Content Selection in Undergraduate LIS Education

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The study presented in this article is aimed to improve the academic education in the field of library and information science by structuring the curricular and pedagogical reasoning that shapes the contents of undergraduate academic programs. It was composed of two methodological phases. The first phase was a systematic Critical Delphi study with 21 leading information science scholars from Brazil. The second phase was an unsystematic formative evaluation of the content categories. The evaluation was based on a Grounded Theory study of more than 100 programs worldwide. The study resulted in a universal model that sets the guiding principles for developing bachelor's degree programs applicable worldwide. The model, which is actually composed of two complementary models, is a systematic four step developing process (model$_{1.1}$) and a structured plan of 288 content categories (model$_{1.2}$). It is grounded on theoretical foundations and empirical studies.

Keywords: LIS Education; Undergraduate Education; Bachelor Degrees; Information Professions; Grounded Theory; Content Analysis; Delphi Studies

Introduction

The field of library and information science (LIS) is constantly changing due to the never-ending developments of new information technologies, which change the nature of the information professions. This condition is reflected in the literature that repeatedly discusses the nature and objectives of LIS education (e.g. Buckland, 2012; Cox & Larsen, 2008; Elmborg, 2008; Given & McTavish, 2010; Hjorland, 2000; Singh & Mehra, 2013). Our review of LIS studies programs worldwide has not found a consensual model that would be acceptable by all the institutions that we surveyed that offer a bachelor's degree. The problem is even more serious when we zoom in at the country level. In some countries the divergence among the programs is striking[1].

This study was initiated in October 2011 at the National Meetings of Research in Information Science (ENANCIB) annual conference, which is the main annual LIS meeting in Brazil attended by hundreds of researchers and practitioners who teach in 38 academic institutions. While meeting colleagues they asked to replicate the study *Knowledge Map of Information Science* (Zins 2007a, 2007b, 2007c, 2007d),

[1]Compare, for example, the Undergraduate Minor in Information Studies and Technology program at the School of Information Sciences, University of Tennessee, Knoxville (http://www.sis.utk.edu/minor, accessed on April 23, 2014) with the undergraduate program at the School of Information: Science, Technology, and Arts, the University of Arizona (http://sista.arizona.edu, accessed on March 16, 2014). While the IS&T minor at UT "will teach you about the impact of information and information technology on society, individuals and organizations" the school's mission at UA "is to provide expertise and promote research in computational methods and thinking across disciplines . . .". The diverse missions are embodied in the two curricula.April 23, 2014) with the undergraduate program at the School of Information: Science, Technology, and Arts, the University of Arizona (http://sista.arizona.edu, accessed on March 16, 2014). While the IS&T minor at UT "will teach you about the impact of information and information technology on society, individuals and organizations" the school's mission at UA "is to provide expertise and promote research in computational methods and thinking across disciplines . . .". The diverse missions are embodied in the two curricula.

J. of Education for Library and Information Science, Vol. 58, No. 3—(Summer) July 2017
ISSN: 0748-5786
doi:10.12783/issn.2328-2967/58/3/1

which clarified the various conceptions of the field and mapped its main subfields; this time—in the context of LIS studies in Brazil. The idea was to formulate the basics of LIS education that are acceptable by all the institutions surveyed that offer a bachelor's degree.

The study was expected to be quick and simple, but it turned out to be both demanding and exhaustive. Initially, the objective was to define the basic knowledge and skills that LIS departments in Brazil should teach as part of the requirements of a bachelor's degree. We assumed that the 38 institutions taught the same basic knowledge and that the diversity among them would be embodied in the additional courses and programs that were designed to meet their specific needs. The research methodology was Critical Delphi. A Critical Delphi study is, usually, composed of three successive rounds. In the first round the researchers present the issues, in the second round they discuss the various positions, and in the third round they summarize the conclusions. However, while analyzing the responses in the first round we discovered that the conditions were far more complicated. The participants had difficulty distinguishing between the current state and the ideal state of LIS education. Their initial positions reflected the triple head structure of the BA studies (i.e. library studies [librarianship], archival studies, and museum studies [museology]), the special interests of their academic environments, as well as the tension between the documentation and the technology competing traditions.

