusses the differences in perceptions of course competency coverage in the course based on responses received for the first eight systems engineering competencies of the space industry model. These eight competencies are grouped into the two areas of: 1) Concepts and Architecture and 2) System Design. The paper also summarizes data related to student demographics including age, gender, and years of professional and systems engineering experience. The paper concludes with recommendations for future research in competency-based curriculum development and other related areas and a summary of observations based on the findings.

Online Pedagogy

Each of the 27 classes investigated in this research study were delivered during the Spring 2010 semester through Stevens Webcampus. Students and instructors interface to the course through the Web Classroom Training (WebCT) / Blackboard learning management system. Within the course, instructors have the option to deliver weekly real-time lectures through a web conferencing interface called the Wimba classroom. In addition, a Wimba Pronto tool is made available to all students and the instructors, with pre-built in class lists, for instant messaging, even when the students and instructors are not logged into the online classroom. Instructors can also post weekly written lectures or slides with annotation, speaker notes, or recorded audio. Discussions take place in the course through two primary means: weekly web conferences, or online ‘any-time’ discussions organized into conversation threads. Students and instructors have additional options to communicate by phone, Mail through the classroom, external mail, or a variety of openly available online chat systems.

Research Methodology

As part of a doctoral-based research study[2], research surveys were developed and administered to 21 instructors (some instructors taught multiple courses) and 348 students (enrolled in one to four online courses) that participated in 27 systems engineering and related online classes in the Spring 2010 semester. A summary of the courses offered through the online university program and the number of student enrollments and survey returns is shown in Table 1. For courses that were offered in more than one section, each section is listed separately.

Table 1. SE and EM Online Courses Offered: Spring 2010

Course and Section	Course Title	# Enrolled	# Returns
EM600W1	Engineering Economics and Cost Analysis	12	5
EM600WS		6	1
EM605WS	Elements of Operations Research	19	4
EM612W1	Project Management of Complex Systems	11	6
EM612WS		22	8
EM665WS	Integrated Supply Chain Management	8	1
EM680WS	Designing and Managing the Development Enterprise	20	1
ES684WS	Systems Thinking	22	7
SES602WS	Secure Systems Foundations	4	2
SSW533WS	Software Cost Estimation and Metrics	8	2
SSW540WS	Fundamentals of Software Engineering	23	2
SSW564WS	Software Requirements Analysis and Engineering	12	6
SSW565WS	Software Architecture and Component-based Design	25	1
SSW689WS	Software Reliability Engineering	13	0
SYS605W1	Systems Integration	20	3
SYS605WS		21	7
SYS611W1	Modeling and Simulation	14	1
SYS611WS		15	5
SYS625W1	Fundamentals of Systems Engineering	14	1
SYS625WS		14	4
SYS635WS	Human Spaceflight	9	1
SYS645WS	Design for Reliability, Maintainability & Supportability	25	8
SYS650W1	System Architecture and Design	19	7
SYS650WS		19	9
SYS655WS	Robust Engineering Design	11	6
SYS660WS	Decision and Risk Analysis	21	3
SYS710WS	Research Methods in Systems Engineering	15	6
		422	107

As shown in Table 1, the population for this research was the students that completed one or more Webcampus courses in the Spring 2010 semester of one of the following types:

- Systems Engineering, including
  - Space Systems Engineering
  - Security Systems Engineering
  - Enterprise Systems
- Engineering Management
- Software Engineering

Both the instructor and student surveys (see Appendix A) included a description of the space industry competency model, a listing of systems engineering competencies to select from as 'covered in course' and the definition for the six levels of systems engineering competency knowledge to choose from. The complete space industry systems engineering competency model is described in earlier papers and online documentation.[12,13,20] A description of the competency model was included in the surveys through a link to Appendix A and B of *Mapping Space-Based Systems Engineering Curriculum to Government-Industry Vetted Competencies for Improved Organizational Performance.*[20] Appendix A from this article provides definitions of each of ten competency areas and the associated individual capabilities and in this way defines all 37 competencies that comprise the model. Appendix B from this article contains a table that provides detailed descriptions of the expected leaderships, roles and responsibilities, expertise and learning and development emphasis for each level of proficiency in the model. The definitions provided to the survey takers for the two areas 1) Concepts and Architecture and 2) System Design and their associated eight competencies are repeated in this paper, in Table 2 and 3, for reference.

