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IDENTIFYING AND EMBEDDING BEHAVIORAL COMPETENCIES IN INFORMATION SYSTEMS COURSES

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Research in Progress

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Abstract

This paper describes our efforts in auditing coverage of critical all-inclusive behavioral competencies in Information Systems (IS) and Computer Science (CS) curricula. The paper introduces a framework to teach critical behavioral competencies such as communications, conflict management and leadership in teams in IS and CS programs. Such programs provide limited opportunity to students to develop these skills of great importance in the workforce. Our research reveals that usually such abilities are spread out across several courses and it is difficult to get a broad picture of which competencies are being delivered and where. We have researched a spreadsheet model that makes it possible to assess if topics such as leadership, teams or communications are underdeveloped. If any specific competency is missing, the model recommends a list of topics and exercises for integration into a course.

Keywords: Information Systems, Project Management, Learning outcomes, Curriculum, Assessment, Communication skills, Behavioral competencies

1 Introduction

In most Information Systems departments introducing technical subjects, such as database systems, data communications, or programming to students can be a challenge. Usually faculty employed in academic units such as Computer Science (CS) or Information Systems (IS), invest a substantial amount of their resources in developing effective lecture notes and activities and effectively deliver the technical learning outcomes. However, instruction of behavioral skills and competencies including interpersonal skills goes under the radar in most IS/CS programs. To produce graduates that meet the expectations of the workforce we must be sure that students develop behavioral competencies; such learning outcomes are valued in the real world by employers.

Behavioral skills, also called *soft skills* in this paper, is defined as the knowledge and skills associated with a range of topics - leadership, emotional intelligence, communications management, ethical practice, working in teams, stakeholder management, global and cultural effectiveness, conflict management and negotiation. However, from a curriculum perspective, addressing such topics is of lower importance in many programs as they are eclipsed by the more technical topics such as cyber security or data analytics. Providing an all-inclusive education requires us to ensure that our graduates are competent at both working effectively with information systems from a technical perspective, as well as engaging effectively in a socio-cultural manner with a diverse range of human beings within the context of producing information systems.

A talent gap report indicates that there is a significant global shortage of workforce competencies as they pertain to the management of teams and projects. "Through the decade ending in 2020, 15.7 million new project management roles will be created. The profession is expected to grow by US$6.61 trillion" (Talent Gap Report, 2013). While this spans industry sectors, IS/IT represents a significant chunk of this growth sector. Since a large component of project management is simply "leadership and

working well in teams" we would like to assert that addressing the education of behavioral skills is very critical in IS programs.

The key issue that must be addressed here is the design of an inclusive IS curricula. Information systems curricula have been the subject of debate and discussion, as to their proper planning, design, and implementation for a long time (Kanabar et al, 2015). Arguments whether a skills gap exists between what is taught in IS curricula and what is really needed in the industry persists widely in literature (Yongbeom, 2006). Current research underscores its importance, for instance Havelka, in the Winter 2016 issue of the *Journal of Information Systems Education,* notes "developing communication and interpersonal skills and learning how to effectively interact with other professionals is also critical for attaining professional expertise and success" (Havelka, 2016).

Subsequently we would like to formulate a research question, "Is it possible to deliver an optimum all-inclusive coverage of behavioral competencies in an IS curriculum or CS curriculum? If yes, what would the pedagogical framework look like? Since such skills might be delivered in several courses, can we audit coverage of behavioral topics and list topics to teach adequately?"

2 Behavioral Knowledge and Skills in IS Area

Developing a modern information system is a complex project that requires an intensive collaboration between developers and clients/users and successful collaboration has a huge influence on the outcome. Chiocchio (Chiocchio, 2015) notes that working in teams is an interdisciplinary undertaking where knowledge of the psychology and management of project teams is critical. With information systems the development teams are usually distributed geographically, and this adds another layer of complexity to communications (Hertel and Orlikowski, 2014). This requires IS developers to have strong technical knowledge but also to have good communication skills. Experienced IS managers will gladly indicate that the success of a project eventually depends on the leaders possessing sound negotiations and conflict resolution skills. An informal communication with any human resources recruiter would reveal that almost all recruiting IT organizations would insist that upon completion of their education students also possess many such soft skills. The main challenge here is how to train the students, considering the limitations of academic schedules at most universities and the prescriptions of IS curricula guidelines (Topi et al, 2011).

