COMPUTING PROGRAM CURRICULUM ASSESSMENT: THE EMERGENCE OF A COMMUNITY OF PRACTICE

J. Harold Pardue
University of South Alabama
hpardue@usouthal.edu

Jeffrey P. Landry
University of South Alabama

Herbert E. Longenecker, Jr.
University of South Alabama

Lynn McKell
Brigham Young University

ABSTRACT

To face the enormous challenge of educating an IS workforce operating in a world of ever-changing skillsets and IT-induced organizational change and to respond in increasing calls for accountability in IS education, postsecondary computing programs are turning to outcome-based approaches for curriculum assessment and improvement. The IS 2002 Model Curriculum and the IS Exit Assessment exam are tools that are part of a curriculum assessment and improvement process involving a growing number of collaborating IS institutions. This paper describes IS institutions who collaborate for the mutual purpose of improving their computing curricula using outcome-based approaches as an emerging Community of Practice. The benefits of an IS education Community of Practice are discussed and a hypothetical example of how such a community might work is described.

Key words: IA01 IS Curriculum

I. INTRODUCTION

Postsecondary computing programs face a major challenge in producing learners who can demonstrate mastery of an ever-widening skill-set against the

backdrop of dramatic changes in how work is structured. This structural change in how organizations accomplish work is driven by two forces: rapid advancements in information technology and the globalization of competition. To remain competitive in today's global market, organizational decision-makers demand shared, accurate, real-time data systems that transparently cross organizational and cultural boundaries; data must be available virtually anywhere, anytime via a wide range of devices and access points. The postsecondary computing programs producing the professionals who engineer these data systems must be as flexible as the organizations with whom these professionals work and collaborate. The need for highly competent computing professionals and their collective impact on the global economy shows no sign of abating. In the U.S. alone, computing-related occupations continue to rank in the top-five list for highest job growth in the Bureau of Labor Statistics monthly labor review (2000-2012 projections).

We propose that in answer to the call for highly competent computing professionals, a Community of Practice (CoP) is emerging. This CoP is focused on outcomes-based assessment of computing programs with the goal of fostering excellence in postsecondary computing education through the creation of knowledge-based social structures. The next section describes CoPs. The third section describes the computing program assessment CoP as being in the initial build-up phase of becoming a CoP. The fourth section enumerates critical success factors associated with the successful development of a CoP. A hypothetical case describes how an outcomes-based IS education CoP for curriculum improvement might work.

II. COMMUNITIES OF PRACTICE

Wenger and Snyder (2000) define a CoP as "a group of people informally bound together by shared expertise and passion for a joint enterprise." Although the term "Communities of Practice" is relatively new, the existence of CoPs is

not. Historically humans have formed communities to cope with uncertainty and a changing environment by creating knowledge-based social structures. For example, during the Middle Ages guilds provided a social structure that not only defined what a craftsmen should know and be able to do but what it meant to be a craftsmen. Further, members derived personal satisfaction from associating with colleagues who shared a similar world view and struggled with the same issues and problems.

Modern CoPs can take many forms and can range in size from small (150 members) to large (3,500 members). An example of a relatively small close-knit CoP is the MirandaNet Fellowship. The Fellowship began with 15 educators and researchers who where focused on using technologies to transform teaching and learning. MirandaNet provides a boundary-spanning forum for education professionals to discuss best practices and promotes and supports such activities as peer mentoring and the creation of a shared professional knowledge base. The CoP director describes her role as "… a dating agency, hooking up people with others. Bringing in groups of teachers from abroad, sponsors from industry and teaming best practice with action research" [Hildreth, 2004, p. 156].

An example of a larger CoP is the Australian Flexible Learning Community with over 3,500 members. The community's mission is to encourage flexible learning and the use of online technology in the vocation and training sector. Educators are faced with constantly changing technologies in hundreds of vocational areas and a workforce that is 75% part time. The environment and changing technology can lead to very stressful and trying work environments. The CoP director sees a major value of the CoP as the ability for educators to "be irreverent at times and have fun. We try to achieve a balance between 'strategic and serious' (credibility) and warm and engaging" [Hildreth, 2004, p. 153].

