Educational Activities and a Competency Framework for Meeting New Challenges in Higher Education

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ABSTRACT

In his article we explore how educational institutions are faced with changes in the modern global business environment, and how this leads to need for changes in curricula for business schools and information systems schools. Most of academia still uses a strict disciplinary model of education resulting in a high degree of specialization within each discipline while the modern business environments require knowledge workers who can address problems that cut across disciplines on an increasingly global scale. Research papers and governmental reports call for more emphasis on particularly three interdisciplinary topics; 1) competencies in globalization issues, 2) communication/working in team, and 3) information literacy. The disciplines of business and in particular information systems education have received much attention in this respect with several calls for change. How to bring about such a change is, however, still an open question. This paper proposes to address this issue in two ways; by suggesting two new educational activities and by proposing a new educational interdisciplinary competency framework to guide curriculum development when including interdisciplinary topics.

Keywords: Educational Competency Framework, Higher Education Challenges, ERP Systems, ICT Curriculum

1. INTRODUCTION

There has been a call for university programs that are more applied, more professionally oriented and more international in character ([4], [2], [3]). In [3], the authors report on a comprehensive joint work by ivory league business colleges in the USA examining critics claiming MBA programs put too much emphasis on theory and in-depth knowledge in specific disciplines. They conclude that there is a need for curriculums to be strengthened in the three areas; globalization, the integrated nature of business processes, and experiential learning. The e-Skills Demand Developments and Challenges [2] by the European Union explore the demand for different types of ICT-related qualifications ("e-skills") in companies. It is a continuation of the work of the e-Business W@tch conducted since 2002 for European enterprises. Their study is based on case studies in 5 companies and statistical data from 1027 enterprise surveys. In addition to these primary sources they used secondary sources from other EU studies, market studies and publications like white papers and position papers and two articles in the ICT press. Their 2009 studies reveal that at the aggregate level the demand for personnel is in balance with supply in terms of quantity of candidates. However, they found a mismatch between what competencies the companies needed and what curricula of ICT studies offer. In particular, they found a demand for communication skills, project management skills, a thorough understanding of business processes, and practical skills in business software systems. The Joint ACM/AIS Undergraduate Curriculum Revision Task Force [1] has given recommendations for new courses including a Business Process Management course about which they said: "The demonstration of leading ERP systems such as SAP and their use in business process management is highly recommended."

A convergence of these demands is evident. It is a call for more emphasis particularly on three interdisciplinary topics; 1) globalization, 2) collaboration in teams, and 3) information literacy. How to incorporate these interdisciplinary issues in standard curriculums that have a strong disciplinary focus is an open question. Many universities are looking into their curriculums in order to adapt to the demand. There is a large body of literature related to curriculum development and disciplines by the academia themselves of which some wide ranging examples are Willi Petersen and Wehmeyer [11], Targowski and Tarn [9], [12] and [6]. The universities, being the supply side, have a long tradition of developing strong disciplines. However, academic departments are organized according to subjects that do not match well with the increasing demand for interdisciplinary competencies. Thus, in this paper we base our suggestions mostly on the demand side, i.e. the needs by industries, businesses, organizations and the society at large for competencies as emphasized in some of the seminary work in this regard ([2], [3]) and argue for a change in the way we teach some of the IT related curriculum.

2. INTEGRATION OF COMPETENCIES

Based on our experience and some of the experiments over the past couple of years we seek a general, holistic model that

captures the major areas of our organized society. The structuring of organizations is used as a foundation that we relate technological issues and new educational activities to. We recognize that the current state of university curriculums are by and large well developed and in good shape to address the needs of the society. They address the need for specialization and in-depth knowledge on complex issues in each field particularly well. Our aim is to add a small, but crucial element; the integration of competencies from several fields that the students have already learned in business, economics and information systems classes.

The mechanisms by which organizations coordinate their activities are closely related to the competencies of the work force. There is a huge variance in competencies required for the various categories of the work force. Thus, we suggest that interdisciplinary educational activities should be related to organizational levels.