The inevitable gap between the desired state and the existing state of affairs was striking. Once again it reminded us that academic programs are planned for given communities, bound by given conditions, designed for given students, and aimed to be taught by a given cohort of staff. What is basic in central universities is not necessarily basic in peripheral and remote universities, and vice versa. Moreover, we noticed that most of the responses were grounded in the Brazilian context and if we omit the Brazilian perspective, we uncover essential positions relevant for LIS studies worldwide. This insight resulted in revising the initial objectives of the study by adding the universal perspective. Consequently, the study was broadened and ended up in two interrelated and complementary exemplary models, universal and local. The universal model$_1$ sets the guiding principles for developing BA programs applicable to LIS education worldwide. It is presented in this article. The second model$_2$ demonstrates the curricular and pedagogical reasoning by setting the guiding principles for developing academic programs in Brazil (see Zins & Santos, 2015). The term "model" refers here respectively to the systematic process of program development (model$_{1.1}$) and to the structured scheme, or plan, of contents (model$_{1.2}$). The two meanings stand for two complementary models ($_{1.1}$ and $_{1.2}$) that are combined into an integrated model$_1$,[2] meaning, the systematic process of curriculum development requires grounding the content selection on the structured plan.

Methodology

The scientific methodology is Critical Delphi. Critical Delphi is a scientific method that facilitates critical and reflective series of in-depth structured and moderated peer discussions among experts (the panel) on the various aspects of the discussed issues while confronting their own biases and prejudgments. The panel was composed of 21 participants. Initially, 58 scholars were invited to participate in the study, 27 agreed to receive the first questionnaire, but only 21 responded, and they formed the panel. The 58 research-

[2]The subscripts are aimed to clarify the different meanings of "model" in the article. "Model$_1$" stands for the universal model and for an integrated model, which is composed of model$_{1.1}$ and model$_{1.2}$. "Model$_{1.1}$" stands for the systematic development process. "Model$_{1.2}$" stands for the structured plan of contents. "Model$_2$" stands for the local (Brazilian) model.

ers were selected from a database using the Lattes Platform and the Brazilian LIS associations. The Lattes Platform is an information system maintained by the Brazilian Government to manage information on science, technology, and innovation related to individual researchers and institutions working in Brazil. The panel members are officially considered as the most important researchers in Information Science in the country. They represent the main aspects of LIS studies in Brazil and are affiliated with 11 central and peripheral academic institutions (see Appendix A).

The study was composed of three successive rounds of structured questionnaires. The discussions among the panel members were indirect and anonymous, and were moderated by the researchers. The first questionnaire was submitted to the panel in November 2011. It contained 12 detailed and open-ended questions. The second questionnaire was submitted in March 2012 and contained 23 questions. The third questionnaire was submitted in August 2012 and contained 17 questions (see selected excerpts from the three questionnaires in Appendix B).

The return rates were high: 21 scholars (100%) participated in first round, 18 (85.7%) participated in the second round, 18 (85.7%) participated in the third round and 18 (85.7%) participated in all the three rounds (see Table 1).

While writing the chapter we decided to demonstrate the model$_{1.2}$ by exemplary fields and courses taken from academic curricula worldwide. We reviewed more than 100 programs in 70 universities from which we selected to refer in the footnotes. In the footnotes we refer to 35 universities from 12 countries (see Appendix C); all of them offer a bachelor's degree in information science based studies. Reviewing the academic programs was not part of the initial research agenda, but eventually it turned to be an invaluable methodological building block that played an important role in shaping the model$_{1.2}$. In a retrospective, the study was composed of two methodological phases. The first was a systematic Critical Delphi study with 21 leading information science scholars from Brazil. The second was an unsystematic formative evaluation of the model$_{1.2}$, which was based on a Grounded Theory study that studied more than 100 academic programs worldwide.

The Model$_1$

Building Blocks

An academic program, or a curriculum, is a structured series of courses and activities (workshops and professional training) designed to provide specific knowledge and develop certain skills. The scope of the knowledge covered by the curriculum is grounded in the conception of the field that sets the boundaries of the knowledge domain. A curriculum is aimed at achiev-

Table 1. Panel Selection & Statistical Details of the Study.