As shown in Appendix A, the six levels of competency knowledge were comprised of three defined levels of basic, intermediate, and expert knowledge, combined with a scale that allowed the instructor or student to choose points 'in between' the defined levels. The definitions provided were:

- Basic: You are able to understand a discussion about and follow directions related to the competency.
- Intermediate: You are comfortable making decisions about and leading discussions related to the competency.
- Expert: Many others look to you for knowledge about the competency.

And the scale provided was:

0 - Little to No knowledge
1 - Basic level
2 - Between Basic and Intermediate
3 - Intermediate level
4 - Between Intermediate and Expert
5 - Expert knowledge

Table 2. Concepts and Architecture

Concepts and Architecture: The first area covers competency in understanding the mission need, the concept of operations, and the system environment and applying this understanding to the development of a viable and complete system architecture. Capabilities within this competency area are defined as follows:
• *Form Mission Needs Statement:* This capability addresses the ability to accurately identify the mission need and the basis for that need. This includes understanding what works and does not work in the current environment. The end product is the formulation of a mission needs statement that will result in desired customer approved outcomes based on defined and agreed upon success criteria.
• *Describe System Environments:* This capability includes a full understanding of the system environment and the inherent constraints and the ability to establish design guidance for the expected environment.
• *Perform Trade Studies:* Trade studies are important for comparing and contrasting the identified viable system level technical solutions. This capability begins with the development of the operations concept, and includes creating, validating, operating and correlating (with operational data) the system model. The end product of this capability is the identification and selection of a well balanced (cost, schedule, technical, quality) system level technical solution.
• *Create System Architectures:* Developing the various system architectural views begins with establishing the proper bounds of the system and defining the external interfaces. Other tasks within this capability include functional decomposition, performance analysis, identification of subsystem relationships and internal interfaces and documentation of the various (operational, functional, physical and data) architectural views.

Table 3. System Design

System Design: System Design starts with defining the stakeholder expectations, translating these expectations to technical requirements, decomposing the technical requirements into derived specification requirements, and generating and selecting the system design solution. Capabilities within this competency area are defined as follows:
• *Define/Manage Stakeholder Expectations:* This capability covers the ability to identify all relevant stakeholders, obtain their expectations, and translate, validate, baseline and manage those expectations throughout the project lifecycle.
• *Define Technical Requirements:* This capability includes defining the technical problem scope and the related design and product constraints; converting functional and behavioral expectations to technical requirements; defining Technical Performance Measures (TPMs); and validating and baselining the technical requirements.
• *Logically Decompose System:* Under this capability, derived requirements are identified, allocated, validated and baselined. Derived requirement conflicts are identified and resolved and the baseline specifications are developed.
• *Define System Design Solution:* The system design solution is developed by first defining, analyzing and selecting the best system design alternative; and then generating, verifying and baselining a full design description for the selected design solution.

Instructor Survey

A total of 23 surveys (4 courses had 2 sections each taught by the same instructor and those responses could be combined into one survey response for both sections) were sent to the 21 instructors (2 instructors taught 2 different courses and needed separate surveys for each course). Instructors were notified that their response was needed to complete the data collection and 100% of the instructor responses were received.

1. Welcome!
   - No data is collected on this screen, this simply welcomes the instructor, thanks them for completing the survey and provides some general direction
2. Course Completed
   - The information about the course, types of course content delivery and discussions used are collected on this page of the survey.
3. Competency Level
   - The data for the instructor's perception of which competencies were covered in the course and the expected student competency knowledge growth upon completing the course in all thirty-seven competencies is collected on this page of the survey.
4. Final Page
   - Here the survey taker is again thanked, and there is a spot for any final comments.

