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Integrated Curriculum for a Bachelor of Science in Business Information Systems Design (BISD 2010)

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Abstract:

Commentators on Information Systems (IS) education have urged the IS community to develop new and alternative IS curricula. The IS 2002 model curriculum has recently been revised. The new IS 2010 curriculum guidelines for undergraduate degree programs in Information Systems [Topi et al. 2010] has a curriculum structure to accommodate the education of several different professional roles within IS. This paper identifies one such role, the Business Information Systems Designer. It presents and argues for a new, integrated Bachelor of Science curriculum for Business Information Systems Design (BISD 2010) to educate for this role. The proposed curriculum focuses on the design and use of IS in business and has a strong design focus. The education focuses on developing and training a set of capabilities that enables the Business Information Systems Designer to participate in the design of business and IS in concert. Some examples of capabilities are communication and presentation skills, business and industry understanding, and high-level modeling. Consequently, the curriculum adopted a capabilities-driven pedagogical model in order to train specific skills. The paper presents the BISD 2010 with its specific expected learning outcomes, structure, and pedagogy, and also how the students should be able to fulfill the learning outcomes. The proposed curriculum differs from much of the current IS model curriculum discussions in a number of respects: (1) it is built on a notion of design, design science, and design as a profession, (2) it is based on a capability driven pedagogical model, (3) the curriculum is modeled for a European higher education context and the Bologna accord, and (4) it is not a model curriculum, but a specific, comprehensive, and ambitious curriculum for a degree program.

Keywords: IS curriculum, IS education, IS design, BISD 2010.

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I. INTRODUCTION

Information Systems (IS) model curricula have a long and important history for the IS community. An IS model curriculum has a number of intended user groups and roles [Gorgone et al. 2002]:

- Academic executives can gain insights into the unique resource requirements of an IS degree program.
- Academic heads can be inspired to maintain and develop their own degree programs.
- Accreditation boards need a widely accepted definition of the IS discipline.
- IS faculty can obtain support in curriculum development.
- Non-IS faculty can get ideas on what general IS skills are required.
- Practitioners and academics can use it for interaction.
- Students can gain better understanding of the discipline and the content of a program.

IS model curricula are continuously revised due to rapid changes in the IS field, such as new and changing information and communication technologies, changing computer skills of incoming students, increased interest in accreditation, and new and increasingly critical IS applications, such as e-business systems, ERP systems, wireless communication systems, social networks, and Web 2.0. The most widespread IS model curriculum is the Information Systems model curriculum 2002 (IS 2002) [Gorgone et al. 2002]. IS 2002 was an update of IS '97. Both IS 2002 and IS '97 were joint efforts by ACM,[1] AIS,[2] and DPMA/AITP.[3]

The IS 2010 curriculum guidelines for undergraduate degree programs in Information Systems [Topi et al. 2010] is the latest report on the model curriculum work in the Information Systems field. IS 2010 supersedes the IS 2002 model curriculum. The new curriculum guidelines were developed for a number of reasons [Topi et al. 2007; 2010]. First, IS 2002 builds on knowledge and outlooks of the mid 90s, and much has changed in the IS field from both a technological and use perspective since then [Satzinger et al. 2007]. Second, IS 2002 is targeted towards mainly US and Canadian education contexts concerning student backgrounds, length of education, and program composition. Third, IS 2002 is narrowly targeted toward IS programs in business schools, while the IS field since the publication of the curriculum has been broadened to other areas such as medicine and law. The task force responsible for revising the model curriculum, aimed for "[a] scope of target audience ... expanded beyond the business school centric models of the prior IS curriculum efforts" [Topi et al. 2007, p. 729]. This broader scope is expressed by Topi et al. [2007] as Information Systems Career Tracks rather than just Technology-enabled business development exit characteristics, thus accommodating for a wider use of IS competence. To support this, a new curriculum structure is presented in a matrix with core and elective topics in rows and career tracks in columns, where certain topics to varying degrees can be matched with certain career tracks, see Figure 1 [Satzinger et al. 2007; Topi et al. 2007, 2010]. The IS curriculum task force devised a wiki repository for its work [Topi et al. 2007] and urged the IS community to participate directly in the curriculum development through this resource, see http://blogsandwikis.bentley.edu/iscurriculum. Topi et al. [2010] illustrate the adaptability and flexibility of the IS 2010 curriculum structure and demonstrate how it can be used in different types of academic contexts. They provide examples of three different degree requirement contexts in which undergraduate degree programs in IS are offered. One of the examples illustrates the structure of a hypothetical three-year business school undergraduate program in a European country that follows the 3+2 Bologna process degree structure (three-year undergraduate followed by a two-year specialized master's degree). This paper presents a degree program called *Bachelor of Science in Business Information Systems Design* (BISD 2010) which is an instantiation of the new IS 2010 and a concrete example of a three-year business school undergraduate IS program in a European country. BISD 2010 is based on an IS design science perspective and the work role Business Information Systems Designer as a profession. It contributes to the work on examples or instances of curriculum, and not to the work with the model curriculum. Hence, the presented curriculum provides details of a finer granularity than the model curriculum and shows how certain career tracks could be implemented in a curriculum in practice. The BISD 2010 is a response to several calls for the development of new IS curricula [e.g., Davis et al. 2005; Topi et al. 2007] and a contribution to a thirty-year-long tradition of continuously adapting and updating IS curricula to the changes in information and communication technologies, business, and IS.

[1] Association for Computing Machinery.
[2] Association for Information Systems.
[3] Association of Information Technology Professionals.

The focus is naturally on business information systems, since the context, frames, and constraints of development of BISD 2010 is the business school. However, we interpret the concept of business to mean not only commercial business, but also activities performed by governmental and nonprofit organizations. The kind of IS we focus with this curriculum resides within the administrative realm of business processes, business concepts, and human users. Following the Scandinavian tradition and the legacy of Börje Langefors, we see that the design of business information systems is an ongoing process that is influenced by changing business requirements and technological evolution. In addition, we acknowledge that the design of business information systems also has an impact on its use context and its users. Hence, we do not consider IS an artifact per se, but as an artifact in context, i.e., IS are artificial systems.

Structure of the IS Model Curriculum:Information Systems specific courses

Career Track:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Core IS Courses:																	
Foundations of IS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Enterprise Architecture	○	●	○	○	○	●	○	○	○	○	●	○	○	○	●	○	○
IS Strategy, Management and Acquisition	○	●	○	○	○	●	○	○	●	○	●	○	○	○	●	○	○
Data and Information Management	●	○	○	●	●	○	○	●	●	○	●	○	●	○	○	○	○
Systems Analysis & Design	●	●	●	○	○	○	●	○	○	○	○	○	○	○	●	●	●
IT Infrastructure	○	○	○	●	○	○	○	●	●	●	○	○	●	●	○	○	○
IT Project Management	●	○	○	○	○	●	○	○	○	○	●	○	○	○	●	●	●
Elective IS Courses:																	
Application Development	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	●
Business Process Management		●	●			○	○	○		○	●				○		
Collaborative Computing						○								○			○
Data Mining / Business Intelligence		●		●	●	○	○	○	●		○	○	○	○	○		○
Enterprise Systems		●	●	○	○	○	●	●	○		●	●	○	○			
Human-Computer Interaction	●					○	○				○					●	
Information Search and Retrieval		○		○	●								○				●
IT Audit and Controls	○		●	○	○	○	○	●		●	○		○	○	○		○
IT Security and Risk Management	○			○	○	○	○	●	●	○	○		●	●	○		○
Knowledge Management		●		○		○	○			○							
Social Informatics													○		○		

A = Application Developer
B = Business Analyst
C = Business Process Analyst
D = Database Administrator
E = Database Analyst
F = e-Business Manager
G = ERP Specialist
H = Information Auditing and Compliance Specialist
I = IT Architect
J = IT Asset Manager
K = IT Consultant
L = IT Operations Manager
M = IT Security and Risk Manager
N = Network Administrator
O = Project Manager
P = User Interface Designer
Q = Web Content Manager

Key:

● = Significant Coverage

○ = Some Coverage

Blank Cell = Not Required

Figure 1: The Revised IS Model Curriculum Structure [Topi et al. 2010, p. 383].