What CoPs have in common is the supposition that knowledge acquisition and creation is social and situational [Lave and Wenger, 1991]. In CoPs, knowledge and meaning are negotiated by members of the community, not something fixed or static. CoPs contain an implicit understanding that the best way to solve problems in extremely complex and changing situations is to incorporate multiple perspectives. In recent years, organizations have recognized the value of supporting the creation of boundary-spanning CoPs as a source of innovation, creativity, and knowledge management. CoPs are more fluid and dynamic and therefore provide more flexible and agile organization forms.

As the term CoP suggests, members of a CoPs have a common set of shared practices that tend toward a common goal or passion. The activity of performing these practices creates the links among members that in turn creates the network upon which the community exists.

Although there may exist individuals with the power to control shared resources, resources in a CoP are communal. However, communities still operate as markets. Through reciprocity and trust-building, members accumulate social capital with which to purchase access to knowledge assets. In a CoP, a link is a knowledge asset. Interaction is not based on power differentials or formal contractual agreements but on relationships and social structures.

To succeed, a CoP must have a compelling common purpose that binds members together and forges a recognizable identity. Often, in the initial stages of evolution, the members of an emerging CoP do not realize they are forming a community but rather only see a loose network of colleagues and friends. These colleagues and friends share tacit knowledge, best practices, insights, and expertise through storytelling. Storytelling can involve telling “war stories” or mentoring and coaching through the relation of past experiences.

Storytelling is a mechanism for accumulating social capital and building trust. Trust is essential for the success of a CoP. Members must have confidence

that the members either individually or in published documents will not misuse or misrepresent information disclosed by another member. It may be acceptable to a member to discuss a failure in a one-on-one interaction or in a small group, but completely unacceptable to have the failure publicly disclosed.

Storytelling is how meaning is created. Through social interaction, members negotiate and renegotiate meaning. For example, a major knowledge acquisition challenge is answering the questions “what does it mean to be a computing professional? What does a computing professional need to know and be able to do?”

III. COMPUTING PROGRAM ASSESSMENT

Wenger et al., [2002] observed that the evolution of CoPs tends to follow a five stage process: potential, coalescing, maturing, stewardship, and transformation. Each stage is characterized by different activities. In the potential stage, members are focused on discovery and imagining possibilities. As the community begins to coalesce, the focus shifts to delivering immediate and short term value to its members. As the CoP matures, the focus tends to shift toward expansion. During the stewardship stage, issues faced tend to deal with ownership and openness to new members and ideas. As the CoP transitions, it either disbands or lives on in some new form. The process flow of computing program assessment CoP as perceived by the authors is depicted visually in Figure 1.

The block arrow represents the flow of educated learners into the workforce. The challenge faced by all participants in the CoP is preparing learners to enter a workplace characterized by an ever changing structure of work. Information technology and globalization have dramatically altered the demands placed on computing professionals. Some learners will enter local markets, some national markets. The dotted box represents the boundary between national and local-level participation in the CoP.