As outlined above, the instructor survey contained a subset of the questions shown on the student survey, which is shown in detail in Appendix A. For example, the questions on experience and education shown on the student survey (outlined in the next section) were not included, and the questions on competency level only asked if the competency was covered in the course and at what level, there was no need for a before/after rating.

Student Survey

The student survey (see Appendix A) was sent to 348 students who enrolled in one or more courses for a total of 422 student enrollments; the number of courses per student was as follows:

- 281 students (80.7%) enrolled in one course
- 62 students (17.8%) enrolled in two courses
- 3 students (0.9%) enrolled in three courses
- 2 students (0.6%) enrolled in four courses

The sections of the survey are summarized below. The return rate for completing the entire survey was 25% (107 student enrollment responses).

1. Welcome!
   - No data is collected on this screen, this simply welcomes the student, thanks them for completing the survey and provides some general direction
2. Experience
   - Background information on years of experience (overall and systems engineering specific) and student and work status are collected on this page of the survey.

3. Education
    - Background information on the student's education primarily focused on level of completed education and previous graduate courses completed are collected on this page of the survey.
4. Course Completed
    - The information about the course, types of course content delivery and discussion used, and the student's overall satisfaction with the course and the instructor are collected on this page of the survey.
5. Competency Level
    - This is the most intensive (and takes the longest time) page of the survey. The data for the student's perception of which competencies were covered in the course content and their perceived competency knowledge growth in all thirty-seven competencies is collected on this page of the survey.
6. Final Page
    - Here the survey taker is again thanked, and some demographics such as age range and gender are collected on the final page of the survey.

Findings

This section reviews student age, gender, and years of professional and systems engineering experience, followed by a summary of the results related to the instructor and student perceptions of the types of systems engineering competencies addressed in each course in the two competency areas of 1) Concepts and Architecture and 2) System Design. Specifically, the finding that these perceptions differ within the course and even within the same class are presented and discussed.

Student Demographics

Figure 1 shows the distribution for years of professional work experience and systems engineering experience for the 107 student enrollment respondents.

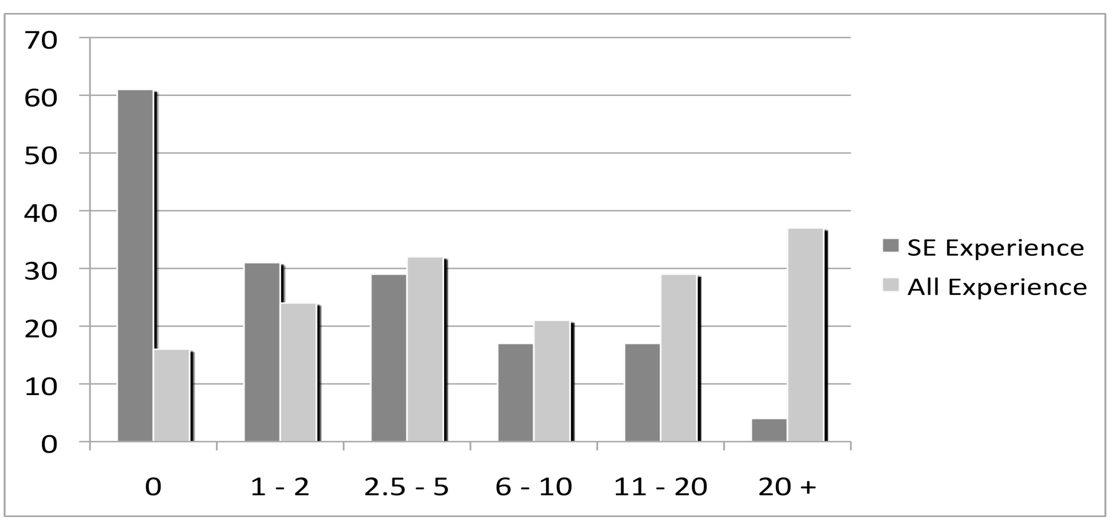

Figure 1. Number of Years of Professional and Systems Engineering Work Experience (107 Student Enrollment Responses)

With regards to professional work experience, over half of the respondents had 10 years or less; about 20% had 11 to 20 years; and the remaining about 30% had over 20 years (up to 42 years) of experience. With regards to systems engineering experience, over three quarters of the respondents had 5 years or less; and the remaining quarter had between 6 and 30 years. On average, the student respondents had 12.5 years of professional work experience and 4.5 years of systems engineering experience.