First Invitation	**Accept Invitation**	**Respond Round 1**	**Respond Round 1**
58 (100%)	27 (46.5%)	21 (36.2%)	21/27 (77.7%)
	Return Rates		
Round 1	**Round 2**	**Round 3**	**Round 1 + 2 + 3**
21 (100%)	18 (85.7%)	18 (85.7%)	18 (85.7%)
Questionnaire	**Round 1**	**Round 2**	**Round 3**
Submission Date	November 7, 2011	March 4, 2012	August 11, 2012
Number of Questions	12	23	17

ing specific goals; it is planned for given academic settings (e.g., central universities, community colleges, and online courses); bound by the given social conditions (e.g., technological sustainability, information accessibility, legal regulations, and ethical norms) and academic milieus (e.g., theoretical based milieu vs. practical based milieu); designed for given students; intended to be taught by given staff and utilized through a given set of effective teaching methods.

In a nutshell, an academic curriculum is developed and taught in given social and academic conditions. It is aimed at achieving academic goals that are embodied in the teaching contents that are planned to be taught within a specific time framework. These elements are culminated in three building blocks: goals, contents, and structure. The goals shape the contents, and the contents should fit into the structure.

This sets the basis for a systematic developing process which is composed of four successive phases. First, the faculty members are required to define the academic goals. Next, they need to specify the derived contents. Then, they have to organize the courses and activities in a reasonable order in a structured plan. Finally, they should evaluate the quality of the program by assessing if the planned courses and activities meet the academic goals, and if the structured plan is really reasonable. This four phase process is applicable, *mutatis mutandis*, for developing each of the academic courses and activities as well.

Academic Goals

The academic goals embody the *raison d'être* and the guiding principles of the curriculum. They are affected by the social and academic conditions, grounded in the conception of the field, and embodied in the contents and the teaching methods. The social and academic conditions vary in the various environments and lead to different programs. In this study we focus on the common knowledge across the diversified environments. Therefore, we omit the environmental conditions and stay with the conception of information science and the planned contents and teaching methods.

The conception of information science sets the boundaries of the planned LIS curriculum. Zins (2007a) defined six generic conceptions (models) of information science. These are:

1. *The Hi-Tech Model*. Information science is the study of the mediating aspects of data, information, knowledge, and message (D-I-K-M) phenomena as they are implemented in the hi-tech domain.
2. *The Technology Model*. Information science is the study of the mediating aspects of D-I-K-M phenomena as they are implemented in all types of technologies (i.e. written, published, and digital).
3. *The Culture Model*. Information science is the study of the mediating aspects of D-I-K-M phenomena as they are implemented in the cultural/social domain.
4. *The Human World Model*. Information science is the study of all the aspects of D-I-K-M phenomena as they are implemented in the human realm, biological and cultural.
5. *The Living World Model*. Information science is the study of all the aspects of D-I-K-M phenomena as they are implemented in the living world, human and non-human.
6. *The Living & Physical Worlds Model*. Information science is the study of all the aspects of D-I-K-M phenomena as they are implemented in all types of biological organisms, human and nonhuman, and all types of physical objects (Zins, 2007a, p. 340).

The six models imply six different bodies of knowledge. Consequently, they establish six different fields of knowledge; all carry the same name, *information science*, and six different LIS BA academic programs. The third model represents the mainstream of the IS academic community[3] as well as the position of the panel in this study. The model presented here follows the culture model of information science.

Academic goals are formulated as achievements (i.e. what the program, or the student, is expected to achieve) or as activities (i.e., what the program, or the student, is expected to do).[4] The achievement goals are embodied in the planned contents. The activity goals are embodied in the teaching methods. Evidently, the teaching methods are necessary for providing the contents, but our main interest is the common knowledge across the various programs. Therefore, we omit the teaching methods and focus on the planned contents; meaning, we focus on achievement goals.

Achievement goals are formulated for programs and students. Programs' goals set the basic standards for programs while the students' goals set the basic requirements from each and every graduated student. Programs' goals and students' goals are interrelated; in fact, they are unseparated complements.

A BA LIS program should provide students the basic knowledge and skills necessary for being (1) literate (i.e. ability to read and write and study), (2) educated and knowledgeable (i.e., have basic knowledge and skills as academics), be familiar with (3) the basic theoretical and empirical knowledge of information science and (4) the basic theoretical and empirical knowledge of their fields of expertise (specialization), (5) be able to perform basic practices and tasks as information professionals (i.e., have practical knowledge common to all information professionals), and (6) as professionals in their fields of expertise (i.e., have practical knowledge common to all professionals in their specific fields of expertise). The six elements must be implemented in courses.

