

Applicability of CMMI to the IS Curriculum: A Panel Discussion

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Abstract

Information Systems (IS), as an academic discipline, has grown from its early days as data processing to where we are now, recognized as a true academic discipline, with graduates assuming positions as systems analysts, project managers, applications developers, web designers and more. Business cannot live without quality information. Quality information systems have become the lifeblood that sustains business; but, information systems projects became notorious for being late, over budget and not delivering what was originally promised or worse yet, having no idea about the true nature of the system requirements at all. A major step to remedying this was the promulgation of the Capability Maturity Model (CMM), which assessed how effectively software development groups were performing. Recently, Capability Maturity Model Integrated (CMMI) was advanced by Carnegie Mellon as the extension of the CMM concepts to organizations. This panel will explore the combining of academic discipline specifications of IS 2002 with the controlled and measured approaches of the CMMI to effectively monitor and deal with IS curriculum change and quality enhancement.

Keywords: CMMI, IS model curriculum, assessment, quality

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Panel Overview

The panel will address the following topics:

1. The proposition that CMMI can be used in higher education curriculum assessment.
2. The specific implementation issues surrounding the proposition.
3. The interpretation of the Key Process Area mapping to higher education.

Intended Audience

Educators who are interested in:

- Improving the quality of IS education
- Assessment of IS curriculum
- Preparing for accreditation (regional or program)

Panel Background and Rationale

1. Introduction

The IS 2002 Model Curriculum (Gorgone, Davis, Valacich, Topi, Feinstein, and Longenecker 2002) represents the extension of IS'97. These Model Information Systems Curricula define a sequence of learning units consisting of goal and objective statements and specified elements of the body of information systems knowledge. IS2002 specifies a set of skills (Landry, Longenecker, Haigood, and Feinstein 2000) that are mapped to the learning units (www.IS2002.org, see reports). These mapped skill-to-learning unit pairs have become the basis for construction of an assessment and certification mechanism for graduating IS students (Landry, Reynolds, and Longenecker 2003; McKell, Reynolds, Longenecker, and Landry 2003; Reynolds, Longenecker, Landry, Pardue, and Applegate 2003).

2. CMM Background

CMM was originally developed at the direction of the Secretary of Defense by the Software Engineering Institute (SEI) of Carnegie Mellon University in 1987. The initial CMM model was developed as a mechanism for maturation of software development firms. The idea was that these firms would pass through stages of maturation that reflected on their advancement. The current version of CMMI-SW has five levels (CMMI 2002) as shown in Table 1.

Table 1 – Overview of CMM Levels

CMM Level	Description
Level 1 – initial	Characterized by individual effort, little control and monitoring and even has been described by some as chaos.
Level 2 – repeatable	The software development task has some established processes. For CMM-SW level 2, there are six KPAs – Key Process Areas – software configuration management, etc. etc. The emphasis is on establishing and following processes that are considered to be among the best of practices.
Level 3 – defined	This level introduces five more KPAs – including training – etc. The emphasis now shifts to using metric measurements to help the organization monitor and control the software development process.
Level 4 – managed	More KPA's – more metrics, more making the defined processes to be managed processes.
Level 5 – optimized	At this level software projects are managed and controlled through metric feedback and control.

3. Synthesis

In 2002, a new model IS undergraduate curriculum model was released. This model is a well-defined effort building on previous IS curriculum models – with a strong consistency between participants in the model building process. This model had the support and endorsement of three major IS professional organizations – Association for Information Systems (AIS), Association for Computing Machinery (ACM) and Association for Information Technology Professionals (AITP) and has 10 courses that cover the goals and objectives of an IS program.

In 2003, a task force was organized to develop an assessment test tied to the IS 2002 model curriculum. IS 2002 contains a set of exit-level skills based on job ad analysis. The skills were summarized within the document text and further expanded on the website (www.is2002.org). These exit level skills are achieved within the curriculum and throughout the curriculum. Aspects of specific skills are contained within the learning units. There is a precise specification of the skill—learning unit mappings on the website. Exit objectives based on these skill—LU maps were determined by a task force meeting in February 2003. These objectives were used as the basis for developing assessment questions. This task force administered a beta test version of their assessment test in the spring of 2003 when over 500 students took the test. The test has been thoroughly analyzed for reliability and validity (Reynolds et al, 2003). Questions were carefully analyzed to determine the effective measurement of the learning objectives of the model curriculum. In June 2003, this task force reconvened to conduct further analysis of the assessment test and process. Using the metrics that were gathered, the task force identified questions that did not effectively measure the learning objectives.