The kind of integrated design of business and IS that we envision with this program requires a pedagogical model that put the design skills in focus and trains the BISD capabilities of the students. BISD is not a singular and atomic problem area, or clearly separable problem realms, but rather design situations that call for an integrated understanding and capability of the designer. The design situation, which might be a work-based project or a multi-facetted design project, is central to the education of the BIS designers. To accomplish this we are inspired by Bowden's [2004] ideas of capability versus content focused curriculum design and built the BISD 2010 to be capability driven rather than traditionally content driven. Also, the capability driven curriculum strengthens the focus on student employability that is a key issue of the Bologna accord.

The proposed BISD 2010 curriculum differs from much of the current IS model curriculum discussions in a number of respects. First, it is built on a notion of design, design science, and design as a profession. Second, it incorporates a capability driven pedagogic model in order to develop specific skills for the envisioned work role. Third, the curriculum is modeled for European education context and the Bologna accord. And finally, it is not a model curriculum, but a specific, comprehensive, and ambitious curriculum for an IS degree program.

Although it does not match exactly with the matrix in Figure 1, the proposed curriculum can be regarded as an elaborated instantiation for career tracks A (Application Developer), B (Business Analyst), C (Business Process Analyst), G (ERP Specialist), K (IT Consultant), and O (Project Manager). Depending on what electives a student chooses and what integration and degree projects he or she pursues, it can also be career tracks E (Database Analyst), F (e-Business Manager), and P (User Interface Designer).

The reminder of the paper is structured as follows. The next section briefly describes three forces that have had an impact on the development of the BIDS 2010. This is followed by a section that puts forward some arguments for the need of a greater design orientation by identifying some key differences between a business information systems designer and a software systems developer. Section IV presents both the development and the content of the BISD 2010 curriculum. Last, we discuss BISD 2010's advantages and disadvantages.

II. EMERGING REALITIES FOR THE INFORMATION SYSTEMS DISCIPLINE AND EDUCATION

In this section we present three forces in the curricula environment that were inputs to the development of BISD 2010. The first are the changes in IT industry and of the IS discipline. The second, and equally important reality, is the convergence of IS and business. The third change is a purely European factor, namely the Bologna accord for higher education.

A Changing Discipline

Over the past ten years the IT industry and the IS discipline have seen their best and worst days. We have seen the crash of dot.com and telecom companies on several stock markets, the boom and fall of the job market, the major decrease in student education applications, the questioning of IT's role in business and society, the outsourcing and off-shoring of IT functions, and the questioning of the academic IS discipline [see, for example, Aspray et al. 2006; Carr 2004; Davis et al. 2005]. A number of factors are also positive for the IS discipline, such as increased importance of IS in business and society, increased IT investments, convergence between IS and business, and in the last years an increase in the number of IS students. In particular, outsourcing and convergence have clear impacts on curricula [Aspray et al. 2006; Bullen et al. 2009; Davis et al. 2005], leading to the requirements for new skills and capabilities of the IT workforce [Gartner 2006b]. In a study sponsored by the Society for Information Management (SIM), it was found that understanding business domains, knowledge of functional industry areas, and client-facing skills will be more critical for IT personnel in the future [Abraham et al. 2006]. In a recent study, Luftman et al. [2009] found that "Build business skill in IT" and "Attracting new IT professionals" were ranked as second and fourth top IT management concerns. Luftman et al. note that their survey "…identified the top skills executives look for when hiring IT professionals at the entry level. It is interesting to note that these same skills are what executives look for when hiring mid-level IT professionals. Nontechnical skills are clearly considered much more important than technical skills for both level hires. Only three of the top fifteen skills are technical: Programming/application Development, Database Knowledge, and Systems Analysis" [ibid., p. 153]. The mentioned studies also suggest that programming, operations, and help-desk skill requirements will decline in demand. Project planning, budgeting, and scheduling are important skills in the near term, as are knowledge of ERP, system integration, wireless computing, and security.

In response to these events and changes, there have been several requests for new and innovative IS curricula. The ACM Job migration task force [Aspray et al. 2006; Bullen et al. 2009], Hirschheim et al. [2005], and Surendra and Denton [2005] discuss educational responses in relation to offshoring. Davis et al. [2005] propose five proactive steps in order to secure the future of the IS discipline. Two out of the five recommendations address IS education: "Be aggressive in research and teaching at the fuzzy boundaries of applications with shared responsibilities" and "Add real value to students in IS courses, particularly for non-majors" [ibid, p. 984]. Zweig et al. [2006] make similar recommendations. Abraham et al. [2006] suggest, based on the analysis of responses from 104 senior IT executives in Europe and the USA, that "IS programs must offer a functionally integrated curriculum and deliver it in an experiential business context." The DESRIST 2006 panel, "Design Leaders Perspective on the Future of Design Science in IS," discussed educational and curricula issues in general. The discussion focused on the development of new curricula and, in particular, how to incorporate IS design science research knowledge and IS design knowledge. In his December AIS President's Message, Michael Myers reported from the AIS Council Strategic Planning Meeting held in conjunction with ICIS 2006. One of the issues discussed and decided on was the development of multiple curricula with application worldwide. Said Myers:

> *"We realize that it is not feasible for just one IS curriculum to meet the needs of all IS programs around the world.… Therefore we agreed that multiple curricula need to be developed."*

Based on the changes of the IT industry and IS discipline we identified future capabilities and skills for IS professionals. For instance, increased globalization made us include an international aspect in project management and outsourcing made us decrease programming skills in favor for modeling skills.

IS and Business Convergence

Over the years there has been a debate, sometimes a quite intensive one, over the identity of the IS field. Part of the debate is an endless quest for "the core" of the IS field and its boundaries. El Sawy [2003] presents three different views on IS: Connection, Immersion, and Fusion. He contends that it may be time for a natural shift of emphasis from the Connection view to the Immersion View to the Fusion view as IT continues to morph and augment its capabilities. Underpinning our curriculum is the belief that we are moving from a connection view of IT and IS, via an immersion view, to a fusion view. In the connection view, IT and IS are viewed as separable artifacts and artificial systems that are used by people as tools. They are separable from work, processes, and people. In the immersion view, IT and IS are immersed as part of the business environment and cannot be separated from work, processes, and the systemic properties of intra- and inter-organizational processes and relationships. This view stresses work context and systemic relationships and mutual interdependencies. In the fusion view, IT and IS are fused within the business environment, such that business and IT and IS are indistinguishable to standard time-space perception and form a unified fabric. Hence, IT-enabled work and processes are treated as one. Steven Alter [2006] has argued for broadening the IS field to be a work-centered systemic interconnected view. El Sawy's and Alter's views and positions influenced the development of the program. The changes and views have implications for the curriculum, for example for what knowledge, skills, and capabilities students should have after finishing the program. Note that we are not arguing that our view is the only position a program can be based on, but that there are good reasons for developing a program based on this position.

Standardization and Harmonization of the European Educational Area

The European Union (EU) is an economic and political union. The EU has developed a single market through a standardized system of laws and policies that apply in all twenty-seven member states, guaranteeing the freedom of movement of people, goods, services, and capital. In the process of making it easier (for students) to switch and move between educational institutions, EU has passed the Bologna declaration. This is an effort to transform higher education in Europe according to the plans for EHEA (European Higher Education Area) and European leadership in higher education and should be achieved by year 2010. The Bologna process is aimed at increasing the movement of students between universities and countries and to create a common educational area by 2010 (for a comprehensive documentation of the Bologna accord and process, see, http://www.bologna-bergen2005.no/). The Bologna declaration describes higher education as three cycles: Basic, Advanced, and Doctoral education. Each cycle is an advancement compared to the preceding one.

Complementary to the Declaration are the so-called Dublin Descriptors (Bologna Working Group on Qualifications Frameworks 2005] that provide "…more detail of the [learning] outcomes of these cycles…" [ibid., p. 64]. Knowledge in the form of skills, competences, and critical evaluation are less often stated explicitly and are "… embedded or implicit in the assessment values and practices" [ibid., p. 63]. The Dublin Descriptors thus take as a departure point the understanding that these types of knowledge should be explicit in a curriculum.