In their classical book on business strategy Quinn, Mintzberg and James [7] describe the basics of organizational structure. From this we pick the three core levels of most organizations; the operational core, the middle line (tactical) and the strategic apex as illustrated in Figure 1. The operational core produces the organization's products and services. The middle line comprises all managers who stand in direct relationship between the operational core and the strategic apex. The strategic apex is where the organization is managed from a general perspective.
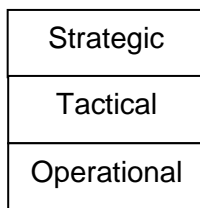
| Strategic |
| Tactical |
| Operational |

Figure 1: The three core levels of the structure of organizations

3. RISE OF ICT CAPABILITIES AND ITS CONNECTION TO COMPETENCIES

Recent rapid developments of ICT and ever pervasive integration into various businesses impel us to view ICT as an infrastructure for all three layers. ICT affects an organization from a strategic point of view since ICT has a transformative power with potential to change existing models, theories and practices. The transformative power of ICT is often omitted from educational frameworks, but the need for three competencies asked for originates from the rapid development of ICT and the ubiquitous use of ICT as a general purpose technology in the society. Thus, we incorporate ICT in two ways in the framework - ICT as infrastructure and the transformative power of ICT.

ICT as Infrastructure
We define the term infrastructure as *the basic, underlying structure of a system or organization, it is compulsory, or something an employee can or should take as granted*. All employees will typically use ICT as an infrastructure in their daily work to fulfil their responsibilities. This can be illustrated as in Figure 2.
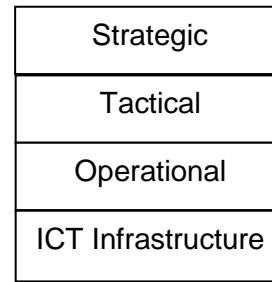
| Strategic |
| Tactical |
| Operational |
| ICT Infrastructure |

Figure 2: ICT as an infrastructure

The Transformative Power of ICT
The transformational power of ICT has an effect on the entire society. As technology evolves, new ICT systems push the limits of what is being possible. This leads to complex new situations where technical, economic, social and political factors interact to change established practices, models and theories. We add a *transformative* layer to capture the need for competencies regarding this in the framework as illustrated in Figure 3.

| Transformative |
| Strategic |
| Tactical |
| Operational |
| ICT Infrastructure |

Figure 3: Adding the transformative layer

4. NEW INTERDISCIPLINARY EDUCATIONAL ACTIVITIES

We developed two new collaborative educational activities - one targeting the operational level with students executing business processes in SAP for a global supply chain [5], and one at the management level where we develop the virtual team role play [8]. We present the major elements of the two activities and relate them to the organizational model discussed.

Activity 1:
Teaching Global Supply Chain Management in Cross-Country Collaborative Teams using an ERP-system
The first new activity focus on teaching Global Supply Chain Management concepts by letting the students run an international supply chain in cooperation with students at other universities using real data in a real Enterprise Resource Planning System provided by SAP. Figure 4 shows different business entities in the supply chain depicting how they are connected along with material and information flows.
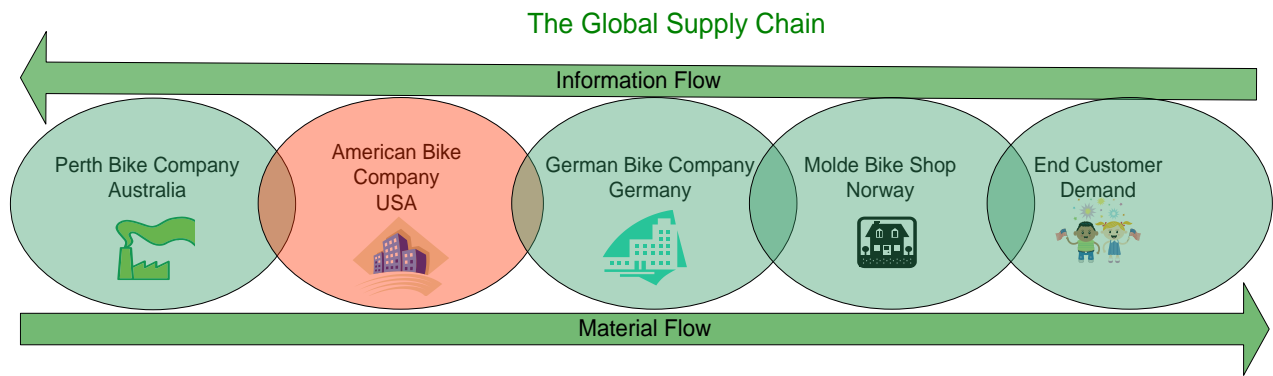
The Global Supply Chain