Since 2012, the Project Management Institute (PMI) has worked in a systematic way to address this issue. A global curriculum guidelines illustrates how academics can educate students with technical and behavioral project management skills while balancing the requirements of the IS curriculum (Task Force on PM Curricula, 2015).The proposed courses curricula focus on the main technical knowledge: preparing project charter, scope statement, creating WBS and project schedule, estimating project cost. In addition, the students should know how to plan, monitor and control projects and how to evaluate progress of the projects. The recommendations from the curriculum guidelines emphasize communication and leadership skills, too. One would note that the nature of behavioral competency topics is not complex and can be understood – for example the guidelines introduces knowledge areas pertaining to: identifying stakeholders, communicating with stakeholders, working effectively in teams, lead and motivating teams, managing conflicts. However, teaching and developing these skills and nurturing them at both undergraduate and graduate level is a very complex task. In (Kanabar and Kaloyanova, 2016) the authors reveal how students consistently score higher grades or marks on team tasks that are technical in nature but obtain lower scores when it comes to tasks such as "communicating with sponsors, interfacing stakeholders, managing team conflict, identifying risks and escalating them in a timely manner".

3 Conceptual Framework

In this section, we introduce a conceptual framework to audit coverage of key behavioral topics in an IS program. The Figure 1 illustrates keywords of behavioral competencies of interest to most faculty.

It is the basis to identify learning outcomes and skills of considerable importance when managing projects and teams. In the middle of the pyramid, we introduce learning outcomes that are associated with teaching topics. We have designed a spreadsheet model that maps learning outcomes to teaching topics. Finally, the framework suggests that any specific IS course can be designed to deliver missing competencies.

3.1   Audit and Benchmark Current Programs for Behavioral Competencies

The first step starts at the base of the pyramid, presented on Figure 1. We brainstorm the skills and learning outcomes pertaining to topics such as Leadership, Communications or Ethics and investigate if it is covered in relevant IS courses.

A spreadsheet-modeling tool that allows us to analyze the results can be useful. Different faculty members can be told to audit their courses and indicate if there is any coverage of topics such as "build a communication plan" in their courses.

We have designed one such modeling tool based on the project management curriculum guidelines sponsored by Project management Institute (PMBOK, 2012; Kanabar and Messikomer, 2015). The modeling tool can be used to probe coverage of behavioral topics across IS programs.

Our research of various programs at universities in the US and Europe lead us to believe that soft skills are taught in about four key courses at most. In the current version of the tool, even if one of the four IS courses addresses a learning outcome the assessment audit is a "Pass". Therefore, when we present our method, as depicted in Table 1, we use four IS courses for benchmarking purposes.

The faculty or academic unit using the spreadsheet is, however, welcome to adapt the model to include additional courses – like Course 5, Course 6, and so on.
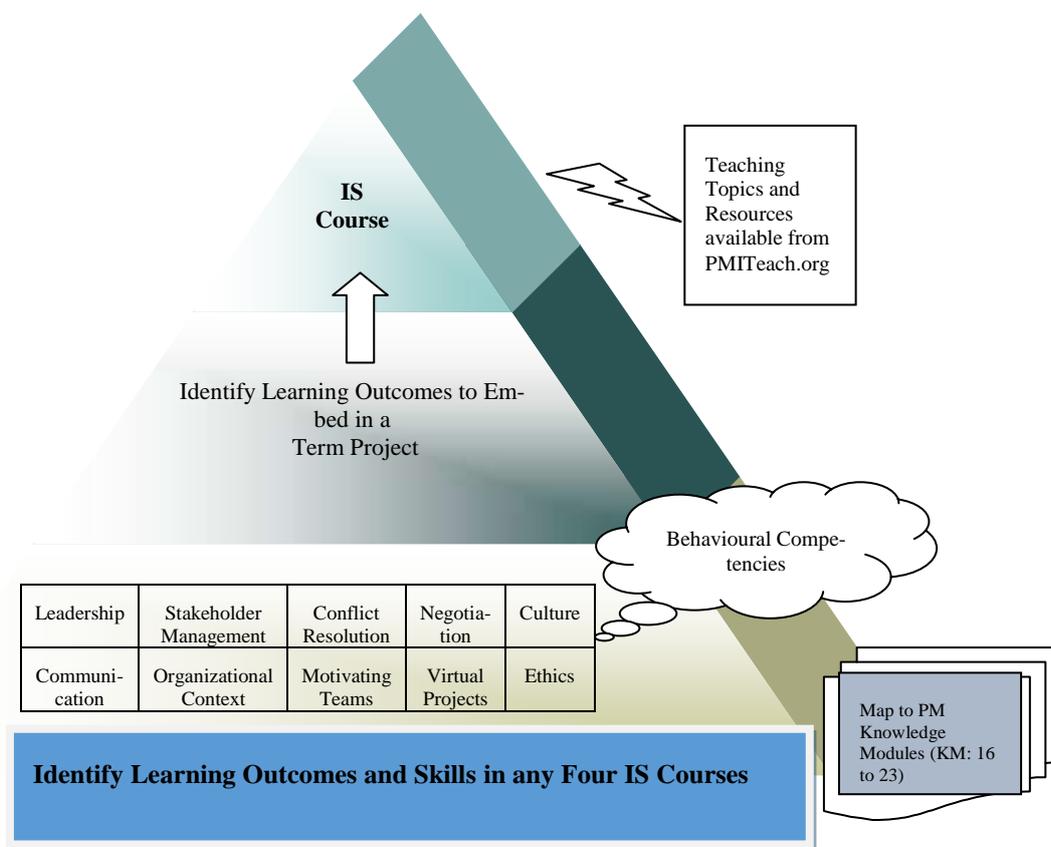