The qualification descriptors are general in order to function across different disciplines and to be possible to adapt to national variations of qualification development and specification. The descriptors state what the learner (the student) is supposed to have learned and what capabilities he or she should have achieved at the end of a Bologna cycle. The descriptors build on the following five elements [ibid., p. 65]:

1. Knowledge and understanding
2. Applying knowledge and understanding
3. Making judgments
4. Communications skills
5. Learning skills

The implication of Dublin descriptors and the Swedish interpretation of it had a direct impact on our pedagogical view. To be able to meet the new qualification descriptors, we had to change the way we teach. In particular, "applying knowledge and understanding" forced us to include more real-life exercises and examinations forms. Otherwise it is close to impossible to examine this particular learning outcome.

III. AN IS DESIGN PERSPECTIVE

A foundation of the BISD 2010 curriculum is the notion of design, which sets it apart from other attempts to devise IS curricula (e.g., the IS 2002 model curriculum). In order to make this clearer to the reader, we will in this section clarify our position on design, how this has influenced our work with the curriculum development, and how this is manifested in the curriculum.

Business IS Design as Planning

To begin with, etymologically the word *design* has its roots in the Latin word *designare,* which means to mark out or devise. The word *design* can mean both the outcome as a design (as a substantive) and the activity to design (as a verb). In its modern usage, *to design* means to determine the form and quality of an artifact or artificial system; i.e., design is a determination process for an artifact or artificial system to come, which is separate from the actual production or building of the artifact [Lundequist 1995]. Thus, design as a determination process is a planning activity focused on sketches, blueprints, models, drawings, etc. of the artifact or artificial system [cf. Zachman framework in Figure 2]. However, not only the product or artifact as such must be planned, but also the determination process as well, as the production and implementation processes must and should be planned. In the case of BISD, this should be done through the assistance of information systems development methods.

The notion of design as planning and determination of form and qualities of these three types is the focal point for the BISD 2010 curriculum. Hence, Business IS designers devise three kinds of plans [Carlsson 2010 adapted from van Aken 2004]:

1. An object-design, which is the plan of the IS solution
2. A realization-design, which is the plan for the implementation of the IS solution
3. A process-design, which is the professional's own plan for the problem solving cycle and includes the methods and techniques to be used in object- and realization-design

The BISD 2010 should give the students the possibility to develop capabilities for all three types of designs.

Based on understanding of context, system, and IS, business information systems designers devise plans for the determination of form and qualities of business processes, ontologies, and business rules, which are core aspects of any business. Since this is core understanding and skills in the BISD 2010, training in these skills is not confined to single courses, but stretches over large parts of the education.

The business information system is fused with and supported by IT artifacts, and, as with any designer, the business information systems designer must have some basic knowledge of the material used to build the planned artifact. In the BISD 2010, the material is considered to be IT architecture rather than software code, even though basic knowledge of the underlying technology is included in order to grasp the higher level of architecture. So, instead of in-depth knowledge in specific programming languages, we focus on the differences between different programming principles, such as procedural programming, object orientation, and declarative programming.

Also, a designer must have some basic knowledge of the actual building techniques and practices, i.e., how plans are realized as artifacts. In the BISD 2010 this understanding and skills are trained mostly in a practice-oriented fashion, since the curriculum is designed for an education in which off-the-shelf systems and automatic transformation from model to code (e.g., Model-driven Development and Model-driven Architecture) are central.

Context and System Boundaries for Business IS Design

In any more complex design venture, e.g., an information system, there are several abstraction levels and perspectives that are valid to and important for various stakeholders and interested parties. Also, the context and system boundaries vary according to the levels and perspectives. One way of showing this is through the highly influential Zachman Enterprise Architecture (EA) framework, as depicted in Figure 2 where the abstraction levels and perspectives are shown horizontally, the basic interrogatives vertically, and possible instantiations in the cells.

	DATA *What*	FUNCTION *How*	NETWORK *Where*	PEOPLE *Who*	TIME *When*	MOTIVATION *Why*
Objective Scope ***Contextual*** *Role: Planner*	List of things important to the business	List of processes the business performs	List of location in which the business operates	List of organi-zations important to the business	List of events/cycles significant to the business	List of business goals/strategies
Enterprise Model ***Conceptual*** *Role: Owner*	e.g., Semantic Model	e.g., Business Process Model	e.g., Business Logistics System	e.g., Work Flow Model	e.g., Master Schedule	e.g., Business Plan
System Model ***Logical*** *Role: Designer*	e.g., Logical Data Model	e.g., Application Architecture	e.g., Distributed Systems Architecture	e.g., Human Interface Architecture	e.g., Processing Structure	e.g., Business Rule Model
Technical Model ***Physical*** *Role: Builder*	e.g., Physical Data Model	e.g., System Design	e.g., Technology Architecture	e.g., Presentation Architecture	e.g., Control Structure	e.g., Rule Design
Detailed Representations ***out of Context*** *Role: Programmer*	e.g., Data Definition	e.g., Program	e.g., Network Architecture	e.g., Security Architecture	e.g., Timing Definition	e.g., Rule Specification
Functioning Enterprise *Role: User*	e.g., DATA	e.g., FUNCTION	e.g., NETWORK	e.g., ORGANIZATION	e.g., SCHEDULE	e.g., STRATEGY

Figure 2: The Zachman EA Framework (Modified after Zachman 1999 and Noran 2003)

Our interpretation of this framework is that the context and system boundaries change from open-ended and highly social and business-related to closed-ended, technical, and non-social and non-business related the further down the rows of framework one reads (until the last row which is the functioning enterprise as such). The BISD 2010 curriculum put a major focus on the conceptual and logical levels in Figure 2 where the context is business IS systems, rather than technical systems where the system boundaries and design scope seldom stretches beyond the IT artifact.

The BISD 2010 curriculum emphasizes the fusion view of El Sawy [2003] which we interpret as IS design fuses with business design to become business information systems design. The context for business information systems is Human Activity Systems [Checkland 1981; Checkland and Holwell 1998] or Work Systems [Alter 2006]. The BISD 2010 curriculum thus aims at an education where these contexts can be supported by designed business information systems.

The Business Information Systems Design Process Is Not an Engineering Process

The notion of design that we put forth as a foundation for the curriculum also brings with it another view on the design process and design ability. Traditionally in the field of information systems, design is thought of as a phase after scoping and analysis in the SDLC (Systems Development Life Cycle), which means that design is preceded by a comprehensive and hopefully exhaustive penetration of the design problem in order to yield a clear understanding and solution frame. After this design is commenced to devise candidate solutions of which one is selected as the best solution, to be followed by the selected solution being constructed, tested, and implemented.

Even though the depicted process can have iterations, it is still a rationalistic and forward-directed flow with clear demarcations between analysis and design activities. This rationalism is founded on the scientific problem-solving process, which has been the ground for mechanistic approaches to information systems development, such as Software Engineering.

Design ability, then, means the ability to identify and transform stated requirements from analysis into correct and well-formed representations. It should be possible to to create a functioning IT artifact from these representations. Design thus becomes a de-contextualized modeling of a solution to a stated problem. In other, more mature fields of design, like architecture [Jones 1981; Lawson 1990; Lundequist 1995], design is not separated from analysis and includes problem discovery. Since design is about a future, would-be situation and world [Simon 1996] or about creating future possibilities for action [Löwgren and Stolterman 2004], an exhaustive analysis is not possible [Lundequist 1995]. Instead, understanding of the design problem grows through efforts to solve it, by action, reflection, and backtalk of the design situation [Schön 1983; 1987]. Situational backtalk is an important part of creative processes.[4] Design is a "reflective conversation with the materials of the situation" [Schön 1983]. This means that externalized representations such as IT artifacts are not simple projections of the designer's intention; they are products of the designer's intentions, the materials, and situational constraints.