Information Flow

Perth Bike Company Australia | American Bike Company USA | German Bike Company Germany | Molde Bike Shop Norway | End Customer Demand

Material Flow

Figure 4: Companies in the Global Supply chain set up for the SAP exercises

In this activity, our goal was to develop and evaluate a curriculum that teaches ERP-system concepts and skills using real hands-on practical exercises in a global context. ERP-systems are highly specialized systems for capturing business transactions in a real-time environment. It is a challenging task to use such real-life systems in teaching since by their nature there are no undo possibilities and no way to try out functions several times for learning purposes. It is a business system, not an educational system. What such systems lack in pedagogic functions, they gain in providing highly relevant real-life experience in systems used by most modern organizations. The curriculum employs Kolb's experiential learning cycle [6] to facilitate student learning about the issues associated with internationalization and globalization of business operations and the use of ERP systems. A study was undertaken with students from Australia and Norway forming teams performing collaborative business operations in a global supply chain implemented in SAP [5]. The study included SAP hands-on exercises for operating a Global Supply Chain including handling of all import and export operations. The survey instrument used asked students to report perceived pre- and post-course knowledge and skills across five dimensions. Table 1 shows the five dimensions viz. general background, business knowledge, process knowledge, transaction skills using SAP and global business knowledge on which they were surveyed.

| 1. **General Background (GB)** – Knowledge of general business work experience and knowledge of ERP/SAP systems. |
| 2. **Business Knowledge (BK)** – Knowledge of the basic business terminology that relate to various functions and cross-functional relationships |
| 3. **Process Knowledge (PK)** – Knowledge of various core business processes, their significance and their relationship with information systems |
| 4. **SAP Transaction Skills (STS)** – Basic software skills in the creation of master data and performing transactions in various SAP application modules |
| 5. **Global Business Knowledge (GBK)** – Knowledge of multi-national/transnational/global business processes |

Table 1: Definition of the Knowledge Dimensions [5]

As shown in Table 2, both Norwegian and Australian students showed a significant gain in perceived knowledge, and students involved in the inter-group international role play showed better understanding of the transactional aspects of business operations that those who did not.

Know. Dim.	AUSTRALIA			NORWAY		
	Pre-Avg	Post-Avg	Diff	Pre-Avg	Post-Avg	Diff
1. GB	2.81	4.88	2.07	2.67	5.19	2.52
2. BK	3.52	5.23	1.72	3.82	5.36	1.54
3. PK	3.42	5.32	1.90	3.58	5.10	1.52
4. STS	1.25	4.27	3.01	1.54	4.78	3.24
5. GBK	3.04	5.05	2.01	2.00	5.00	3.00

Table 2: Full Study Mean Scores of Pre- and Post Survey for Australian and Norwegian students [5]

Activity 2:
Virtual Team Role Play Using Second Life for Teaching Business Process Concepts

The second proposed activity is a virtual team role play using a 3D virtual world to teach team and collaboration skills in addition to concepts on business information systems [8]. This work describes the use of a virtual world environment to facilitate a role play assignment for buying and selling Enterprise Resource Planning (ERP) software solutions in a distributed environment. Citing Gartner's research Wasko et al [10] note the emergence of virtual worlds from the "trough of disillusionment" onto the "slope of enlightenment"; which entails real benefits and not hyped expectations. They report that due to the facility provided by the broadband Internet access and incredible increase in the processing power of computers individuals and organisations are experimenting with virtual worlds. They are using such worlds "to communicate, collaborate and organise economic activity". Virtual world experience could be very engaging, immersive and rich in experience, especially, for the younger generations. For example, some blog posts on the Nordic Virtual Worlds Network (http://nordicworlds.net/2011/03/06/what-do-students-think-about-virtual-worlds-some-reflections/) report and we

quote "So now you have the technological resources to make the *avatar* experience more real, interactive and engaging online. And now we are adding internet to your TV. Then in some years 3D TV will be more and more common. Finally you have this interactive and engaging platform that we only have on a computer screen in real size". In the "next 5 to 10 years the virtual world technology will move into the second and third generations" and the current young virtual gaming generations will move into to the workforce and "we will most likely see the borders between work, play and learning dissolve or at least be reshaped" [10]. These significant changes due to technology are having a transformational effect on the society as a whole. They compel us as educators to think in advance of activities that would be engaging and appealing to our future generations of students.