Table 4 shows, for those who responded with gender and age range, a summary of the responses. The sample was comprised of 31% females and 69% males, with nearly half of the respondents 30 years of age or less.

Table 4. Student Gender and Age Distribution

	< 25	**26-30**	**31-35**	**36-40**	**41-45**	**46-50**	**51-55**	**56-60**	**>60**	**Total**
Female	8	10	4		2	4	3	1		32
Male	16	16	6	8	4	10	6	5	1	72
(blank)						1				1
Total	24	26	10	8	6	15	9	6	1	105
	23%	25%	10%	8%	6%	14%	9%	6%	1%	

Instructor and Student Perceptions of SE Competencies

At the conclusion of the Spring 2010 semester, the instructors and students of the 27 online classes shown in Table 1, were asked to select from a list of 37 systems engineering competencies grouped into 10 competency categories to identify which competencies were covered in the content of the course. All 21 instructors of the 27 sections of the courses responded; however, one course had no student responses (SSW689WS), and several others had only one to four students respond. For simplification of this analysis, these courses and responses are not included. The competency comparison analysis addresses the 12 remaining classes comprised of 10 different courses for the as shown in Tables 5 and 6. These tables show the selections for the first 2 of 10 competency categories, 1) Concepts and Architecture and 2) System Design, respectively. Each category is comprised of 4 competencies each. Selections are shown for each of the 12 classes, by showing whether the instructor (shown as Inst) selected that the competency was covered in the course, and the numbers of students who selected (Yes) or did not select (No) the competency as covered in the course.

In Table 5 and 6, where the majority of the students agree with the instructor, the cells are highlighted. Where more than 65% of the students agree with each other the font is bolded and underlined. Table 7 summarizes by course, the number of each competency where the majority of the students agree with the instructor, and where more than 65% of the students agree with each other. Table 8 summarizes by competency, the number of each competency where the majority of the students agree with the instructor, and where more than 65% of the students agree with each other.

Table 5. Concepts and Architecture: Which Competencies Were Covered in the Course?

	Form Mission Needs			Describe System Environments			Perform Trade Studies			Create System Architectures		
Course	Inst	Student		Inst	Student		Inst	Student		Inst	Student	
		No	Yes		No	Yes		No	Yes		No	Yes
EM600W1	Yes	2	3	Yes	3	2	Yes	**4**	**1**	No	**4**	**1**
EM612W1	Yes	**4**	**2**	No	**2**	**4**	No	**2**	**4**	No	**4**	**2**
EM612WS	Yes	5	3	Yes	5	3	Yes	**6**	**2**	No	**7**	**1**
ES684WS	No	4	3	Yes	**1**	**6**	No	**6**	**1**	No	**5**	**2**
SSW564WS	Yes	3	3	Yes	**5**	**1**	Yes	**6**	**0**	No	**6**	**0**
SYS605WS	No	4	3	Yes	**0**	**7**	No	**5**	**2**	No	3	4
SYS611WS	No	2	3	Yes	2	3	Yes	**4**	**1**	Yes	**4**	**1**
SYS645WS	Yes	5	3	Yes	**2**	**6**	Yes	4	4	Yes	**6**	**2**
SYS650W1	No	**1**	**6**	Yes	**2**	**5**	Yes	3	4	Yes	**0**	**7**
SYS650WS	No	4	5	Yes	5	4	No	4	5	Yes	**0**	**9**
SYS655WS	No	**5**	**1**	Yes	**0**	**6**	Yes	3	3	Yes	**4**	**2**
SYS710WS	No	**5**	**1**	No	**4**	**2**	No	**6**	**0**	No	**5**	**1**
Totals		44	36		31	49		53	27		48	32

Please note: Highlighted cells represent instructor/majority of student agreement; bolded/underlined numbers represent >65% student agreement.

Table 6. System Design: Which Competencies Were Covered in the Course?