The difference between the solution processes of science, which is the foundation for engineering, and design is evident in an experiment reported in Lawson [1990]. In this experiment a group of students from postgraduate studies in architecture and science were given the same simple design-like problem with building blocks to be arranged according to some hidden rules. The science students, in an analytic fashion, tried out as many diverging arrangements as possible in order to maximize the information for the problem, while the architect students worked stepwise, trying different, refined design solutions piece-by-piece. As Lawson [ibid.] concludes, the students used totally different strategies; the science students focusing on discovering the rules and the architect students focusing on reaching the desired solution.

In information systems development research and teaching, scientific and engineering thinking and problem perspectives have been strong. Many of the methods, models, and techniques for information systems development are founded on the engineering way of solving problems [Iivari et al. 2004], which does not sufficiently consider the social and business perspectives.[5] This is evident in the dominant field of Software Engineering, which builds on a rationalistic epistemology which views reality as given and consists of objective facts "out there" to be discovered [Floyd 1992a, b]. Subjectivism and human interpretations are dismissed and, therefore, software development is regarded as purely rational problem solving [Floyd 1992a]. With this view, methods "… are seen as rule systems for finding a solution" [Floyd 1992a, p. 21] and they "… tend to assume a machine-like behavior…" [ibid., p. 18]. The rationalistic epistemology overemphasizes formalization at the expense of communication and learning [Floyd 1992a]. Software design does not deal with structured engineering problems, but rather with wicked problems [Budgen 2003; Rittel and Webber 1984] or ill-structured problems [Simon 1984]. The results of software design thus depend on perspectives, constraints, and negotiations in the development process [Floyd 1992b].

Hence, from within one of the dominant fields of science for Software Systems—Software Engineering—the notion of design instead of classical engineering is put forth. This is even more appropriate when the field of Information Systems (IS) is considered [McKay and Marshall 2008; Carlsson 2006; 2010]. While many of the problems of software engineering still can be construed to remain in a realm of closed-ended problems and algorithmic solutions, the world of information systems is more contextual in nature, or at least has another, more social context where people and businesses are constantly changing and developing. The constraints and affordances in these design situations cannot as easily be framed and boxed as in science problems, and Floyd's notion of construction of reality and negotiations of perspectives in a design process seems feasible. This means that the nature of IS design is both like and unlike material object design [Carlsson 2007].

The prevalent, rationalistic view of software engineering tends to see many IS problems as chess problems, that is, as rational problems with finite and rule-based solutions. However, this is problematic,

> *... since we have a tendency to focus on the solution, in large part because it is easier to notice a pattern in the systems that we build than it is to see the pattern in the problems we are solving that lead to the patterns in our solutions to them* [Ralph Johnson in Jackson 1995, p. 2].

This is also noticeable in the IS 2002 curriculum. But the changes and development in the use of IS and in IS itself lead to other types of problems and contexts which do not, anymore, resemble chess. Today the common view of IS is that they are artificial systems for business activities, processes, and interactions, as well as for other types of purposeful human activities, while some years ago the interpretation of the systems part of IS was that they were technical artifacts, such as computers and software (an excellent empirical illustration of this can be found in Markus [1982]). Instead of constructing artifacts within a technical domain, social artificial systems must be designed in a design process where situations cannot be fully analyzed and scrutinized and where perfect and optimal solutions cannot be found.

The BISD 2010 curriculum departs from the rationalistic view by applying a design perspective with another underlying worldview. The differences between a business information systems designer and a software engineer are summarized in Table 1.

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4 Backtalk of a situation is also known as "situational feedback."

5 The strong engineering tradition has several explanations. One of these is the fact that a lot of information systems development research has been financed by engineering oriented agencies, such as NASA.

Table 1 Differences Between BIS Designers and Software Engineers		
Worldview	**BIS Designer—design perspective**	**Software Engineer—rationalistic perspective**
Problem solving style	Creation of solutions, understanding the problem by trying to solve it [Löwgren and Stolterman 2004]	Exhaustive analysis, divide and concur in order to find the design rule [Lawson 1990]
Number of solutions	There are many equally good	There is one and it is possible to identify it by rational means
Context	Human Activity Systems or Work Systems [Checkland 1981; Checkland and Holwell 1998; Alter 2006]	Mechanistic systems and Software Technology [Iivari 2004]
IT/Design failure	Poor design ability [Kapor 1996; Ehn et al. 1997]	Dysfunctionally behaving people [Markus 1982]
Perspective on ISD methods and techniques used	Support and exemplars for design ability [Ehn et al. 1997; Meggerle and Steen 2002]	Prescriptions and rule systems to be followed [Floyd 1992a]
Learning style	Learning by doing in context and reflection, a practicum [Schön 1983; 1987; Mathiassen and Purao 2002]	Acquiring rule systems out of context to apply without deliberate reflection [Mathiassen and Purao 2002]
Quality perspective	Quality is a balance between inharmonious functional, ethical, and aesthetical system interests [Ehn et al. 1997; Vidgen et al. 1993].	Quality is the harmonious control of measurable optimal artifact characteristics.

Educating Business IS Designers

To educate and train a designer is thus something else than to educate and train an engineer. Since a designer learns about and discover the design "problem" by trying to "solve" it [Lawson 1990; Lundequist 1995] the reflective and creative ability and rationality of the designer is highly important. However, these are not skills or traits that teachers in IS/MIS aim for students to acquire [Mathiassen and Purao 2002]; rather, the teachers focus on methods and prescribed ways or rules for development work, such as Rational Unified Process or Capability Maturity Model. Referring to work by Russo and Misic [1999] addressing what MIS teachers emphasize, Mathiassen and Purao [2002, p. 86] conclude that a "…bias towards a prescribed, rational, top-down approach to systems development and an emphasis on documentation is evident in these [teachers' emphases]." Without downplaying the need for methods in IS design Mathiassen and Purao [2002] argue for educating reflective systems developers who "…discover their own methods-in-action and reflect more broadly upon their experiences as members in a community of practice…" [p. 89].

This echoes Schön's [1983; 1987] ideas of the reflective practitioner's knowing-in-action and reflecting-in-action while he or she listens to the backtalk of the design situation and tries new design moves. In a teaching situation, this can be accomplished through learning by doing in more-or-less real IS design situations, where the IS design process is not just the application of prescribed methods and rule systems to be followed. The context, simplified or not, for the IS design situations must likewise be present, as it represents both the constraints and the affordances, in the sense of people, work processes, resources, etc., for the possible design solutions. These contexts are not themselves part of the methods and rule systems for development and must thus be brought in to "stage" the design situation.

However, reflection-in-action is not enough, since a designer cannot focus only on the work at hand and reflect on the design moves. Also, reflection on reflection-in-action and reflection on action [Schön 1987] is needed in order for the designer to reach a level of critical insights into what guides his or her design work; what are the principles, methods, and values that come to play in the design work, and can these be criticized, altered, and refined? The teacher has to then become a facilitator for the students, and the "… role of coach and supervisor is therefore essential in making the students reflect critically on their experiences" [Mathiassen and Purao 2002, p. 91]. The learning situation must thus be supportive and beneficial to learn to design and reflect in a learning-by-doing manner where the teachers can act as coaches. What is needed is then a learning environment which resembles Schön's [1987] idea of a practicum which is:

… a setting designed for the task of learning a practice. In a context that approximates a practice world, students learn by doing …. They learn by undertaking projects that simulate and simplify practice; or they take on real-world projects under close supervision. The practicum is a virtual world, relatively free of the pressures, distractions, and risks of the real one, to which, nevertheless, it refers …. It is also a collective world in its own right, with its own mix of materials, tools, languages, and appreciations. It embodies particular ways of seeing, thinking, and doing that tend, over time, as far as the student is concerned, to assert themselves with increasing authority [Schön 1987, p. 37].

In the BISD 2010, we tried to build the curriculum, content, and structure to get close to a practicum through a capabilities-driven curriculum. This is supported through BIS design projects in every semester (see Figure 4). These projects are capabilities focused centers for training the skills and understanding necessary for BIS design.

