Recommendations for a New Undergraduate IS Curriculum

Completed Research

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Abstract
This paper presents analyses on the trends of IS curriculum development that has evolved since its inception from the classical report by the AIS/ACM task force led by Heikki Topi and colleagues published in 2010. Based on an integrated synthesis of the literature, we categorize it into three theoretically-driven dimensions: (i) IS Curricula; (ii) Topic-Based IS Curricula, and (iii) IS Identity Crisis, followed by the identification of four empirically-driven contingencies: (i) Dangers of Legacy; (ii) Resource Competence; (iii) Technological Availability; and (iv) Trend Sensitivity. The paper presents IS curriculum development recommendations specifically driven by the four identified contingencies. Our findings inform how we design and re-design IS curricula worldwide. This in turn can influence the way we cross-fertilize with other disciplines forming a consolidated IS education that can offer the right competence to our future graduates, and will likely trigger more attention on information systems across the industry.

Keywords
IS curriculum development, IS education, IS legacy.

Introduction
The Information Systems (IS) body of knowledge shows a clear dependency on the computer science curricula in some of its first undergraduate curriculum development where questions we ask today were vital more than four decades ago (Ashenhurst 1972). Such dependencies are considered to have taken the IS field out of its key focus (Hassan and Mathiassen 2018). Years later curriculum guidelines continue to show a struggle in defining the IS body of knowledge within the undergraduate curriculum (Topi et al. 2010; Topi, 2017). Today, IS programmes rely on curricula that are able to successfully orchestrate the use of modern information technology (IT) (Goldkuhl et al. 2017; Jones and Liu 2017; Reynolds et al. 2017; Topi et al. 2010). IS curriculum lies in the core of the IS discipline, where social and technical practices are inter-twined towards understanding an organizational phenomena where the IS artefact remains central (Hassan and Mathiassen 2018; Lowry et al. 2017). Blending contemporary IS-related practices (e.g. big data analyst) and IS-related aspects (e.g. digitalization processes in organizational context) into one curriculum can help students better position themselves as reflective practitioners (Schön 1983), and also help them realize that digital innovation is a fundamental and powerful concept of the IS discipline (Carlsson et al. 2010). The next generation of reflective practitioners is represented as a technology-savvy generation, who habitually interact via IT and often challenge the traditional classroom (Kinash et al. 2013).

IS as a discipline is driven by novelty and cross-fertilization targeting the social context, while IT is designed and used by and for that context. To design an IT system is a complex process that refers to the
design of important business processes driven by IS, where cross-disciplinary aspects (e.g. psychological and/or engineering) portray it to devise and design an IS artefact (Sidorova et al., 2008; Lowry et al., 2017). Teaching fundamentals of the IS discipline constitutes the foundation of IS education. The rapid changes of the IS discipline however, make it complex and challenging to cover every aspect and principle in a coherent way (Stair and Reynolds 2017).

The objective of this paper is to address the above-mentioned challenges. First, we provide a thorough review of the state-of-the-art of the undergraduate IS curriculum development. Then, we proceed by assessing a concrete undergraduate IS curriculum (Carlsson et al. 2010), named Business Information Systems Designer (BISD) 2010 curriculum. The urge to present the review of the state-of-the-art and then present the capabilities-driven pedagogical model is for understanding how the BISD curriculum, which, at that time, differed from many of the IS model curricula (Carlsson et al., 2010) has transformed since its inception and, as most IS curricula, must be kept up-to-date to meet the expectations of the future generation of reflective practitioners (Clark et al. 2017).

The IS curriculum presented in the form of the BISD 2010 programme assessed in this study is formed on the bases of four pillars: (1) it is built on a notion of design as a profession, (2) it is based on a capabilities-driven pedagogical model (influencing programme course structure), (3) the curriculum is modelled 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 programme. We particularly focus on the second (2) pillar, which created the guidelines and rules as an essential starting point to run the curriculum successfully based on a 3-year cycle as per the Bologna accord (namely the 3+2 Bologna process with 3 years undergraduate degree followed by 2 years master's degree) (Carlsson et al. 2010). In this respect, our objective is to give a comprehensive understanding of how we could design an innovative IS curriculum towards reflective practitioners.