Figure 1.   Conceptual Framework to Select Behavioral Competencies

Table 1 provides an illustration from the spreadsheet model only for the first knowledge module called "Plan, Distribute and Management Project Communications". Let us explain the information on the figure briefly using three scenarios for the above topic.

Learning Outcomes (LO) per Knowledge Module	Is the LO Being Addressed in the Course?				AUDIT RESULT
	Course 1	Course 2	Course 3	Course 4	One YES is sufficient to address the LO
Plan, Distribute and Manage Project Communications (B-DC)					
(LO-1) Distinguish between formal and informal communications methods and defend when each is applicable on a project.	YES	YES	YES	NO	ADDRESSED
(LO-2) Evaluate and select appropriate communication tools and methods to communicate with identified stakeholders, including commonly used templates for communication activities such as status reporting, issues tracking, change control, and project reviews.	YES	NO	NO	NO	ADDRESSED
(LO-3) Given an organizational context and project objectives, construct a communication-management plan that defines the participants, communication processes, tools, and methods required for appropriate project communication.	NO	NO	NO	NO	NOT ADDRESSED
Project Team Building and Motivating (B-DC)					
(LO-4) Demonstrate how teams are assigned and formed and describe the stages of team development.	YES	YES	YES	YES	ADDRESSED
(LO-5) Plan and conduct a successful project-kickoff meeting and reflect upon the formation and dynamics of teamwork and how to motivate teams.	YES	YES	YES	YES	ADDRESSED
(LO-6) Analyze sources of conflict and, given a specific challenge, apply a problem-solving process that focuses on confronting and resolving the conflict.	YES	YES	YES	YES	ADDRESSED
...					

Table 1.   Learning Outcomes and Their Reflection in the Courses

Scenario 1: A group of several professors teaching a Database course, an IS systems analysis and design course, an IT Project Management class, and a Programming with Python class assess their

courses for learning outcomes. He or she would enter data as follows. In the first row, we see three "Yes" and one "No". IS Course 4 does not address the learning outcome "Distinguish between formal and informal communications methods and defend when each is applicable on a project". This, however, is not an issue since three other courses might have term projects that deliver the above learning outcome.

Scenario 2: In the second row, the same professors continue benchmarking. We only see one "Yes" in the Table 1 for the learning outcome, "Evaluate and select appropriate communication tools and methods to communicate with identified stakeholders, including commonly used templates for communication activities such as status reporting, issues tracking, change control, and project reviews." But from an assessment perspective we feel that this is adequate.

Scenario 3: Finally, in the third row, we don't see any "Yes" and the tool concludes that the competency "….construct a communication-management plan that defines the participants, communication processes, tools, and methods required for appropriate project communication" is missing in the IS program.

3.2 Identify Learning Outcomes to Embed in a Term Project

The second step in the pyramid (Figure 1) is to identify the learning outcomes associated with the knowledge modules that are not being addressed in an IS or CS program. In our Scenario 3, described above, we determined that key competencies, such as constructing a communications management plan are not being taught to students in a specific USA college. Most practitioners and project managers will testify to the importance of teaching project communications management. This is what most project managers and team members engage in when developing projects in the real world.

Module	Learning Outcome
KM - 16 Communication	Distinguish between formal and informal communications methods and defend when each is applicable on a project.
	Evaluate and select appropriate communication tools and methods to communicate with identified stakeholders, including commonly used templates for communication activities such as status reporting, issues tracking, change control, and project reviews.
	Given an organizational context and project objectives, construct a communication-management plan that defines the participants, communication processes, tools, and methods required for appropriate project communication.
KM - 17 Individual as Team Member and Teams	Demonstrate how teams are assigned and formed and describe the stages of team development.
	Plan and conduct a successful project-kickoff meeting and reflect upon the formation and dynamics of teamwork and how to motivate teams.
	Analyze sources of conflict and, given a specific challenge, apply a problem-solving process that focuses on confronting and resolving the conflict.
KM – 18 Leadership	Describe the fundamental aspects of team structure, interpersonal dynamics, and the role of the project manager.
	Given a project situation that may involve multicultural, inter-generational, hierarchical, and virtual teams, apply leadership techniques and defend the use of appropriate practices for motivating teams and developing leadership abilities.
	Reflect upon personal strengths and weaknesses and develop a plan for continuous improvement with respect to team-management skills.