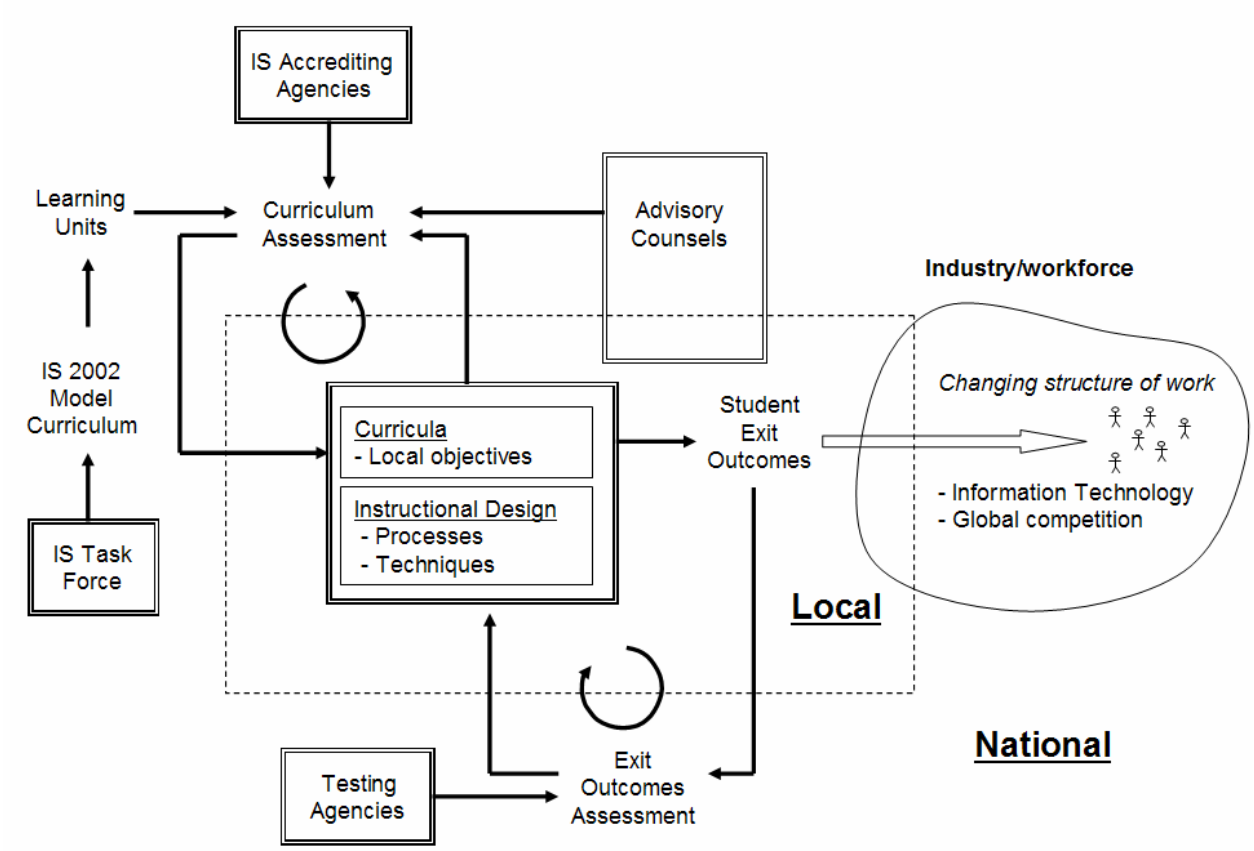

Figure 1. Computing Program Assessment CoP

The solid arrows represent information flows. The IS task force publishes a model curriculum, IS 2002 which defines logical courses comprised of learning units. A learning unit is a clearly stated educational goal with a set of supporting behavioral objectives expressed in terms of expectations of students at a specified level of depth.

Accrediting agencies publish standards, policies, and create assessment reports for programs. The body responsible for IS accreditation is the Accreditation Board for Engineering and Technology (ABET). ABET requires computing programs to report content coverage in six IS core areas as an estimate of semester-hour-coverage [ABET, 2003, p. 9]. Landry et al., [2004] proposed an initial linkage between the IS core areas and IS 2002 learning units.

National and local advisory counsels provide feedback on the currency and relevance of a local curriculum. The local computing program publishes information on its curriculum and instructional design processes and techniques. These information flows create a feedback loop that enables a program to evaluate and revise its curriculum.

The lower feedback loop represents the measurement educational outcomes. Outcomes-based education [Killen, 2000; Spady, 1994] focuses not only on what learners know, but what learners can do with their knowledge (culminating skills) in a meaningful context and whether the learner is prepared to assume membership in their chosen profession as a result of their education. For example, a graduating learner entering a career in networking should be well versed in the layers of the Open System Interconnection model (OSI). However, an outcome objective would be, given a trouble-shooting situation, the learner should be able to identify the correct OSI layer at which to begin the investigation and provide likely causes for the problem behavior. The focus is not on what the learner knows per se, but what they can do with the knowledge. A major theme of outcome-based education is that assessment of educational outcomes should provide feedback for curriculum improvement.

The lower feedback loop can also be seen as the assessment of "graduateness." Graduateness is the threshold outcome expectations for a postsecondary degree award [HEQC, 1996]. However, instead of defining outcome expectations in terms of culminating skills, "graduateness" focuses on personal attributes that contribute to applied competence. Graduateness goes beyond a command of field-specific content and methods to include such personal attributes as being self-motivated, taking responsibility, and using critical and analytical approaches to problem solving and persuasion.

In the Computing Program Assessment CoP, exiting learners take an exam and the results are used to evaluate and revise curriculum. In 2003, the

Center for Computing Education Research (CCER), a non-profit division of the Institute for Certification of Computing Professionals Education Foundation began administering a bi-annual national IS exit assessment exam for postsecondary computing programs [Reynolds et al., 2004]. The CCER exit assessment exam measures student performance on specific IS 2002 learning units and job-related skill combinations. Participating programs are provided with detailed reports organized by IS 2002 learning units or ABET accreditation core areas. To date, over 30 postsecondary computing programs have participated and nearly 3,500 graduating seniors have been assessed.