	Stakeholder Expectations			Define Technical Requirements			Logically Decompose System			Define System Design Solution		
Course	Inst	Student		Inst	Student		Inst	Student		Inst	Student	
		No	Yes		No	Yes		No	Yes		No	Yes
EM600W1	Yes	2	3	No	2	3	No	**4**	**1**	No	3	2
EM612W1	Yes	**2**	**4**	Yes	3	3	No	**4**	**2**	No	**4**	**2**
EM612WS	Yes	3	5	Yes	3	5	Yes	5	3	Yes	5	3
ES684WS	Yes	**5**	**2**	No	**6**	**1**	Yes	4	3	No	**5**	**2**
SSW564WS	Yes	**0**	**6**	Yes	**0**	**6**	No	**5**	**1**	Yes	**5**	**1**
SYS605WS	No	4	3	Yes	**1**	**6**	Yes	**1**	**6**	No	**2**	**5**
SYS611WS	No	**4**	**1**	Yes	3	2	Yes	**4**	**1**	Yes	**5**	**0**
SYS645WS	Yes	**2**	**6**	Yes	3	5	Yes	**6**	**2**	Yes	4	4
SYS650W1	Yes	**0**	**7**	Yes	**0**	**7**	Yes	**0**	**7**	Yes	**1**	**6**
SYS650WS	No	**2**	**7**	Yes	**2**	**7**	Yes	**0**	**9**	Yes	**1**	**8**
SYS655WS	Yes	**5**	**1**	Yes	3	3	Yes	**5**	**1**	No	**1**	**5**
SYS710WS	No	**4**	**2**	No	**5**	**1**	No	**5**	**1**	No	**5**	**1**
Totals		33	47		31	49		43	37		41	39

Please note: Highlighted cells represent instructor/majority of student agreement; bolded/underlined numbers represent >65% student agreement.

Table 7. Level of Agreement by Course

	Instructor/Student Agreement		Student/Student Agreement		Both	
Courses	**#**	**%**	**#**	**%**	**#**	**%**
EM600W1	5	42%	3	25%	2	17%
EM612W1	4	33%	7	58%	4	33%
EM612WS	3	25%	2	17%	1	8%
ES684WS	6	50%	6	50%	5	42%
SSW564WS	4	33%	7	58%	4	33%
SYS605WS	6	50%	5	42%	4	33%
SYS611WS	2	17%	5	42%	1	8%
SYS645WS	3	25%	4	33%	2	17%
SYS650W1	7	58%	7	58%	6	50%
SYS650WS	4	33%	5	42%	4	33%
SYS655WS	2	17%	6	50%	2	17%
SYS710WS	8	67%	8	67%	8	67%
Totals	**54**	**38%**	**65**	**45%**	**43**	**30%**

Table 8. Level of Agreement by Competency

	Instructor/Student Agreement		Student/Student Agreement		Both	
Competencies	**#**	**%**	**#**	**%**	**#**	**%**
Form Mission Needs Statement	6	50%	4	33%	2	17%
Describe System Environments	7	58%	8	67%	6	50%
Perform Trade Studies	4	33%	7	58%	3	25%
Create System Architectures	8	67%	11	92%	8	67%
Define/Manage Stakeholder Expectations	9	75%	9	75%	6	50%
Define Technical Requirements	7	58%	6	50%	6	50%
Logically Decompose System	7	58%	10	83%	7	58%
Define System Design Solution	6	50%	9	75%	5	42%

As shown in Table 7, the class that had the highest level of agreement across the board, between instructors and students, and between students and students, was the SYS710 Research Methods course. This was primarily due to the specific competencies not being addressed in the course, specifically, by the course content.

As shown in Table 8, of the eight competencies, the highest level of agreement between instructors and students was 'Define/Manage Stakeholder Expectations' and the highest level of disagreement was 'Perform Trade Studies'. The highest level of agreement between students was 'Create Systems Architectures' and the highest level of disagreement was 'Form Mission Needs Statement'.

