

Curriculum Structure of the Undergraduate Programs of Information Systems in Indonesia in the Year of 2013

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Keywords:

Information Systems,
Curriculum Development,
Higher Studies, Pedagogy

ABSTRACT

Recent developments in the field of information technology have led to the increase of the number of undergraduate program of information systems in Indonesia (UPIS). In spite of UPIS's fast growing, there is no common understanding in terms of curriculum among UPISs. Hence, each UPIS can independently develop its curriculum based on its faculties' self-interest. This paper seeks to understand the level of concordance between UPISs curriculum and one of the acknowledged Information Systems (IS) curriculum guidelines: ACM/AIS IS Undergraduate Curricula 2010. With this aim, the study collects courses from the UPISs' curriculum and maps them with seven core courses of IS described in the ACM/AIS IS Undergraduate Curricula 2010. In the end, the study finds that despite programming revocation as the core courses in IS 2010, many UPIS still assume system development is the most important aspect for IS graduate. In the other hand, numerous UPISs do not include IS strategy course in their curriculum even though IS strategy course is a core course in IS 2010.

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1. INTRODUCTION

According to Indonesian Ministry of Education and Culture (Kemdikbud), the number of UPISs has grown rapidly from 38 in the year of 1999 to 280 in the year of 2013 and has been the second largest computing-disciplined undergraduate program after informatics engineering. Kemdikbud recognizes four computing disciplines in Indonesia: Informatics Engineering, Computer Science, Information Systems, Computer Systems, and Computer Engineering. According to APTIKOM, Informatics Engineering is considered equivalent with Information Technology while Computer Systems is strictly identical to Computer Engineering. APTIKOM is an acknowledged association for computing discipline and is holding prominent roles in developing computing discipline in Indonesia. Kemdikbud regards APTIKOM as an official representative of computing discipline in Indonesia.

Despite UPISs rocketed increase, to date there is a little agreement among UPISs on what is information systems and how is articulating IS body of knowledge into curriculum. APTIKOM has not characterized in detail the cores of each computing discipline in order to distinct one discipline to others. In the other hand, APTIKOM recommends ACM Curricula 2005 (ACM 2005) for universities in developing computing curriculum. The main issue comes up with ACM 2005 is its wide interpretation of IS as the study of computing for business and is potentially confusing UPISs to best arrange their IS curriculum. ACM 2005 does not clearly specify the IS core courses, consequently it opens broad discussion about the coverage level of business and computing content in the curriculum. This wide-ranging understanding likely leads to extensive curriculum implementation among UPISs, hence introduces different learning outcomes. Here, learning outcomes is a set of knowledge and skills that a graduate need to have after finishing his/her study. Learning outcomes is necessary for companies to distinguish IS graduates to other computing or business-related graduates. Good and more standardized learning outcomes can help companies to best allocate vacant positions to right candidates based on their educational background. Standardized learning outcomes also can

help universities to reduce their graduate waiting time to find a job and to evaluate their learning processes. Achieving good and more standardized learning outcomes is possible by adhering standardized curriculum guidelines.

The research question is what is the existing condition of UPIs, especially the relevance between their existing curriculum with indispensable aspects of IS Discipline that every UPI has to meet. By understanding it, UPIs are able to develop a more competitive curriculum to meet global market. For that reason, the aim of this study is to reveal the structure of the curriculum UPIs and to understand the level of compliance among UPIs curriculum and one of the acknowledge curriculum guidelines in the IS discipline: ACM/AIS IS Undergraduate Curricula 2010 (IS 2010). IS 2010 is the lattermost collaboration from two notable organizations (ACM and AIS) to develop a guidelines for IS curriculum for undergraduate level. Here, IS 2010 is not the only guidelines, previous similar efforts have been initiated before such as: IS Curricula 1995, AITP IS 1997, and IS Curricula 2002 [[HYPERLINK \l "IS202" 1](#)]. However, due to the nature of global computing field which is continuously changing, this study selects IS 2010 as the basis of comparison.

The study measures the level of compliance of non-elective courses with the seven IS core courses in IS 2010 because every student is obliged to pass non-elective courses in order to graduate by using summary statistics which is part of descriptive statistics [2]. Summary statistics are used to summarize a set of observations, in order to communicate the largest amount as simply as possible. Arithmetic mean is one of the methods in the summary statistics that utilized in this study.