IV. CoP CRITITCAL SUCCESS FACTORS

Moving a CoP beyond the potential stage to the coalesce stage is characterized by false starts, turmoil, and uncertainty. A successful CoP depends on a combination of leadership skills, common motivation, technology, and a people focused approach. A summary of CoP critical success factors [Vestal and Lopez, 2004] along with how each factor could be met by the existing CoP is shown in Table 1 below.

Table 1. CoP Critical Success Factors

CoP Critical Success Factor (Vestal and Lopez, 2004, p. 148)	**Assessment of How Factor is Met in Computing Program Assessment CoP**
Compelling business case	Educational challenge to meet ever-changing needs IS workforce
Leadership	CCER directors, IS Model Curriculum Task Force
Knowledge map of core content	IS 2002 Model Curriculum
Knowledge sharing process	Scholarly publishing, face-to-face interaction at conferences and meetings
Technology medium for knowledge exchange	CCER online assessment and reporting
Success metrics	CMMI levels applied to IS curricula [White et al., 2003]
Recognition plan for participants	Outlets for publication and presentation of work, such as journals, conferences, panels, workshops

Success Metrics

A candidate measure of success for a computing program assessment CoP is the process maturity of the local program. In Figure 1, this refers to the maturity of the process that takes input from the two feedback loops to evaluate and revise local objectives and instructional design processes and techniques. Process maturity is embodied by the Capability Maturity Model Integration (CMMI) developed at Carnegie Mellon University [Capability, 2002]. CMMI is used to identify key process areas in order to measure the degree to which an organization has institutionalized or adopted continuous improvement processes.

In the CMMI, organizations evolve through five levels of maturity: Initial, Repeatable, Defined, Managed, and Optimizing. White et al., [2003] mapped out the applicability of CMMI to evaluate the maturity of IS curriculum assessment, evaluation, and revision processes. Programs with the highest chance of producing graduates prepared to meet the challenge of the work force would be those programs reaching level 5 process capability (optimizing).

V. BENEFITS OF IS EDUCATION COMMUNITIES OF PRACTICE

Humans form and participate in communities because doing so creates value for individuals and the community. The benefits of participating in a CoP have been well documented in the literature [Wenger et al., 2002]. Benefits include faster answers to questions, reduced development time, improved quality of decisions, a forum for benchmarking performance, better forecasting and with participation in a CoP comes the ability to take advantage of emerging trends, increased confidence, meaningful participation, a sense of belonging, and having fun with like-minded colleagues. The following narrative is a hypothetical example of how Computing Program Assessment CoP might work once it has coalesced and moved towards maturity.

IS Education CoP: A Hypothetical Case

Assume a CoP member program is hosting a curriculum assessment workshop either at their University or as an ancillary meeting at a conference. The topic of the workshop session in question is teaching the undergraduate database course. Pam Smith, a professor who teaches her program's database course has been invited to attend. The previous semester, her program assessed her program's educational outcomes using an IS exit assessment exam. She discovered that her graduates performed unacceptable below the national norms on the database-focused learning units in IS 2002. Her program is applying for first-time IS accreditation in the next year or two. Her Dean, a relatively new member of the CoP requested that she attend the workshop and learn how their program can improve their performance in the database area.

Pam has not yet mapped her local course objectives to the learning units in IS 2002. She attends a workshop earlier in the morning and is coached on the process. She does not quite finish the mapping process. However, the mapping software is web-based so she will return to her school and finish the mapping there. As an aid to formulating her local objectives, she has access to an online repository of local objectives mapped by other members of the community and the email address of the mapping mentor for the workshop. A major component of the workshop is a chance for participants to share mapping stories. There are also online tutorials for using the mapping software and writing effective objectives (in the form Student Will Be Able To or SWBAT).