In one case there was an instance of complete agreement. For, SYS650, 'System Architecture and Design', there were two competencies that both instructors and all 16 students agreed upon as covered in the course, and those were 'Create System Architectures' and 'Logically Decompose Systems'. On the other hand, there were one competency that seemed to be split as to whether or not the competency was covered, and the split was between both instructors and well as between the students, and that competency was 'Perform Trade Studies'.

This analysis reviewed in detail eight of the 37 competencies surveyed; however, the analysis revealed some interesting findings, and the data can be used to identify areas for focus by the instructor for additional curriculum development going forward.

Future Research Areas

First, for a more complete comparison, instructor age, gender and years of professional work experience and systems engineering experience could also have been collected. At a minimum, an understanding of years of systems engineering experience for the instructors would have provided a more complete context within which to evaluate and understand the findings. For example, instructors with little or no systems engineering experience may not interpret the competency areas as accurately as an instructor with extensive systems engineering experience. Second, additional information about the instructor and student background experience across all disciplines could be collected and used to explore how various backgrounds influence an understanding of systems engineering and the competencies that are critical, as defined by government and industry, to the success of their business.[12,20] Also, this research, as defined, focused on competency knowledge development, rather than addressing changes in both cognitive competency (knowledge) and affective competency (behavior and attitude), both of which are important to maturing as systems engineers; future research in this area should address both types of competency. And finally, additional analysis of the remaining eight competency areas that include 29 competencies, as well as a detailed analysis of the level of the competency knowledge addressed in the courses, can be completed on the data already in hand and once done, will provide a more complete picture.

Conclusion

While competency development is an important factor in the development of curriculum for systems engineering, and these courses were not developed based strictly on a competency-based curriculum development approach, the findings from this research have a strong message for any efforts involving competency-based curriculum development. Further research is needed to understand the differences in perceptions of what knowledge lies in which area of systems engineering competency. Without a common base of understanding and consensus on this point, developing curriculum to support a specific systems engineering competency is problematic. Systems engineering instructors may require additional training and guidance in understanding systems engineering competency models and implementing these models in the classroom; and students may benefit from a broader view of how systems engineering competencies fit into the discipline of systems engineering.

Acknowledgements

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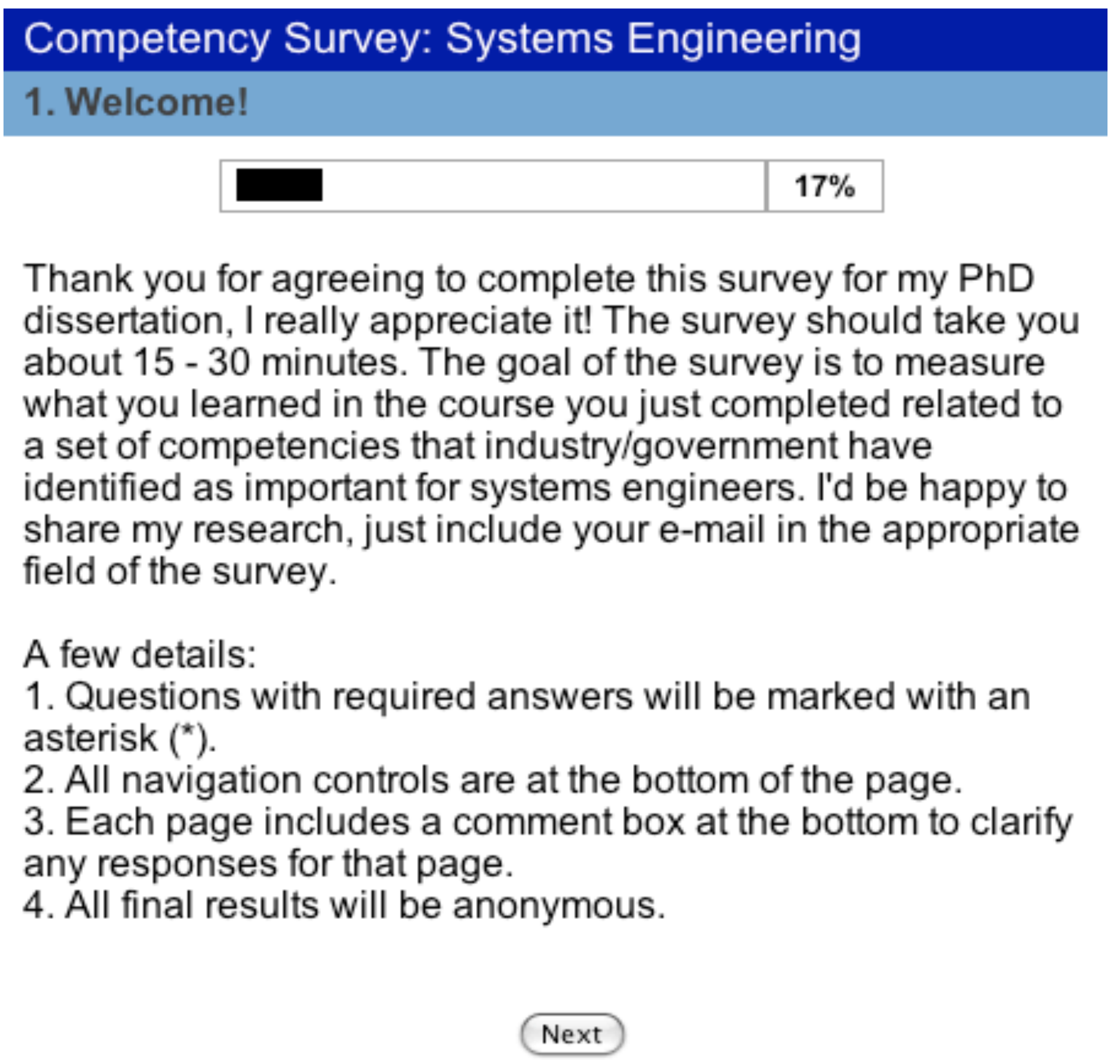
Appendix A: Student Survey[2]