The activity involved the use of Second Life for the virtual presentation by several competing ERP solution providing vendors to a purchasing group representing the buyer of ERP software. Students playing vendors and purchaser roles were organized into teams who meet, collaborate, and negotiate business transactions in the virtual environment. The aim of the experiment was to introduce students to properties of ERP systems since these are the most common software systems used by businesses. At the same time we introduce tools for virtual team collaboration in an international setting between students in Norway and Australia. The research [8] reports the experiences from the students' and teachers' perspectives and gives recommendations regarding the use of virtual worlds in role-playing exercises. Table 3 shows the results of the study on a 7-point Likert scale.

Questions	A. My general impression of using Second Life for doing a Virtual Team Role Play is that it's ___	B. When doing the role play I experienced a feeling of presence with the other participants __	C. As compared to traditional (face-to-face) projects on campus the workload in preparing for the role play in Second Life required __
Scale	1.Totally useless 2. Useless 3. Mostly useless 4.Useful 5. Useful, this can be used by real businesses 6.Very useful 7. An indispensable tool	1. Not at all 2. Only to a very small extent 3. Somewhat 4. Yes, I got a feeling of presence with the others 5. I got a good feeling of presence. 6. It was almost like in real life 7. Just like real life	1. Quite a lot more work 2. Much more work 3. More work 4. About the same amount of work 5. Less work 6. Much less work 7. Quite a lot less work
Norway	4.9	4.4	4.5
Australia	5.2	4.3	5.2
Combined	5.1	4.4	4.8

Table 3: Questions with numbered alternatives, the scales and the average result of answers [8]

Our research found that students adopted both tacit and explicit knowledge by participating in the virtual team role play in Second Life. As in real life, a thorough and comprehensive preparation is required by the students in order to get a successful learning outcome. We found that the students easily handled the technical operation of Second Life for use in the role play.

5. THE ACTIVITIES AND THE FRAMEWORK

The two new collaborative educational activities address the need for competencies at primarily two organizational levels - the operational level and the tactical level as illustrated in Figure 5. Activities for the other levels are currently being developed. For the ICT Infrastructure level we introduce a laboratory based course for developing the main components of a mini-ERP system. This is done using application generators requiring no procedural programming since the target students are business and IS students. The students first try to develop the mini-ERP system using Microsoft Excel. Facing difficulties in the development process, they soon discover (Excel being a spreadsheet software is not geared to handle entity-relationship complexities) Excel's limitations. Next, they try to build it further by using Microsoft Access to develop a functional system supporting the sales and procurement processes. The last part of this activity is to use and study the Microsoft Dynamics Great Plains ERP system to see how the components are implemented in a professional ERP system.

6. FUTURE WORK

For the Strategic level we are developing a Business Intelligence activity in which the students use SAP's Business Warehouse and Business Intelligence modules to extract and analyse the data. For the top level, the transformative level, a management seminar series is planned for reading relevant literature and discussing previous business cases along the lines of the Harvard Case method.

7. CONCLUSIONS

Initial evaluation of results from Activity 1 and Activity 2 show that the students consider these to be valuable activities and that they have gained interdisciplinary skills by participating in them. Responses from peer review at conferences have also been positive to our initiative. More work is needed to streamline educational activities at each layer and last but not the least, to organize interdisciplinary topics across boundaries at each university and among different universities.

Transformative	Transformative Competence Activity – *To be defined*
Strategic	Strategic Competence – *To be defined*
Tactical	**Activity 2: Virtual Team Role Play**
Operational	**Activity 1: Global Supply Chain in SAP**
ICT Infrastructure	ICT Competence – *To be defined*

Figure 5: Activities related to the Interdisciplinary Competency Framework

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