The database workshop is facilitated by a community member whose program is recognized for excellence in database educational outcomes. After an initial discussion of best practices employed at the facilitator's school, the workshop breaks out into small groups and specific local objectives, process, and techniques are discussed. Pam has learned that her students are particularly weak in SQL concepts associated with learning unit IS.8 (90) IS Database and IS

Implementation. Her group's mentor discusses how LU 90 is delivered in their program and shows the group how to use the knowledge repository to find best practices directly related to a specific learning unit. A member familiar with accrediting standards is present at the workshop. The question is put to this person "how does this learning unit relate to the current IS core areas?"

After the conference, Pam returns to her school to consider how to proceed. At first she feels reluctant to take risks and try the techniques she learned at the workshop. The task of mapping seems daunting now with all the other obligations of a professor converging around her. However, in a CoP, Pam comes home with more than new knowledge; she comes home with new knowledge assets and social capital. Pam has established links to knowledge resources and acquired a sense of belonging. She is part of a larger process of continuous improvement.

Pam uses her social capital to call and email her mentor and finishes mapping her database course. Once her course is mapped, she can compare her instructional design processes and techniques to those of similarly mapped local courses. Pam can use the online software to conduct what-if analysis to determine the impact of her proposed curriculum changes on her course and other mapped courses in her curriculum [Landry et al., 2004]. At the database workshop, a member related a story about getting his advisory counsel to review and assess his local objectives for his database course in terms of educational outcomes or culminating skills. Pam considers this suggestion and schedules a meeting with a member of her advisory counsel.

Moving Beyond IS

The benefits of a computing program assessment CoP would extend beyond IS curriculum assessment. Once the CoP has attained maturity, the community could be extended to any computing discipline that has a model

curriculum, for example, computer science, information technology, and computer engineering.

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Authors' Biographies

Harold Pardue is a Professor of CIS in School of Computer and Information Sciences at the University of South Alabama. He received his Ph.D. in MIS from the Florida State University in 1996. His current research interests include computing curriculum development and assessment, trust in computer-mediated environments, and Information Systems architecture. His articles have been published in Review of Business Information Systems, Information Systems Education Journal, Communications of ACM, Journal of Engineering Education, Journal of Information Systems Education, Engineering Economist, System Dynamics Review, Journal of Psychological Type, and Journal of Computer Information Systems. He is also a director of the Center for Computing Education Research, a division of the ICCP Education Foundation.

Jeffrey P. Landry is an Associate Professor of Computer and Information Sciences (CIS) in the School of CIS at the University of South Alabama. He received his Ph.D. degree in Information and Management Sciences from the

Florida State University. He previously worked in the commercial software development sector for eight years as a software engineer, project manager, and software department manager. His research interests include behavioral aspects of IS development and project management, including the role of trust in the context of IS, and IS education and curriculum development. He has published in Communications of the ACM, Review of Business Information Systems, International Business and Economics Research Journal, Journal of Engineering Education, Journal of Information Systems Education, and in numerous conference proceedings. His teaching interests include information systems project management, information systems management, human-computer interaction, and advanced application development. He is also a director of the Center for Computing Education Research, a division of the ICCP Education Foundation.

Herbert E. Longenecker, Jr. is a Professor in the School Computer and Information Sciences at the University of South Alabama in Mobile. He has served on the faculty since 1972. His primary teaching involves a graduate sequence for the development of enterprise information systems. He earned a Ph.D. from Rockefeller University in New York, and did post Doctoral Studies at Cornell University Medical College. He is a co-author of IS'90, IS'97 and IS2002 national model curricula for Information Systems. He was recognized as Information Systems Educator of the Year in 2001. He is also co-founder and a director of the Center for Computing Education Research, a division of the ICCP Education Foundation.

Lynn J. McKell is a Professor of Information Systems at Brigham Young University. He is resently serving as Vice President of the ICCP Education Foundation and Chair of the ICCP New Examination Committee. He has served as the President of the Utah Academy of Sciences, Arts, and Letters, and he was the first National Chairman of the Information Systems/Management Advisory Services section of the American Accounting Association. He was a member of

the AICPA Education and Professional Development Subcommittee and the IIA Systems Auditability and Controllability Advisory Committee. Professor McKell has worked as a member of the professional staff of Arthur Young & Co. (now Ernst & Young) and Bell Telephone Laboratories (now Lucent Technologies) where he received a patent for work on the Touch Tone dial system. His educational preparation includes a B.S. from BYU in electrical engineering; three Master of Science degrees from Purdue: electrical engineering, industrial management, and computer science; and a Ph.D. from Purdue in computer systems analysis and design.