2. IS CURRICULUM AND ADVANCEMENT

The development of IS curriculum has been started since early 1970s by various academic society. The largest societies have been ACM (Associated of Computing Machinery), AIS (Association of Information Systems, and AITP (Association of Information Technology Professional). ACM has imitated the first IS curriculum by introducing Curriculum Recommendation for Information Systems [3]. Afterward several efforts for IS Curriculum Guidelines has been established such as ACM 1983[4], DPMA 1990 [5], IS 97 [6], IS 2002 [1] and IS 2010 [7]. IS 97 and IS 2002 is a collaboration guidelines set up three organization: ACM, AITP, and AIS. IS '97 is the first IS guidelines to commence core courses. IS 2002 is considered as minor changes for IS'97 by introducing Electronic Business Strategy, Architecture, and Design. The latest guideline is IS 2010. Unlike its two predecessors, IS 2010 attempt to accommodate IS Department within non-business school and more content that is adaptable to local. Table 2 denotes the comparison between IS'97, IS 2002, and IS 2010.

3. IS 2010

IS 2010 specifies seven outcomes that an IS graduates must have (in which called: High-level IS capabilities). The seven high level capabilities are: 1) Improving organizational processes, 2) exploiting opportunities created by technology innovations, 3) understanding and addressing information requirements, 4) designing and managing enterprise architecture, 5) identifying and evaluating solution and sourcing alternatives, 6) securing data and infrastructure, and 7) understanding, managing, and controlling IT risks. In order to determine the detail curriculum courses, it is necessary to transform the high-level capabilities into three groups of knowledge and skills: IS specific knowledge and skills (IS Specific), Foundational knowledge and skills (IS Foundation), and Domain Fundamentals. IS specific is particular knowledge and skills to IS and is the IS core courses discipline. IS Foundation is set of basic communication and analytical knowledge and skills that enable IS professional to compete in the real world. Domain Fundamentals is any knowledge and skills that enable IS professional to cope up with domain-specific implementation. Here, domain-specific implementation can be organizational type (e.g. government, nonprofit), industry (e.g. Banking, Manufacturing), or business function (e.g. human resource, financial accounting, material management, sales and distribution). IS 2010 outlines the IS core courses and let the UPIs to develop their more localized curriculum. This study uses the IS Specifics to measure the alignment between UPIs with the IS 2010. The IS Specific described in IS 2010 are Foundation of Information Systems, Data and Information Management, Enterprise Architecture, IS Project Management, IT Infrastructure, System Analysis and Design, and IS Strategy, Management, and Acquisition. Moreover, IS 2010 revokes traditional IS courses such as application development and personal development tools (e.g. Microsoft Offices), thus is more proximate to business discipline rather to computing discipline

4. RESEARCH METHOD

As mentioned earlier, the study only investigates the non-elective courses and excludes the elective ones. The reason of only investigating the non-elective course is that every IS student must qualify this non-elective courses in order to graduate. The non-elective courses are basic learning capabilities that every IS student

must have after finishing his/her study while elective courses are more optional learning course. Therefore, all IS specific courses should be included in the non-elective courses. However, some UPISs fully include IS Specific courses in the elective courses instead of attached them in the non-elective courses. In this regards, this study do not consider the UPIS has included the IS Specific in its curriculum because of the non-obligatory nature of the electives courses.

Table 1. Comparison between IS'97, IS 2002, and IS 2010 [[HYPERLINK \l "Top10" 7 \]1\]](#)

IS 1997	IS 2002	IS 2010
IS.97.P0 Knowledge Work Software Tool	IS. 2002.P0 Personal Productivity with IS Technology	<i>Abolished</i>
IS '97 Personal Productivity with IS Technology		
IS '97.1 Fundamentals of Information Systems	IS. 2002.1 Fundamentals of Information Systems	IS 2010.1 Foundation of Information Systems
<i>Not Existed</i>	IS 2002.2 Electronic Business, Strategy, Architecture and Design	IS 2010. 7 IT Strategy, Management and Acquisition
IS. 97.3 Information Systems Theory and Practice	IS. 2002.3 Information Systems Theory and Practice	<i>Abolished</i>
IS '97 Information Technology Hardware and System Software	IS 2002.4 Information Technology Hardware and System Software	<i>Abolished</i>
IS '97.Programming, Data, File and Object Structures	IS 2002.5 Programming, Data, File, and Object Structures	<i>Abolished</i>
IS '97 Network and Telecommunication	IS 2002.6 Network and Telecommunication	IS 2010.4 IT Infrastructure
		IS 2010.3 Enterprise Architecture
IS '97.7 Analysis and Logical Design	IS 2002.7 Analysis and Logical Design	IS 2010.6 System Analysis and Design
IS '97.8 Physical Design and Implementation with DBMS	IS 2002.8 Physical Design and Implementation with DBMS	IS 2010.2 Data Management
IS 97.9 Physical Design and Implementation with a programming environment	IS 2002.9 Physical Design and Implementation in Emerging Environment	<i>Abolished</i>
IS 97 Project Management and Practice	IS'97 Project Management and Practice	IS 2010.5 IS Project Management