The rest of the paper is structured as follows. We first present our theoretical underpinnings, followed by our methodological considerations. Finally, we discuss the analysis and our findings, the implications, and conclusions further driven by future directions that can positively affect the design and re-design of undergraduate IS curricula worldwide, towards ambitious undergraduate IS curricula for a degree programme.

**State-of-the-Art in Undergraduate IS Curriculum Development**

The IS discipline has recently launched an advanced version of the graduate curriculum development, named MSIS 2016 (Topi et al. 2016), co-jointly produced by the Association for Information Systems (AIS) and the Association for Computing Machinery (ACM). De facto, MSIS 2016 does not offer a pre-defined IS curriculum, but it rather focuses on how to design a curriculum tailored to bring forward competencies of the graduates upon completion of the programme. While the graduate IS curriculum development has taken a leap forward, the status of the undergraduate IS curriculum development is still in need of emphasizing its unique identity when compared to other programmes, such as those in computer science or related disciplines to IS. One way to do so is to consolidate the IS field from the fragmented intellectual structures by using a specialized method such as the one proposed by Hassan and Matthiessen (2018). This specialized method shows how we can better locate relevant articles, key topics, significant concepts and theories useful for developing an IS-related competence (Clark et al. 2017).

Constant technological evolution requires IS educators to continuously be aware of the changing landscape that the students will need to adapt in the class (Topi et al., 2016). This requires tremendous efforts on behalf of the faculty who have to make sure that the courses evolve with the changing times (Clark et al. 2017). IS education is driven by teaching concepts and skills that cover IS practice and research, with the former being key to undergraduate degree programmes, where students should master learning-by-doing (Goldkuhl et al. 2017). The exponential growth of technology has led to the development of specialized topics that today have become mainstream in industry as per Forbes Technology Council. Just to name a few, technologies like Blockchain, Human and Artificial Neural Networks, and particularly Internet of Things and Big Data, have become board-of-director-level and corporate-wide concerns (Lowry et al. 2017). Although attention has been given to undergraduate IS curriculum development, this focus remains specific to sub-fields that do not find a consolidation from an IS point-of-view of what competence we aim to instill in our students upon graduation (Shah et al. 2018).
The graduate IS curriculum designed by Topi et al. (2016) presents the state-of-the-art view of what a graduate curriculum development should maintain (Shah et al. 2018), but such outlines have not been adopted by the undergraduate programs. The important revisions highlighted by Topi et al. (2016) must also be undertaken in our BISD 2010 curriculum recommendations, before it becomes too late to align with the industrial needs for jobs such as Information Manager, where specific sub-fields will only become trivial in achieving a comprehensive competence upon graduation.

The pursuit of the IS field to build a new undergraduate curriculum for a new generation depends a lot on our recognition of the previous extensive and important work conducted by the joint AIS/ACM task force for IS curriculum development at the undergraduate and graduate level led by Heikki Topi and colleagues. Particularly in reference to Topi et al. (2010), our analysis reveals that Topi et al. (2010) has been the key source for two types of curriculum developments across IS programmes worldwide: (i) scholars use Topi et al. (2010) to design and re-design their local undergraduate IS curricula (e.g. Barnes et al. 2015; Gallaugher and Wyner (2016); Clark et al. 2017); and, (ii) scholars use Topi et al. (2010) to design and re-design topic-based IS curricula (e.g. Slauson et al. (2010), White et al. (2014); Wang and Jin (2015); Jones and Liu (2017)). While our expectations were not far from what we have identified in (i) and (ii), we also found that Topi et al. (2010) is considered as a consolidating point for the IS identity crisis debate that took a significant turn during early 2000, influenced by the work of Benbasat and Zmud (2003), for instance. We thus identified the third input for curriculum development: (iii) scholars have continued their debate on IS identity crisis also in the light of IS education with exemplar studies conducted by Brooks et al. (2018); Hirschheim and Klein (2012); Alter (2012) and Sidorova and Harden (2012), who see curriculum development as a point for consolidation of the IS field. While these views were few, we recognize that the influence of curriculum development in IS field’s identity is also essential. Against the backdrop of these findings, our ultimate goal is to pave the way for urging our AIS/ACM task force not only to design and re-design the IS undergraduate curriculum in a timely fashion, but also to facilitate a closer interaction between the AIS community educators for consolidating their local curriculum development, starting at the base level by unifying the name for the IS programmes (Clark et al. 2017). In reference to such analysis, our categorization leads to identification of three dimensions, namely (i) IS Curricula; (ii) Topic-Based IS Curricula, and (iii) IS Identity Crisis.