Business IS Design Expands the Notion of Quality

The design notion of the BISD 2010 also leads to the importance of other qualities than efficacy and efficiency that are the focus for the rationalistic view on information systems development. If the "world out there" does not exist but is proposed and shaped by design and if the mechanistic perspectives based on the rationalistic epistemology does not hold, quality means more than a working artifact. A Business Information System is a system containing but not being equal to IT artifacts; hence the context is wider than the machine and the knowledge interest stretches beyond instrumental control and technical functionality.

A Business Information System shapes the affordances for and constraints [Norman 2002] on the business in the way people can work, how the work can be organized, what the purpose might be, and how it should be fulfilled. Therefore, also use qualities like ethics and aesthetics [Ehn et al. 1997] or elegance, effectiveness, and ethicality [Vidgen et al. 1993] are important. Not only should the BIS be designed to function technically, but also be appropriate for or "fit" the context and the proposed use, fulfill long-term goals, and, ultimately, not do wrong to people and organizations. Hence, the design ability must incorporate an understanding of these use qualities and the ability be trained to assess the aesthetics and ethics of the artificial system being designed (see Table 1 for the differences between this view of quality and the rational engineering view).

The BISD 2010 curriculum provides support to acquire an understanding of and skill to evaluate these qualities since the learning outcomes state that students should be able to "Critically examine, analyze, and evaluate IS design and change proposals from different perspectives" (V2 in Figure 4) and demonstrate knowledge about "How IS and its use affects or may affect organizations, business activities, society, and individuals" and "How requirements, wishes, needs by organizations, businesses, society, and individuals may be fulfilled by IS and its use."

However, since the curriculum is structured around capabilities, no single course or module is devoted to developing that understanding and those skills. Instead, this ability and understanding is demonstrated through discussions and arguments in the reports that are written by the students about the various kinds of project work that they undertake in their education. Each project report must include assessments of their designs, as well as reflections on the design process and learning. These, together with the design documentation, are part of the learning portfolio discussed further down.

IV. THE BUSINESS IS DESIGN CURRICULUM (BISD 2010)

In May 2006, the School of Economics and Management at Lund University (LUSEM) gave us the assignment to design a new and innovative IS bachelor education program. Besides the changing skill and capability requirements identified by, for example, Abraham et al. [2006], Aspray et al. [2006], and Gartner [2006a, b], a number of important factors affected the development of the program.

In the process of developing the new IS curriculum, we examined and evaluated several existing curricula in Sweden and Europe, and the IS 2002 model curriculum. In the process, we also reviewed the *Journal of Information Systems Education* and *Communications of AIS*, as well as a number of recent reports, such as the ACM Job migration task force [Aspray et al. 2006], for input. Many sources may function as inspiration, but some are not suitable for our situation since curricula in Sweden and Europe are redesigned due to the Bologna accord.

The IS 2002 model curriculum was not suitable for the following reasons:

1. Although there is a greater emphasis on skills and capabilities in IS 2002 than in IS '97, IS 2002 is still to a large extent content focused and not capabilities focused.
2. The IS 2002 has a structure based on program structure conditions in the United States and Canada, and these do not fit the European structure.

3. IS 2002 is not adapted to the requirements of new capabilities and skills of IT workforce.
4. IS 2002 lacks a clear design focus.

The Bologna declaration, with the Dublin descriptors, was a major input on how to think and design the education program. The curriculum should be built on first-cycle qualifications of the Dublin Descriptors and thus state the expected learning outcomes clearly. The Dublin descriptors can be viewed as constraints, but they can also be viewed as affordances, since they "afford" us to think of and elaborate what students are expected to know and be able to do after completing the education. Hence, they also functioned as "driving principles" and had us focus on the most important aspects first. In essence, we adapted to the constraints and affordances of the Bologna declaration based on both the national and local regulations and to the Dublin Descriptors. Since the proposed program is developed for the education of BIS designers, the curriculum should focus on design abilities and thus on the skills and capabilities required for a BIS designer. For this to be functional, a new pedagogical design was needed that focused on the capabilities instead of content. Through this the curriculum should render possible integrated and deep learning [Marton and Säljö 2000] essential for IS design.

Consequently the curriculum had to focus on capabilities [Bowden 2004] instead of on content. Therefore, we connected the Bologna constraints and affordances to Bowden's [2004] pedagogical model for curriculum design. Bowden contrasted content- and capability-focused curriculum design (Figure 3). Content-focused is the common design that takes its point of departure in a given content, e.g., modeling of entity types using UML, and centers a course on this. Thus, all the problems and examples of the course deal with UML for modeling entity types. In another course, the content could be to model business processes also using UML, and in a third course the content could be Business Rules and modeling of these using OCL (object constraint language—a part of UML) or another relevant "language." All the examples and problems in the courses would be targeted at respectively entity types, business processes, and business rules without any attempts to view these as different perspectives of business modeling. The content of UML is the primary goal of the courses, not the capability to model business problems and solutions using relevant techniques and knowledge. Therefore, the students would likely only reach surface learning [Marton and Säljö 2000] of three isolated aspects of business modeling. They would probably not be able to transfer knowledge from one content-focused course to another or develop the capability to address similar, but not exactly the same problem situations. The needed integration of knowledge across contexts and contents would be left for the students to achieve by themselves without support from the content focused curriculum.

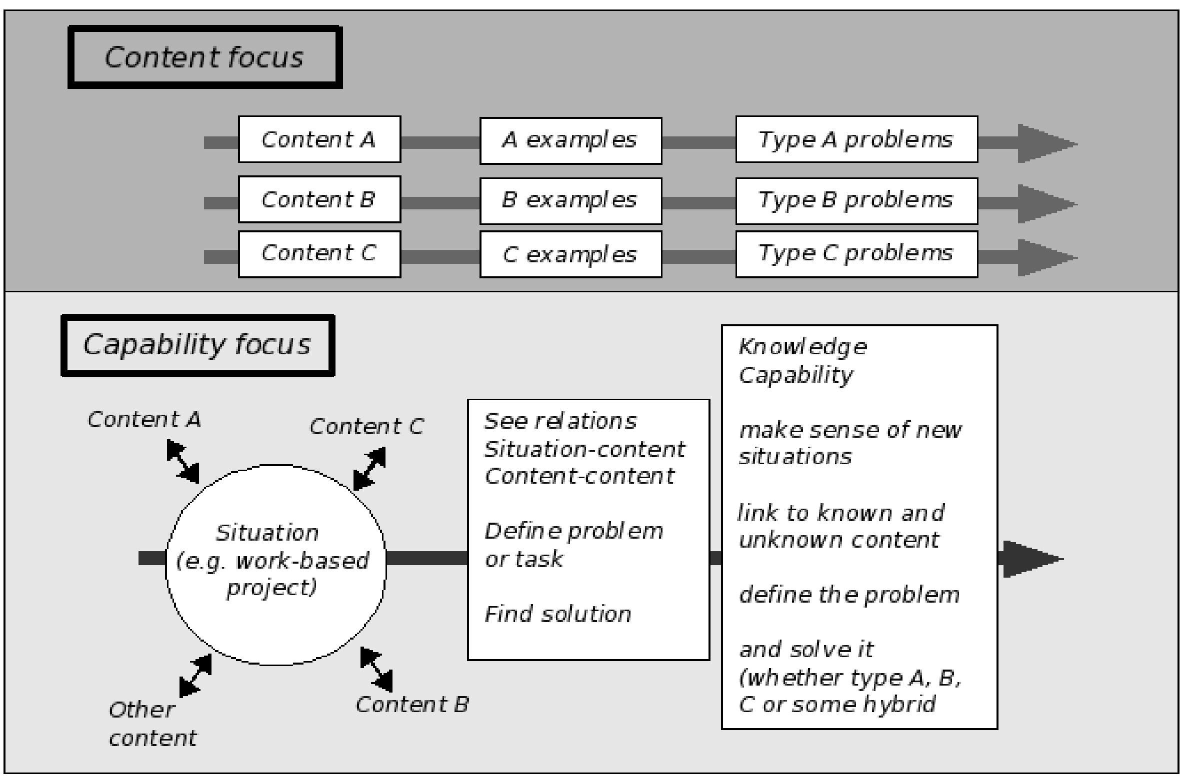

Figure 3: Content Versus Capability Focused Curriculum Design [Bowden 2004, p. 39]

Since the curriculum for the BISD 2010 education program is built on the notion of designing artificial systems and artifacts for business contexts the training of design ability and capability is central. We have thus put emphases on those qualifications and learning outcomes that connect to skills and capabilities. Hence, we started by asking us the questions: “What should the students be able to do? What should their skills be?” and phrased the answers as “applying knowledge and understanding” descriptors. On a general level, these descriptors say that the students should have the skill and capability to design IT supported business solutions and improvements in the form of artificial systems and artifacts. Based on this, we went on to elaborate the other qualifications and devise the descriptors in such a way that they would be a support to and provide necessary contributions to the “applying knowledge and understanding” descriptors.