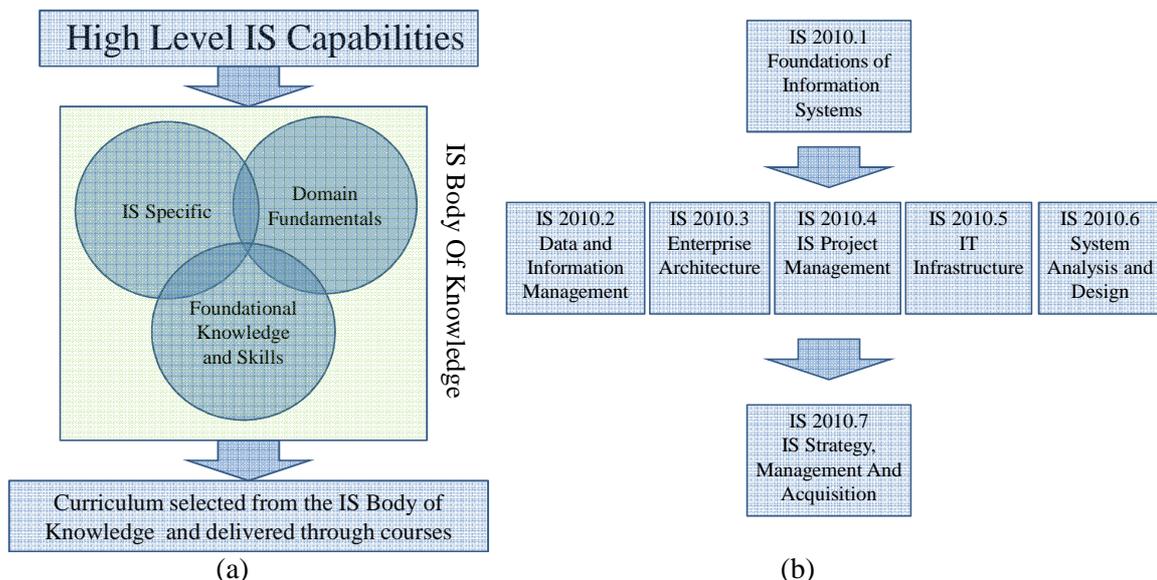


Figure 1. (a) Overall structure of IS 2010 (b) IS 2010 Core Courses

This study categorizes the non-elective courses into two groups: the IS core courses and IS Non-core courses (see Table 2 and Table 3). IS core courses are the seven IS core courses and are IS Specific courses while IS

Non-core courses are any courses beyond IS core courses. We also categorize curriculum into two other groups: Role in the curriculum and Focus of discussion.

Role in the curriculum is to explain the position of the courses in terms of IS Body of Knowledge while Focus of Discussion is to explain the objective of the course. Different with the IS core courses, the IS non-courses covers university's mandatory courses, IS Foundation, and domain fundamentals. University's mandatory courses (UMC) are any courses that should be held due to meeting university's learning outcomes. The UMC may different from one university to another university. For instance, University of Jember oversees agricultural industry as important aspect thus inserts modern agricultural industry course in its IS curriculum. Another example is religion-based university such as Ahmad Dahlan University, Duta Wacana University, Maranatha Christian University, and Pelita Harapan University. The universities provide approximately 4-8 credits for religion-based courses.

Table 2. IS core courses and their keywords [[HYPERLINK \l "Top10" 7](#)]

No	Name	Keywords	Role in the Curriculum	Focus of discussion
1	Foundation of Information Systems	Introduction to IS, Computer and Society	IS Specific	Discipline Introduction
2	Data and Information Management	Conceptual Data Modeling, Database Management Systems, Normalization, Database in the Organizational Context, Data Security, Data Warehousing	IS Specific	System Development
3	Enterprise Architecture	IS/IT Investment, Risk Management, Information Architecture Design, Business Continuity, IS/IT Audit, Enterprise Application Integration, Service Oriented Architecture, Distributed Computing, IT Control and Service Management Frameworks (e.g. ITIL)	IS Specific	System Maintenance
4	IS Project Management	Project Management Life Cycle, Project Schedules, Project Resources, Project Quality, Project Risks. Project Scope, Project Procurement, Project Control and Closure	IS Specific	System Development
5	IT Infrastructure	Computer and Networks, Client-Server, Service Virtualization, Communication Protocol, IP Networks, large-scale organizational IT infrastructure, Cloud Computing, Network Security, Digital Forensic	IS Specific	System Maintenance
6	System Analysis and Design	Business Process Modeling, Business Process Analysis, Data Collection Methods, Requirement Engineering, Analysis and Design of IS, Software Development Life Cycle, Change Management	IS Specific	System Development
7	IS Strategy, Management, and Acquisition	Strategic Information Systems, Information Economics, IS to enhance Organizational performance, IS Strategic Alignment, IS Planning, IS/IT Governance	IS Specific	System Maintenance

5. RESULTS AND ANALYSIS

The sample space of the study is 45 UPIs and is selected randomly from 380 UPIs. We categorize the UPIs into two folds: UPIs from public university and UPIs from private university. The following table illustrates the curriculum organization of UPIs in 2013 grouped by three main subjects: IS Specific, Business-related and System Development Subject. In term of system development, application development constitutes 17.45% of subject configuration which is a slightly less than a half. It is worth noting that private university put more portion than public university, which is roughly a quarter of the proportion of private university.