4. Use of the IS 2002 Model by Universities

It was intended within the design of IS'97 and IS 2002 that individual institutions could prove their relationship to the national model curriculum by mapping the learning units to their own courses. Such an accounting was done at the University of South Alabama (Daigle et al 2003). As a component of the IS Curriculum Development website (www.is2002.org), software is provided to accomplish this mapping. During the mapping process the interpretation by the university implementation of a learning unit in a given course is specified through a Local Objective (LO). Additional software is provided within the website to show how a sequenced thread of LOs culminates in a task force specified exit objective. Scoring on the task force questions relates to the effectiveness of the LO sequence and specific coverage. Deficiencies provide opportunity for improvement.

5. Proposition

Curriculum models and reform can be discussed as a form of capability modeling. In the past institutions have inspected the model curricula and developed courses in an ad hoc manner. Table 2 shows how the CMMI process can be utilized to enable institutions to use the national model and certification exams to attain a desired level of CMMI performance.

Also, while past model curriculum design activities may have been described as Level 1 efforts – heroic efforts of IS curriculum experts over the years – the IS 2002 model has become a very stable representation of the IS curriculum. With the assessment test metrics and with the metrics from the analysis of job ads and positions around the world, the CMMI process can be extended further as the basis for careful and meaningful modifications of the model curriculum in the future.

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Table 2: Key Process Areas Applied to IS Curriculum Assessment⁶

Level	Characteristic	Key Process Area (KPA)	Key Process Area Characteristic Interpretation Assessment
Optimizing (5)	Continuous process capability improvement	Technology change Management Process Change Management Defect Prevention	<ol style="list-style-type: none"> 1. New technology insertion into courses. 2. A comparative analysis of industry educational & skill requirement criteria for the current courses. 3. A comparative analysis of the postgraduate industry performance population based on exit objective criterion analysis of Learning
Managed (4)	Product Quality Planning Tracking of measured IS courseware process	IS Course Quality Management Quantitative Process Management	<ol style="list-style-type: none"> 1. Insure that each developed course is consistent with the overall meets the objectives of the specific course outline. Provided by developing skill threads based on LU local objective development 2. Maintain quantitative control within the course set. Provided by performance in classes of instructors: comparative aggregation at LU level as aggregated to the industry standard.
Defined (3)	IS Course development process defined & institutionalized to provide product quality control	Peer Reviews Inter-group Coordination Courseware Product Engineering Training Program Organizational Process Definition Organizational Process Focus	<ol style="list-style-type: none"> 1. Intergroup reviews for courseware content & development. Provided by Curriculum Exit Objectives compatible with industry skill analysis question database with question validation for LU and exit criteria 2. Intergroup reviews for courseware interaction between IS sub of Curriculum Exit Objectives compatible with industry skill analysis question database with question validation for LU and exit criteria 3. Training Program for active participation in CMMI & courseware development 4. Define courseware development process. Provided by the mapping and, definition of course responsibilities in skill production based analysis. 5. Organization process focus within the IS department. Provided by LU's to courses; definition of course responsibilities in skill production and thread analysis.
Repeatable (2)	Management oversight & project tracking; Stable planning & product baselines	Course Configuration Management Course Quality Management Course Project Tracking & Oversight Courseware Project Planning Requirements Management	<ol style="list-style-type: none"> 1. Courseware Configuration Management processes that insure courseware. Provided by adjustment of the curriculum based on new skills, analysis of local objectives. 2. Quality assurance that provides for outcome based expectation analysis of student performance in classes of instructors: comparison-wide analysis at LU level as aggregated to the national standard 3. Course Project Tracking & Oversight that provides the IS department management. 4. Course Project Planning that provides for new and continuing courseware 5. Requirement management, which provides assurance that developed desired objectives. Provided by an analysis of job ads and survey with confirmative factor analysis.
Initial (1)	Ad hoc	"People"	Level 1 is characterized by success achieved by ad hoc methods carried out by exceptionally hard workers.

⁶ A process area is defined as a cluster of related practices in an area that, when performed collectively, satisfies a need that is considered important for making significant improvements in that area.