The objective was to design a curriculum that focused important IS design capabilities as centers for course content. The capabilities should be important for the whole education and not be constrained to delimited courses. The capabilities are thus structured as flows stretching over several semesters and courses to provide the opportunity for the students to reach integrated, deep learning of IS design. In each flow, the particular capability is problematized to accommodate progressively higher levels of problem complexity. Also, during the semesters the students are supposed to work on projects, where situations are created as the center for learning-by-doing, guided by the contents provided. In a sense, this pedagogical model comes close to Schön’s [1987] practicum.

The Underpinning Values

The assumed work role, Business IS designer, can comprise several specific career tracks. However, there is a growing demand for people with the skills and abilities to design business and IS, i.e., artificial systems, in concert rather than for technical equilibrists, who has an in-depth knowledge in programming and algorithmics.

Fundamental concepts in the curriculum program are business activities which are central in the design and use of IS; and IS which is central in the design of business activities. Business activities, including the design of IS, are organized in formal ways with regard to structure, processes, rules, and power relationships, but they also emerge in an informal way with regard to cultural and cognitive structure, such as norms, values, and other social arrangements within an organization.

Individuals, i.e., people, reside within and outside of the formal organization and constitute the most important part of the business—no people, no business. In that sense, people represent an actor that both fulfill personal goals, as well as the contextual goals (e.g., organizational goals). The link that glues people, business activities, and context together is information. Therefore, IS have to be designed with regard to all these aspects independently, either as a business organization or a governmental agency.

The learning outcomes crystallized from the underlying view of the IS designer, the design of information systems, the role in business activities, and human beings.

Expected Learning Outcomes

The learning outcomes for the BISD 2010 model curriculum are based on the Dublin descriptors and are presented below.

Applying Knowledge and Understanding

On successful completion of the program, the student, individually and as a member of a group, is expected to demonstrate the skills and ability to (C1, C2, etc., refer to learning outcome bars in Figure 4):

- Design IS in order to achieve improvements and innovative change in organizations and business activities (C1)
- Apply theories, design methods, and tools for the development of IS (C2)
- Participate in and manage IS related change and innovation projects in national and international settings (C3)
- Deploy IS and ICT in organizations and business activities (C4)
- Plan, carry out, and report design and social science investigations and studies (C5)

Making Judgments

On successful completion of the program, the student should be able to demonstrate the ability to (V1, V2, etc., refer to learning outcome bars in Figure 4):

- Analyze and evaluate theories, processes, models, methods, and tools for IS-related design work from different perspectives (V1)
- Critically examine, analyze, and evaluate IS design and change proposals from different perspectives (V2)
- Evaluate the individual’s own knowledge and need for further knowledge (Life Long Learning—LLL) (V3)
- Analyze and evaluate IS, organizations, and business activities (V4)

- Analyze and evaluate competencies and resources for IS (V5)
- Analyze and evaluate project work and group dynamics (V6)
- Critically examine scientific studies and other reports (V7)
- Appraisal of outlooks and general tendencies in society in relation to IS and automatic data processing with regard to relevant scientific, societal, human, and ethical aspects (V8)

Knowledge and Understanding

On successful completion of the program, the student should demonstrate knowledge and understanding for (since these are the basis for C and V, they are not explicitly shown in Figure 4):

- The foundation, the history, the theories, the concepts, and the contemporary research issues within the scientific field and knowledge area
- Relevant IS design processes, models, methods, and tools
- How IS and its use affects or may affect organizations, business activities, society, and individuals
- How requirements, wishes, needs by organizations, businesses, society, and individuals may be fulfilled by IS and its use
- Different organizational structures and business activities and their relationship to IS
- How data, information, and knowledge may cooperate, be applied, and used in organizations and businesses activities
- Different ways of organizing IS-related work, in general, and project work, in particular
- Important perspectives, theories, models, frameworks for the design and use of IS and ICT
- Perspectives on and approaches for the deployment of IS in organizations and businesses

Communications

On successful completion of the program, the student should be able to demonstrate the ability to (these are generic skills which are not explicitly shown in Figure 4):

- Independently and in group plan and present good presentations in speech, writing, symbol language, and pictures of ideas, plans, and solutions in dialog with varying stakeholders
- Use computer-based support systems for collaboration in IS design work

Learning Skills

On successful completion of the program, the student should be able to demonstrate the ability to (this is a generic skill which is not explicitly shown in Figure 4):

- Learn new relevant theories, models, methods, and techniques as well as critically examine these for professional work and further studies (LLL)

The student cannot acquire all learning outcomes at the same time; so different courses focus on different learning outcomes. In Figure 3 we show the relationship between two of the learning outcomes (“Applying knowledge and understanding” and “Makings judgments”) and the distribution of learning outcomes in the program. As illustrated in Figure 2, some of learning outcomes (e.g., V7—scientific studies and reports) are part of all courses. Whereas others, e.g., C3—deploy IS and ICT in organizations and business activities, are part of one course. In addition, Figure 3 includes the main examination tasks, which are supposed to be examined after each semester. (Note: Sweden has a two-semester school year and courses may be as long as a semester, which is twenty weeks of fulltime studies.)