Competency Survey: Systems Engineering

1. Welcome!

17%

Thank you for agreeing to complete this survey for my PhD dissertation, I really appreciate it! The survey should take you about 15 - 30 minutes. The goal of the survey is to measure what you learned in the course you just completed related to a set of competencies that industry/government have identified as important for systems engineers. I'd be happy to share my research, just include your e-mail in the appropriate field of the survey.

A few details:
1. Questions with required answers will be marked with an asterisk (*).
2. All navigation controls are at the bottom of the page.
3. Each page includes a comment box at the bottom to clarify any responses for that page.
4. All final results will be anonymous.

Next

Competency Survey: Systems Engineering

2. Experience

33%

First I need to know a little bit about your level of experience. Please feel free to add comments and clarifications to your responses at the bottom of the page.

*** 1. Please enter the total number of years of professional work experience in industry, government, or academia working in any area (enter '0' if none):**

*** 2. Please enter the total number of years of professional work experience in systems engineering (enter '0' if none):**

3. Please select the options that best describe your current situation.

	Full-time (>= 30 hrs weekly)	Part-time	Not Applicable
Work	○	○	○
Student	○	○	○

4. I am

- ○ a graduate student
- ○ an undergraduate student
- ○ not a student

5. Please enter any comments or clarification on your experience here:

Prev Next

Competency Survey: Systems Engineering

3. Education

50%

Next, I need to know a little bit about your education. Please skip any areas that do not apply! Add comments and clarifications at the bottom of the page at any time during the process.

*** 6. Please select the highest degree that you have completed.**

- None
- High School
- Bachelors
- Masters
- Doctorate

Please enter school and field for highest degree completed here, and any additional comments:

7. Please answer the following about systems engineering or related education you are currently pursuing.

	Area	# Graduate Courses Completed	Towards a....
Stevens Institute of Technology			
Other Institution - see comment			

Comment: Other (please specify Institution, Area and/or Highest Level)

8. Please enter any comments or clarification on your education here:

Prev Next

4. Course Completed

67%

Please tell me about the course that you just completed.