KM – 19	Analyze the nature of stakeholder groups and summarize their impact on project performance.
Stakeholder Management 19	Choose from among a suite of appropriate strategies for stakeholder management, and recommend an approach based upon stakeholder strengths and weaknesses, their impact on the project, and other categories of stakeholder characteristics, such as priority and authority.
	Given a specific project context, create a Stakeholder Engagement Plan that includes approaches to issues such as communication, ethics and leadership.
KM - 23	Evaluate and assess the importance of ethics and professionalism in every aspect of the project's operation, and examine the factors that influence moral conduct.
Ethics and Professionalism	Given a case-study scenario involving ethical considerations, determine how a project can be executed per the standards of the organization performing the project.
	Analyze ethical situations and recommend best practices for ethical decision making.

Table 2.   Sample of Knowledge for Behavioral Skills & Learning Outcomes (Task Force on PM Curricula (2015).

We color code the level of coverage as it demonstrated in Table 2, "Learning Outcome" column. White fields implies significant coverage of the learning outcome, light grey fields reflects on modest coverage, and dark grey text shown is an opportunity for teaching coverage.

3.3   Mapping Learning Outcomes to Teaching Topics

In the final step, we map teaching topics to learning outcomes. The modelling tool leverages the curriculum guidelines for implementation of such mapping. All behavioral knowledge modules and learning outcomes are mapped to approximately 10 teaching topics. Such information is available at PMITeach.org. The authors played a significant role in demonstrating mapping all learning outcomes to teaching topics and to transferable skills.

Below a list of conceptual topics is shown that should be covered if an instructor is interested in addressing the following knowledge module: ***Plan, Distribute and Manage Project Communications (B-DC).*** This module is associated with the following three learning outcomes (LO):

- Distinguish between formal and informal communications methods and defend when each is applicable on a project.
- Evaluate and select appropriate communication tools and methods to communicate with identified stakeholders, including commonly used templates for communication activities such as status reporting, issues tracking, change control, and project reviews.
- Given an organizational context and project objectives, construct a communication-management plan that defines the participants, communication processes, tools, and methods required for appropriate project communication.

In order to achieve the above LO's we introduce the following conceptual topics:
- Plan, Distribute and Manage Project Communications (B-DC)
- Communication models, communication process
- Communication barriers, communication tools and techniques
- Types of communication and information distribution
- Communication planning
- Relationship between project complexity and communication
- Planning and executing effective project communications, such as formal and informal, face-to-face, virtual meetings, performance reporting, and briefings

- Personal communication, managing meetings and presentations
- Writing performance reports

The discussion of teaching methods associated with the delivery of the above topics (usually, traditional lectures, labs, exercises, homework) is outside the scope of the current paper. However, the authors have identified relevant theoretical and applied knowledge that can be embedded in term projects. For instance, in an IS course at a large east coast university in the USA, in order to communicate the importance of software developers and project managers being ethical, the following article is introduced to students for purposes of discussion (Smith and Parloff, 2016): *Hoaxwagen: How the massive diesel fraud incinerated VW's reputation—and will hobble the company for years to come.* This article is required class read. The discussion goes into lengthy details on the Volkswagen emissions scandal and thought provoking questions on ethics are asked by the professor. The article is detailed enough and even a YouTube video within the article explains a study that connects 60 deaths to the emissions scandal.

A very valuable resource to teach behavioral skills leveraged by the authors is the PMITeach.org website which provides free resources for teaching technical and behavioral skills via useful activities, exercises and term projects that can be leveraged at no cost. It is quite possible that certain topics such as ethics might not be covered adequately in a term project. In such a case students can be assigned external reading material.

4 Conclusion

In this paper, we have tackled the key issue of benchmarking missing soft skills knowledge in a curriculum. We have introduced a basic framework to teach behavioral competencies grounded in the PMI curriculum guidelines framework and our research could be of significant relevance to faculty that teach in the IS, CS and any related curriculum. The various steps associated with the framework start at the base of the pyramid when a faculty member explores the coverage of skills and competencies using keywords such as leadership or ethics and maps them against learning outcomes. A spreadsheet model introduced here plays a key role in providing a system perspective of coverage of key behavioral topics in a program. We believe this tool adequately answers the following questions, "What learning outcomes are important? What key behavioral topics are being covered adequately and what topics are not being addressed?

In a subsequent research, we plan to map freely available resources to the behavioral knowledge modules, and discuss how faculty using "flipped classroom" techniques or "blended education" can assure education of soft skills in IS curricula.

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