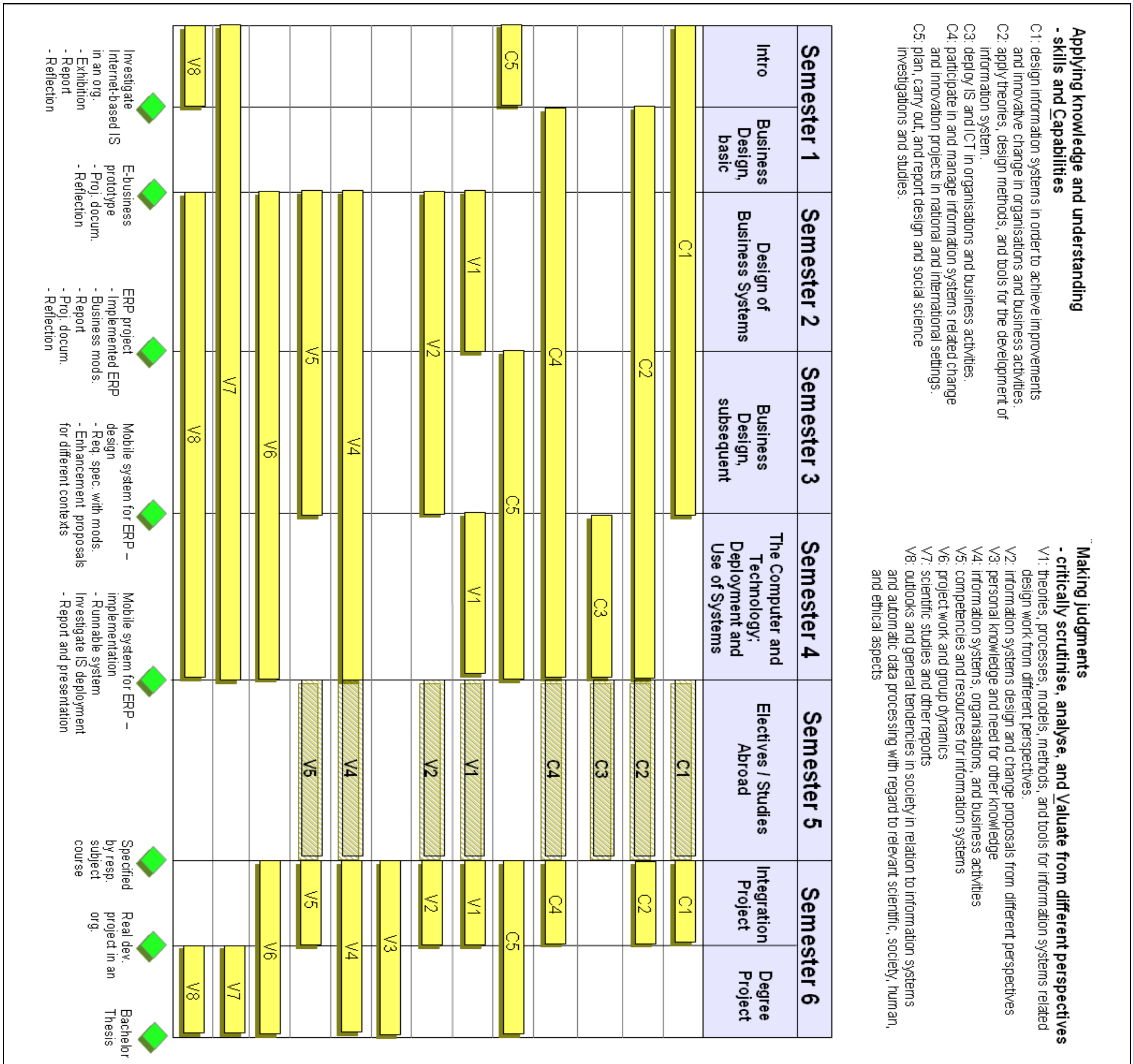

Figure 4: The Distribution of the Learning Outcomes in the BISD 2010 Education Program.

Knowledge Areas and Content Based on Expected Learning Outcomes

Based on the defined learning outcomes and the body of knowledge in information systems [Iivari et al. 2004], we outlined a number of knowledge areas with content; see below. Iivari et al. [2004] presented five distinct knowledge areas for IS experts, including technology knowledge, application domain knowledge, system development process knowledge, organizational knowledge, and information systems application knowledge. In addition to these five knowledge areas, we suggested two more. First, IS design science knowledge, which is the ontological ground for BISD 2010. Second, we added knowledge about systematic investigations, i.e., knowledge about how to conduct, evaluate, and present scientific research and consulting reports. These are essential skills for a reflective practitioner. We "transformed" the seven knowledge areas into five major knowledge areas: (1) design of IS and business, (2) business, organizational, and IS knowledge, (3) information and communication technology (ICT) knowledge, (4) project work for IS and ICT, and (5) systematic investigations. The knowledge areas with their contents are central, since these are the ground for a student's possibility to reach the outlined learning outcomes. Knowledge areas with contents are the basis for individual courses. In order to secure a complete coverage between learning outcomes and knowledge areas, we used a spreadsheet to map each learning outcome with the knowledge areas. The knowledge areas with content and examination tasks are depicted in Figure 5. As with learning outcomes, all knowledge areas cannot be taught at the same time. In Figure 5, we outlined the distribution of knowledge areas over time (K1, K2, etc. refers to knowledge area bars in Figure 5).

Design of IS and Business (K1)

- The history, theories, and concepts of the scientific field and knowledge area
- Design as problem solving processes
- Design of artifacts and artificial systems
- Modern paradigms, models, methods, techniques, and tools for integrating the design of IS, organization, and business
- Modern paradigms, models, methods, techniques, and tools for evaluating the IS design process and its artifacts in the form of ideas, plans, and solutions
- Development of the IS design and IS evaluation process
- Requirements and change management of integrated design of IS, organization, and business as well as systems maintenance
- Test management
- Ethical, legal, power, and security issues in the design of IS
- The field of profession for IS designers (including competences, roles, tasks, life long learning, professional ethics, genus and gender issues, as well as sustainable development)

Business, Organizational and IS Knowledge (K2)

- The history, theories, and concepts of the scientific field and knowledge area
- Private, public, and none-profit organizations
- Organization theory and business knowledge (including structure, business processes, communication, functions, co-work, coordination, innovation systems, entrepreneurship, standards and quality models, change management, strategy, goals, decision, and action)
- Information management (data, information, and knowledge)
- IS classes and instantiations
- Modern paradigms, models, methods, techniques, and tools for implementing IS in different contexts
- Stakeholder and power perspectives in the diffusion and adaptation of IS
- Evaluation of IS use
- Outlooks, perspectives, and general tendencies in society in relation to IS

Information and Communication Technology (ICT) Knowledge (K3)

- The history, theories, and concepts of the scientific field and knowledge area
- Instantiations and classes of ICT
- Computer and ICT architecture
- ICT quality models and standards
- Software engineering
- Outlooks, perspectives, and general tendencies in society in relation to ICT

Project Work for IS and ICT (K4)

- Management and planning
- Organization
- Group dynamics
- Standards/techniques/tools
- Project work in national and international environments

Systematic Investigations (K5)

- Basic scientific paradigms
- Strategies, approaches, methods, and techniques within design science and social sciences
- Presentation, critique, defense, and evaluation of investigations

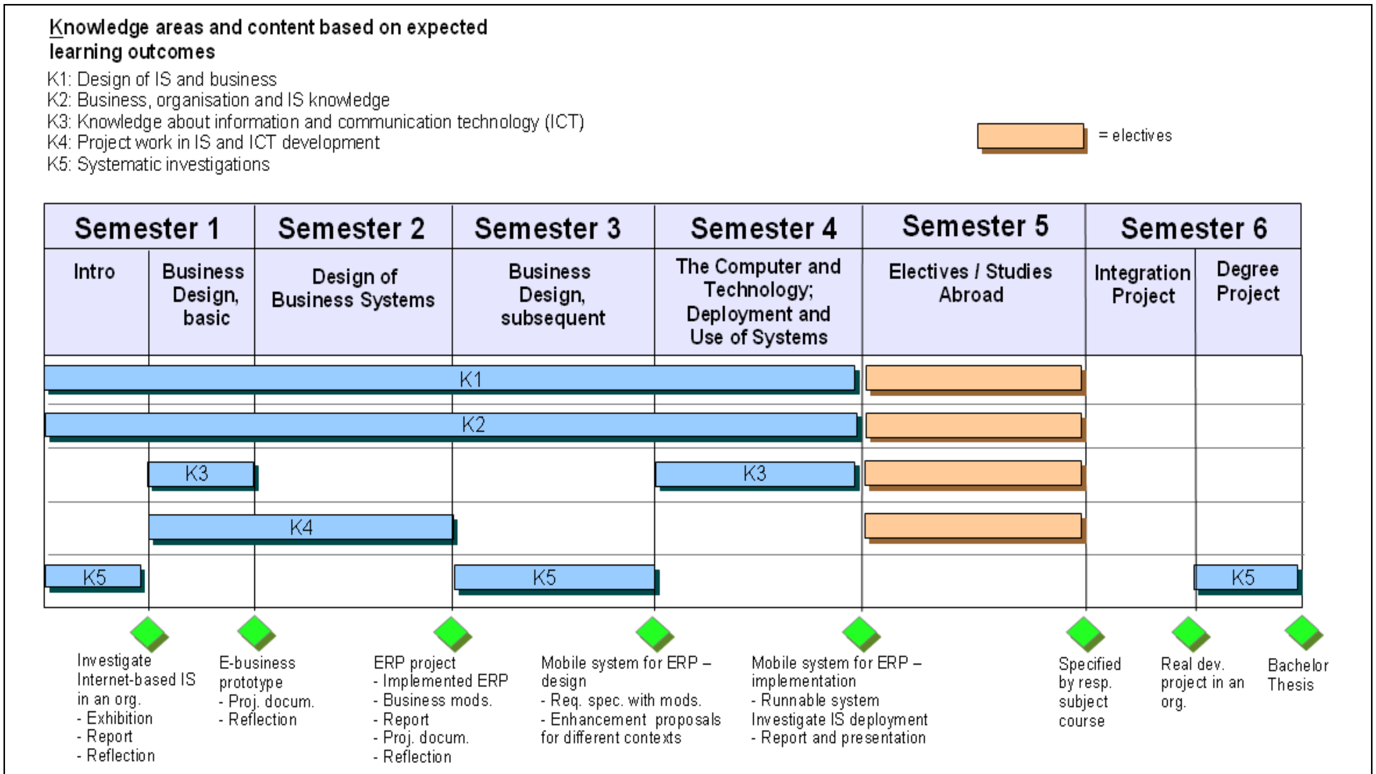

Figure 5: Distribution of Content in the BISD 2010 Education Program.