***9. Please select which course, by topic, using the drop-down menu, that you are reporting on for this survey. If you have completed more than one course this semester, please complete a separate survey for each course. This will ensure that the results are accurate and I would also love to hear about your experience with each course!**

	Please select the course you are reporting on for this survey, from the drop down	Section
Course Completed		

Other (please specify other course number and section completed if not in list above)

***10. Please comment on the following for the course you selected (I apologize for any repeats from your course evaluation survey, but I need the information here to link to your other responses).**

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
The instructor was an effective teacher.					
This was an excellent course.					
I participated fully in the course.					

***11. Please select how often each method was used to deliver lectures in the course. Feel free to skip any method not used. If no lectures were delivered in the course, please select Never under Other.**

	Weekly	Every other week	A few times during course	Never
Real-time webconference w/ slides/visuals				
Real-time webconference -- no visuals				
Asynchronous Recorded Audio w/ slides/visuals				
Asynchronous Recorded Audio -- no visuals				
Slides w/ Visuals/Text and speaker notes				
Slides w/ Visuals/Text -- no speaker notes				
Text Based Only Notes or Slides				
Other - see comment				

Please add additional comments about lectures and Other here:

***12. Please select how often each method was used to discuss course content during the course. Feel free to skip any method not used. If the course did not include any type of discussion of course content, please select Never under Other.**

	Weekly	Every other week	A few times during course	Never
Instant Message with instructor only				
Instant Message with instructor and other students				
Instant Message with other students only				
Asynchronous public (discussion group, etc..) with instructor only				
Asynchronous public (discussion group, etc..) with instructor and other students				
Asynchronous public (discussion group, etc..) with other students only				
Asynchronous private (Mail, etc...) with instructor only				
Asynchronous private (Mail, etc...) with instructor and other students				
Asynchronous private (Mail, etc...) with other students only				
Real-time audio-based (web, phone, etc...) with instructor only				
Real-time audio-based (web, phone, etc...) with instructor and other students				
Real-time audio-based (web, phone, etc...) with other students only				
Other - see comment				

Please add additional comments about discussion and Other here:

13. Please enter any comments or clarification about your course here:

Prev Next

Competency Survey: Systems Engineering

5. Competency Level

83%

These are the most important responses for the entire survey and for this reason, every row and column for each question requires a response in order to proceed to the final page. This page will require the most time to fill in.

The directions for each of the questions on this page are as follows:
Please indicate whether you believe the topic was covered in the course, and then what you believe your level of knowledge was in that competency before you started the course and what you believe your current level of knowledge is in that competency now that you have completed the course.

This is the scale provided for each Before and After drop down:
0 - Little to No knowledge
1 - Basic level
2 - Between Basic and Intermediate
3 - Intermediate level
4 - Between Intermediate and Expert
5 - Expert knowledge

The three main levels of knowledge are defined as follows:
1. Basic: You are able to understand a discussion about and follow directions related to the competency.
2. Intermediate: You are comfortable making decisions about and leading discussions related to the competency.
3. Expert: Many others look to you for knowledge about the competency.

Each competency is defined in more detail in the document at this url:
http://personal.stevens.edu/~asquires/AppendixAandBJSE.pdf
(Please copy and paste the above url into another browser window to open.)

Please feel free to add comments and clarifications in the comment boxes provided for each question and at the bottom of the page, as needed.

✱14. For Concepts and Architecture, and System Design (directions located at top of page):

	Covered in Course?	Before Course Started	After Course Completed
Form Mission Needs Statement			
Describe System Environments			
Perform Trade Studies			
Create System Architectures			
Define/Manage Stakeholder Expectations			
Define Technical Requirements			
Logically Decompose System			
Define System Design Solution			

Other (please specify)

– Several additional pages concerning other competencies were included here –

Competency Survey: Systems Engineering

6. Final Page

100%

Please let me know a little bit about you (optional) so I can better categorize my data. All results will be anonymous.

Thank you so much for completing this survey!

20. Please provide the following demographic data (optional but very helpful).

	Age Range	Gender
About Me:		

21. If you would like a copy of the results of this survey, please provide your e-mail (optional):

22. Last Chance! Please provide any final comments or suggestions here:

Prev Done

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