Significant differences which is roughly one in four. Foundation IS is the highest portion of IS Specific. System Analysis and Design is the second highest portion for IS Specific in term of private university, but the third highest for public university. Data Management is the second highest portion of IS Specific in term of public university, but the third highest for private university. IS Strategy is the smallest portion for IS specific for both universities and the smallest differences.

Table 3. Non-IS Specific courses and their keywords

No	IS Non-core courses	Keywords	Role in the Curriculum	Focus of discussion
1	Application Development	Programming, Data Structure, Internet and Web Development	IS Foundation	System Development
2	Business	Organizational Theory, Introduction to Management, Business Foundation, Entrepreneurships, Technopreneurships, Basic Accounting, Managerial Accounting, Economics, Business Administration, Human Resource Management, Organizational Behavior	Domain Fundamentals	Business
3	Mathematics	Basic Math, Discrete Mathematics, Statistics, Logics, Linear Algebra, Management Science, Operation Research	IS Foundation	Mathematics
4	Computing	Operating Systems, Computer Organization, Human Computer Interaction	IS Foundation	Computing
5	Enterprise Systems	Customer Relationship Management, Supply Chain Management, Enterprise Resource Planning	Domain Fundamentals	Business
6	Other	Final Project, Practical Works, English, Religion, Basic Cultural Knowledge, Bahasa Indonesia, Interpersonal Communication, Scientific Research, Professional Ethics	UMC	Other

Table 4. Curriculum Structure of Undergraduate Program of Information Systems in Indonesia (2013)

#	Topic	Public Univ. (Rank)	Private Univ. (Rank)	Differences between public and private	Focus of discussion	IS Specific?
1	Application Development	13.86% (2)	18.31% (2)	4.45%	System Development	NO
2	Business	7.74% (7)	10.67% (3)	2.93%	Business	NO
3	Foundation of IS	7.87% (5)	9.13% (4)	1.26%	Discipline Introd.	YES
4	Mathematics	9.83% (4)	6.92% (6)		Mathematics	NO
5	Computing	11.52% (3)	6.40% (7)		Computing	NO
6	System Analysis and Design	7.59% (8)	7.15% (5)	0.44	System Development	YES
7	Data and Information Mgmt	7.80% (6)	6.34% (8)	1.46	System Development	YES
8	IT Infrastructure	4.68% (9)	5.19% (9)	0.51	System Maintenance	YES
9	IS Project Management	2.47% (11)	2.06% (10)	0.41	System Development	YES
10	Enterprise Systems	2.58% (10)	1.13% (11)		Business	NO
11	Enterprise Architecture	1.37% (12)	0.69% (12)	0.68	System Maintenance	YES
12	IS Strategy, Mgmt. & Acquisition.	0.48% (13)	0.50% (13)	0.02	System Maintenance	YES
13	Other	22.21% (1)	25.50% (1)		UMC	NO
	Total	100%	100%			
	Total IS Specific	32.26%	31.06%			
	Non IS Specific	67.74%	68.94%			
	System Development	31.72%	33.87%			
	Business	10.32%	11.81%			
	Discipline Introduction	7.87%	9.13%			
	System Maintenance	6.53%	6.38%			
	Mathematics	9.83%	6.92%			
	Computing	11.52%	6.40%			
	UMC	22.21%	25.50%			

The overwhelming majority of system development subjects belong to IS specific with as many as 16.2%, which is a little over than a half of the overall composition of system development. This constitutes the highest portion of IS Curriculum in Indonesia. Overall, the vast majority of the curriculum belongs to IS Specific and no significant preference between public and private university.

6. CONCLUSION

This study presents curriculum structure of undergraduate program of information systems in Indonesia. This study groups courses into 13 categories in which 7 categories are adapted from IS 2010. This study has found that first, the vast majority of UPISS perceive system development as the most important aspect in the curriculum, even though system development is not the IS core according to IS 2010. Second, the overwhelming majority of IS department omit strategic IT and Enterprise Architecture from its curriculum, even though they are part of IS core in IS 2010. Here, the focus of IS department is clearly different than IS 2010. IS department focuses more to develop new systems rather than to maintain the existing ones, while IS 2010 focuses on IT management and assumes that the systems have already existed and need maintenance strategy. Further research might compare UPISS curriculum with other Undergraduate Program in Information Systems in the South East Asia and Asia Pacific region and might pertain the localization strategy of the international IS curriculum.

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