The actual conceptualization and interpretation of the three identified dimensions became clear in the early phase of our literature analysis. These conceptualizations are developed on the basis of analyzing each study to derive characteristics that placed it in one of the dimensions. For instance, highlighting “IS Curriculum” or “IS sub-topics” and related, were crucial for interpreting the three dimensions. In parallel to this finding, focusing on the empirical view of the selected literature for analysis, we categorized the literature also in terms of the following four contingencies: (i) dangers of legacy; (ii) resource competence; (iii) technological availability; and (iv) trend sensitivity. The overall procedure led to a refinement of the identified three theoretical-driven dimensions and to four empirical-driven contingencies. Table 1 presents our results.

<table>
<thead>
<tr>
<th>Contingencies</th>
<th>IS Curricula</th>
<th>Topic-Based Curricula</th>
<th>IS Identity Crisis</th>
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<tr>
<td><strong>Dangers of Legacy</strong></td>
<td>Barnes et al. (2015);</td>
<td>Slauson et al. (2010);</td>
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<td>Brooks et al. (2016)</td>
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<td><strong>Resource Competence</strong></td>
<td>Shah et al. (2018);</td>
<td>Chung et al. (2010);</td>
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<td><strong>Technological Availability</strong></td>
<td>Kim and Kishore (2018);</td>
<td>Wang and Jin (2015);</td>
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<td></td>
<td>Sanchez-</td>
<td>White et al. (2014)</td>
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Morcilio and Quiles-Torres (2014); Woolridge and Parks, (2016); Niederman et al. (2016); Liu and Murphy (2012)

Gallaugher and Wyner, (2016); Jaeger and Helgheim, (2011); May and Lending (2015); Stefanidis and Fitzgerald (2014);
Pawlowski and Hollkamp (2011); Sjöström et al. (2016); Mitri and Palocsay (2015); Bhaduria et al. (2015); Gupta et al. (2015); Jones and Liu (2017); Sidorova (2013)

Table 1. Three identified dimensions mapped with the four identification contingencies.

We define the four contingencies as follows: (i) dangers of legacy - driven by the fact that an outdated curriculum can lead to more abstractions than necessary in the class, for example business-driven concepts that no longer are key phenomena in the IS field can lose credibility in the class, and too technical-oriented classes that drive students to suspect that they need a computer science background to be ready for an IS programme; (ii) resource competence – frequent changes in courses often lead to major revisions where resource competence becomes a problem; (iii) technological availability – with frequent revisions within IS courses and programmes, technological skills become mandatory to keep-up-to-date in profiling the students towards the right trends, however, IS programmes often cannot keep-up-to-date with such trends; (iv) trend sensitivity – fast moving markets, show that the industry can often move towards a direction that finds our students not compatible with their immediate competence needs.

We apply our findings in terms of the three dimensions as a starting point for paving the way towards an integrated IS education development plan. In doing so, we consider that our approach can initiate consolidation among IS researchers not only in terms of curriculum development, but also in terms of finding the right approaches to unify the programme names, enhancing competences for our future graduates, and becoming more attractive for the industry.

Research Design

The study used two different methods to present the results. The first method applies to the literature review that presets the state-of-the-art by introducing three dimensions followed by four contingencies. Topi et al. (2010) - as the current official guideline for undergraduate IS curriculum development and as a classical reading - assisted us to develop the setting for literature findings in this area. In doing so, we recognized that this article is amongst the highly cited works of Topi and colleagues in this area, with more than 500 citations, and with the majority referring to positive citations. Doing such citation analysis, we form a comprehensive state-of-the-art knowledge on a classical report (Hassan and Mathiassen, 2018).