Skills Training and Examination Tasks

The structure of the education program is not based on content. It is based on and structured according to the learning outcomes. This has implications for the choice of electives. The students are not allowed to freely choose any elective. The electives have to conform to the overall learning outcomes of the program. To help students in their selection of electives, we outlined a number of courses that comply to the knowledge areas. Table 2 outlines the knowledge area and related courses. The elective gives the student an opportunity to get more in-depth knowledge or broaden its knowledge. For instance, courses in Decision Support Systems (DSS), Human Computer Interaction (HCI), and User Oriented Design are such courses.[6]

Based on the learning outcomes and the defined knowledge areas, we outlined a number of skills training and examination tasks. This is a key component in an IS education program. In Table 3, the training skills and examination tasks are presented along with the main courses of the education program. The view that IS and business is converging makes it difficult to distinguish between business concept and human users. Thus, business concepts and human users are continuously addressed in the same courses. Note that the training skills and examination tasks are tentative suggestions.

[6] DSS, HCI, and User Oriented Design are naturally part of other courses. In these courses, for example, HCI is primarily addressed along the lines of the view expressed by Te'eni et al. (2007).

Table 2: Knowledge Areas Followed by Potential Elective Courses	
Knowledge Areas	**Electives**
Design of IS and business	Systems Analysis and Design Human Computer Interaction Design User Oriented Design Business Process Modeling Business Rules Modeling Requirements Engineering Model-Driven Development Component-based Development
Business, organizational, and IS knowledge	Organizational Theory, with focus on business and IS Systems Theory IS Strategy IT Management Service Management Business Process Management Workflow Management IS and ICT procurement IS/IT Operation Management Change Management
ICT knowledge	Business Intelligence Business Process Management Systems Business Rules Management Systems Workflow Management Systems Cloud Computing Middleware Applications Service-oriented Architecture Decision Support Systems Information Security
Project work for IS and ICT	Distributed projects International and culturally heterogeneous projects Project management methods and tools Advanced studies in Group Dynamics

Learning Portfolio

In order to stimulate deep learning of skills and capabilities, i.e., learning outcomes, we decided to implement a Learning Portfolio in BISD 2010. It is one of the tools to comply with Bowden's ideas of a capability-focused curriculum.

A portfolio consists of a representative or selective structured collection of a student's work, in this case, the examination tasks and other artifacts created by the student, which can be used to provide evidence of certain skills and competences. The portfolio is an old tradition and a necessity in other design professions like architecture and fashion design. A portfolio is a way to increase employability and give tangible examples of sought-after skills. This kind of portfolio can be called a *dossier portfolio* [Tillema 2001] and is summative in character, while it has an evidentiary rather than a pedagogical and forming role.

A Learning Portfolio has an extended and a formative purpose, since it also has a pedagogical role of supporting the learner's learning during the whole education. A Learning Portfolio can be course related or reflective [Tillema 2001]. A course related portfolio extends a dossier portfolio with: (a) which learning outcomes that should be achieved, and (b) a self-assessment by the learner of how well these have been achieved. A reflective portfolio extends the course-related portfolio with the learner's own reflection on the learning process and competence improvements. In an experiment, the latter type of portfolio was shown to lead to deeper insights, more accepted feedback, and greater impact on the learning than the two former types [Tillema 2001]. Although the management of the Learning Portfolio and the reflection requires commitment and sometimes hard work by the learner, it has great impact on learning and learners' self maturation [Zubizarreta 2004].

The Learning Portfolio in the BISD 2010 curriculum thus has two major functions. First, it is a pedagogical learner-centered assessment and reflection to reach deep learning and learner's self-knowledge. Second, the people developing the portfolios can provide examples of their work (via artifacts) in order to provide evidence for claims that they are making about their learning. We strongly believe that Learning Portfolios with examples will increase students' employability. The Learning Portfolio will be an e-portfolio, i.e., an electronic portfolio, which is suitable for an IS education.

Table 3: Courses, Skills Training, and Examination Tasks in BISD 2010

Courses	Skills Training	Examination Task
Introduction	Read and position oneself within the scientific field	Set up an exhibition and report of an Internet-based IS
Business Information Systems Design basic	Design and development of a simple prototype of an e-shop using contemporary development tools	Design an E-shop solution and prototype with scenarios and storyboards
	Management and organization of project work	Different project documents and the use of project management support tools
Business Information Systems Design	Design and configuration of ERP system	A configured ERP system based on a requirements specification
	Modeling and design of basic business processes	As-is and To-be models of business processes
	Quality evaluation of ERP projects and business processes	Written report
	Project work with project closure	Project documentation
Business Information Systems Design Advanced	Design of a innovative mobile application that interacts with an ERP system	Requirements specification with models
	Conduct business and organizational analysis from different perspectives	Present change and improvement suggestions
The computer and technology, deployment and use of systems	Realization of previous course's mobile application	A functional mobile application
	Evaluation of an IS implementation in an international environment	Presentation of report
Electives	Different for the elective courses	Different for the elective courses
Studies abroad	Different for the elective courses	Different for the elective courses
Integration project	Design of an artificial system using contemporary approaches, methods, techniques, and tools	Documentation, presentation, and defense of design process and artificial system
Degree project	Based on design science or social sciences	Degree work, opposition and defense

DISCUSSION AND CONCLUSIONS

We presented an integrated curriculum for a Bachelor of Science program in Business Information Systems Design (BISD 2010). The curriculum is an instantiation of the new IS 2010 curriculum guidelines for undergraduate degree programs in Information Systems. The curriculum meets the goals and restrictions in the Bologna Declaration and Dublin Descriptors. This is critical for European curricula. A number of issues related to the development process of the program and the program's content are worth stressing.

First, the program was developed for students in one country, Sweden, which is fairly advanced in applying ICT in businesses and in various spheres of life. Sweden also has a fairly strong ICT industry.

Second, in developing the program we had a number of quite intensive interactions with IS professionals and students. For example, we run focus groups with IS professionals in the activity of generating learning outcomes. The IS professionals not only had great knowledge of the professional field, but also great educational knowledge and experiences (one has a Ph.D. in informatics and has been a teacher at the department for five years). We also sent different program "drafts" to CIOs and IS managers for comments and suggestions. This activity was very fruitful and lead to changes and enhancements of the program. One example is the summative project last semester. Some IS professional suggested this as a way to increase the students' employability.

Third, the program is integrated, which means a move away from most other programs' "stove-pipe" structure, where programs are built up of fairly isolated courses offered by different departments. This move requires organizational changes of power over program content and structure from departments to undergraduate school, breaking up of departmental boundaries and forming of cross-departmental course development and teaching groups, and a cross-departmental consensus on content and skills, pedagogy, and learning outcomes.

Fourth, the program is based on a specific pedagogical model. Based on experiences from, for example, medicine and design programs, it is tempting to suggest that BISD 2010 will prepare students better for working life than "traditional" IS programs.

Fifth, the program also has a track for developing generic skills. This track includes, for example, the development of writing and communication skills, skills in using different sources for finding data and information, and skills in mixed-culture collaboration. Also, the employability will be enhanced since students use many types and instances of ICT.

To conclude, BISD 2010 is an education program for those who pursue careers as Business Information Systems designers. We hope that the ideas presented in the paper may stimulate future curricula development efforts around the world.

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