The inclusion and exclusion criteria of the literature review helped the selection process. Around 30% of all literature which cited Topi et al. (2010) were excluded from our study, mainly because they were written in a language other than English, the majority were not academic or the citation had nothing to do with one of the three dimensions we identified originally; thus were out of the scope of our research objective. Further on, we continued with the exclusion criteria based on the three dimensions and the four contingencies, which led us to focus our analysis only on 31 papers (see Table 1) that cited the work of Topi et al. (2010) and were relevant for the objective of this study.

The second method applies secondary data analysis based on a local case description with longitudinal data collection. The study was carried out at Lund University in Sweden. The university currently hosts approximately 42 000 students. The BISD 2010 programme runs at the Department of Informatics, School of Economics and Management, each year hosting 100 new students, while maintaining around
300 students for one cycle according to the Bologna accord. As the number of the applicants is increasing each year, we see a positive trend following BISD 2010 programme. The longitudinal data is collected in the form on narratives. A total of fourteen courses’ narratives were analysed, with ten basic courses repeated every year during a five-year period, while four courses were developed and introduced in the program during the last four years. Lecturers’ and programme directors’ qualitative feedback on the basis of students’ evaluation forms on a five-year period were analysed in detail to find patterns along their evaluation that implied an overall evaluation of the courses that reflected on the programme. Our intention with analysing the narratives was driven by our literature findings in reference to Topi et al. (2010).

The narratives were derived from ten basic courses that were given between 2013-2018 plus four other courses that were developed during 2014-2018. In total, narratives from fourteen courses were included in our analysis. Furthermore, depending on the type of the course, mandatory courses (the total number of enrolled students per year, ca. 100) or elective courses (the number of students trending from 15 to 75 students per course), generated the narratives with at least 50% response rate on students’ evaluations per course. This influenced the narratives created by the programme director each year, where other forms of programme evaluations designed by the school and the student union also influenced the narratives.

Analysis from the Local Case

We begin by acknowledging the fact that the success-story of the BISD 2010 programme can clearly be seen from an increased number of applicants that has tripled since its inception. In just eight years, we have re-designed parts of the program to focus on current important trends that we have mentioned earlier, such as digitalization of infrastructures, particularly focusing on big data and Internet of Things possibilities, where aspects such as systems thinking and security thinking become central.

Shown in Figure 1, the contingencies presented on the Y axes are plotted against the academic years dating five years (13/14 – refers to the academic year Autumn 2013 / Spring 2014, and so forth). From this data, we identify a trend-line across the years on how the contingencies were mapped. However, the early occurrence of a contingency shows that it can occur again after five years in a bigger context, leading us to consider that such contingencies could be cyclical and can re-occur through time as the programme evolves, presenting the need to show pitfalls of such a programme.

Analysing such patterns further, we suspect that this happens when a new trend begins at the programme. For instance, when we identified trend sensitivity, the students reported that they had less hands-on experience with the latest technology and business-needs trends. Moreover, we consider that such findings are also a reflection of the market trends. The key intake from market trend is that an unprecedented technological growth in terms of solutions, methodologies and frameworks is not easily integrated in the programme at the moment they occur, but that it rather takes critical thinking, time and persistence to make the proper changes. But students’ expectations are to be met right away.

![Figure 1. Mapping contingencies to the courses.](image)
While students’ expectations seem to match with the market trends, this is not necessarily a need to be matched with scientific developments of a programme, particularly because such market changes must first be observed, analysed, and their effects measured, in order to conclude on their sustainability in the long run. Even more importantly, resource competence also becomes a key criteria to meet the student demands right away. Scientifically speaking, we need to be cautious when we make the proper adjustments to the programme that prepares the next generation of reflective practitioners.

To better understand these results as presented in Figure 1, we also reviewed the overall programme by analysing the course development over the five-year period. We did so in order to reflect on the trend-line found in Figure 1, which led us to discover that a result of it is also another trend-line that occurred with the courses’ developments. Figure 2, shows that the programme has started with fewer courses than today. The development of at least three new courses since three years ago, shows that the contingencies have taken a new form, which we strongly believe leads to the cyclical occurrence of the older contingencies, as is the case with the trend sensitivity and technological availability.

**Figure 2. BISD 2010 courses and applied knowledge areas over the years 2013-2018(19).**

In figure 2, we show the knowledge areas applied to each course (Carlsson et al. 2010). Namely K1 – design of IS and Business; K2 – business, organizational and IS knowledge; K3 – technological knowledge (also referred to as IT or ICT knowledge which we explained at the beginning of this paper); K4 – project work for business and technology; K5 – systematic investigations. While in Figure 1 some of the contingencies start to occur later in the years post program implementation (such is the case with dangers of legacy), this is also the time when new courses occur, which might benefit from the legacy, but also fall in its trap. In this figure, we also include the forthcoming academic year 2018/2019, where one course is predicted to start with the application of K4 and K5 knowledge areas.

The interesting finding is that the contingencies do not necessarily meet the occurrence of the new courses, but that these new courses lead the students to reflect on the older courses where K3 and K4 knowledge areas are exclusively applied. We consider this to be an important finding that can affect the IS curriculum development worldwide, particularly because K3 and K4 are the alarming knowledge areas where trend sensitivity and technological availability fall, as shown in Figure 1. The overall effect then leads us to be more critical about the dangers of legacy.
Discussion and Implications

The AIS/ACM task force has been criticized for keeping a modest pace in the IS undergraduate curriculum 2010 development (Clark et al., 2017). It has been almost a decade since the first design of the current approved IS curriculum guidelines was presented (starting in 2009) letting us adhere to guidelines not always applicable for designing a contemporary IS program. In spite of the fact that the IS2010 undergraduate model might be outdated, dangers of legacy, resource competence, technological availability and trend sensitivity of IS programs is reflected upon the fact that there is no consensus on how IS programs should be called world-wide. More importantly, the call that Topi (2017) makes in his analysis for a co-joint computing curricula 2020 (CC2020) emphasizes the following: “for the information systems education community, one of the important open questions is the approach chosen for the next version of undergraduate level guidance for degree programs in information systems (IS202X)”. Our theoretical and empirical understanding aligns well with this emphasize, yet our aim is to inform the task force that there is an urge to bring the IS202X much earlier than predicted.

Reflecting on our local experience, similar to other studies that used Topi et al. (2010) for IS curriculum development, IS undergraduate curriculum 2010 has also been the key inspiration and our guideline for our BISD 2010 programme. However, students expectations, industry needs and technological development, have led us to re-think the design.

Shaping a program based on a new curriculum for a new generation of reflective practitioners in its own right is challenging. To stress our findings, referring to Clark et al. (2017) who found seventy-six unique names for an IS-related major program in the US context alone, shows that the use of the local experience in developing a new programme follows a trend of pitfalls, rather than adhering to updated international guidelines that would give a safer path towards sustaining quality, interest and use of appropriate technology for the competence of our graduates.

With the intention to assess the BISD 2010 capabilities-driven pedagogical model from narratives, we have taken a critical stance by discovering a number of challenges that showed trends forming on the base of technological evolution. From practice, we know that one of the most interesting modes of teaching is blended learning, as a mode that started to occur more rigorously in the BISD 2010 programme in the last three years. Hence, this mode became a call for students of the current programme to reflect on the courses by asking for more hands-on experiences with the latest technological trends, and with less abstractions of concepts taught in a course. A fundamental change in the classroom as soon as a technology occurs is not necessary. The recommendation rather focuses on developing better methods to convey the message of change to our students (Clark et al., 2017) bearing in mind the contingency of trend sensitivity.

Our analysis shows that students are primarily pushed to study IS by focusing on technological trends rather than on conceptual trends. This clearly denotes their needs to show “ready-to-be used” skills with hands-on experience, as opposed to being capable to reflect holistically. As BISD 2010 relies on the deductive approach, students often seem to forego the holistic perspective, but rather prefer to jump start their knowledge by surfacing the empirically-driven education. While we begin our discussion with such criticism, we also position ourselves towards reflecting on the actual findings, which we do not take lightly as a recommendation.

On the one hand, students are driven by the urge to learn the “trendy technologies”. On the other, their criticism reflects a good deal on how BISD 2010 is taking shape and the necessities for it to be considered thoroughly and urgently. Our findings show that the four contingencies ((i) dangers of legacy; (ii) resource competence; (iii) technological availability; and (iv) trend sensitivity) occur more often, particularly when new courses enter the programme. This is a lesson that must be learned, not only for us, but in the wide spectra of IS curriculum development. Our findings point towards the knowledge areas that courses apply, and that those defined in K3 and K4 must be considered with caution. However, we strongly believe that a reflective practitioner should be balanced between theory and practice, and that the students’ feedback is a course to take new action.

Keeping up to date with trends e.g., internal (the IS field) and external (e.g., business and society), cannot be done on a yearly basis, but needs contemporary guidelines to be managed in an organised way. A
reflective practice on how these courses evolve, develop and are included in IS program must be better managed.

At the time when hands-on experience becomes key for students to be prepared for industry, we, as lecturers, sometimes tend to distance ourselves from that by enforcing more abstract thinking on our students. To practice this in reality, we consider that the blended learning approach should not strictly begin with pre-defined approaches on what students should study, analyse, use and apply, but rather leave room for flexibility for students to choose, a recommendation to this is to practice the case method.

While we value the application of all knowledge areas to the extent that they become inherent for the lecturer of the programme, this is not the case for the student. Differences in the knowledge areas must be better conveyed as messages to the students, in order to avoid biased measures on how they criticize an “All Ks” oriented - course as opposed to K3 and K4 oriented - course. Considering such findings, at least two implications, one theoretical and one practical, can be derived. From a theoretical perspective, there is a need for the IS community to mobilize themselves with the purpose to set an IS agenda to be taught such that the whole community can learn from. While one IS program might not be trend sensitive another will. This is a key concern that parallels with our findings. It can be said that the questions are: 1) who are we preparing for the industry? and 2) how do we better prepare our early careerist for the contemporary job market?

From a practical perspective, we foresee the application of blended learning to advance and transform together with technological trends. In courses e.g., decision support-, content management-, database systems, we must not take the offered technologies for granted. We should rather start infusing technology into the classroom, by clearly defining why a particular technology and not a concurrent one and how it will be used and, what learning goals it must serve as opposed to other concurrent technologies that students might consider better aligned with trends.

Conclusions

It can be said that novelty and cross-fertilization have become mandatory measures for sustainability in the IS discipline. In the positive light of Topi et al. (2010) we should further stimulate our IS community to find new ways to re-invent contemporary IS curricula driven by the local experiences that have been established for decades. We strongly believe that this study can become a start for re-inventing not only the BISD 2010 programme, but also to facilitate the overall IS curriculum development worldwide. Our study can further facilitate the struggle to identify the practical dilemmas that IS researchers often find themselves in through the key competencies that become crucial for the rapid changing professionals and academic IS field.

Based on that, we consider our approach to be able to consolidate among IS researchers not only in terms of curriculum development, but also through finding the right approaches to unify programme names, competences, goals and attractiveness. Such an approach could shape and enhance our IS curricula in a relevant, contemporary and innovative way, which in turn can imply managing well known contingencies (i) dangers of legacy; (ii) resource competence; (iii) technological availability; and (iv) trend sensitivity) in an organized way e.g., technological developments of our digital age. Our findings inform and indicate how an IS curriculum is designed and re-designed. This in turn can affect the way we cross-fertilize with other disciplines forming a consolidated IS education that can offer the right competence to our future graduates. Such an effort at shaping the future generation of reflective practitioners, who are also part (and creators) of the current informational revolution, will likely trigger more attention across the industry with a consolidated IS education agenda.

We recommend that the IS community should be better prepared to propose and foster adaptable and frequent changes of IS curricula that can easily re-invent themselves with an open and reliable platform accessible to all. We believe the identified contingencies will pave the way to such adaptations when designing, re-designing or analysing the IS curricula in general.

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