The goals for students do not affect the course list provided by the program, but they are necessary for setting standards and evaluating criteria of the graduated students. Note that they should be compatible with the same 6 elements: a graduate is expected to be (1) literate, (2) educated and knowledgeable, be familiar with (3) the theoretical and empirical knowledge in the field of information science and (4) in his/her fields of expertise, (5) be able to perform basic practices and tasks as an information professional, and (6) as a professional in his/her fields of expertise.

The six goals are culminated in four foci—general education (goals 1 and 2), general information science education (goal 3), specialization (goal 4), and professional training (goals 5 and 6)—that turn into four groups of contents.

Contents

The contents are the core of an academic program. Information science programs include four content groups: general non-information science contents that are common across fields and categorized as general education (GE), general information science knowledge (GIS) that are core contents common to all LIS programs, knowledge in the specialized fields of expertise (SP), and practical knowledge (PR) relevant to information professionals. The four content groups are grouped in two main parts, general education (GE) and information science education (GIS, SP, and PR), which set the basic structure of all BA academic programs worldwide

[3]See the stated approach of the iSchools organization; a consortium of 65 universities worldwide (http://ischools.org/about/, accessed on June 15, 2014): "The field is concerned broadly with questions of design and preservation across information spaces, from digital and virtual spaces such as online communities, social networking, the World Wide Web, and databases to physical spaces such as libraries, museums, collections, and other repositories."

[4]See the BA program at the Faculty of Information, University of Toronto. The goals are stated as achievements ("(students will) learn how to . . .") and as activities ("(students will) be exposed to . . ."). (http://www.ischool.utoronto.ca/idm, accessed on June 15, 2014).

although they are expressed in various forms.[5]

The general education part consists of six categories (categories 1–6). The information science education part includes the GIS, SP, and PR contents and consists of 30 categories in 10 sections (categories 7–36). Each of the 36 categories has two levels, basic (B) and advanced (A), which indicate its importance in the eyes of the faculty; a total of 72 categories (see Table 2).

Defining the importance of a subject matter, in terms of the scope and intensity of the coverage, is illusive and contextually based. To simplify the definitions we base them in a quantitative criterion—the duration of the suggested courses. The basic level is equivalent to an academic course (i.e., 30 academic hours; an academic hour is 45 minutes). The advanced level is equivalent to two academic courses (i.e., 60 academic hours) or more.

The *general education* part covers fields that are not part of information science and we expect that open minded educated knowledgeable graduates will be familiar with. It is composed of six categories. Category 1 encompasses literacy studies.[6] It provides basic knowledge and skills that facilitate learning and social communication; among them language skills, communication skills, learning skills, computer literacy, Internet literacy, and the like. Category 2 comprises the humanities,[7] (e.g., art, literature and mathematics[8]). Category 3 encompasses social sciences,[9] (e.g., anthropology, economics, and history[10]). Category 4 encompasses natural sciences,[11] (e.g., chemistry, physics, and physical geography). Category 5 encompasses life sciences,[12] (e.g., biology and psychology). Category 6 encompasses technology studies, mainly computer science.[13]

The *information science education* part consists of 10 main sections following Zins' (2007c) knowledge map of information science; including foundations, resources, knowledge workers, contents, applications, operations & processes, technologies, environments, organizations, and users. The foundation section encompasses the meta-knowledge of information science. The other sections are grounded in the definition of information science as the study of the mediating conditions of human knowledge. Connecting resources and users involves nine elements: the mediated resource, the knowledge worker who conducts the mediation activity, the mediated content, the application (or purpose), the knowledge/information based operation and process, the utilized technology, the social environment, the organizational setting, and the prospective user.

[5]See the undergraduate program at the University of Pittsburgh. It is composed of four parts: (1) basic skills, (2) general education, (3) related areas, and (4) information science. Still, it keeps the general education (1–3)—information science education (4) structure (http://www.ischool.pitt.edu/bsis/about/degree-requirements-2006.php, accessed on June 15, 2014).

[6]See the University of Pittsburgh, *op. cit.*, the LIS BA program at the University of Southern Mississippi (http://www.usm.edu/undergraduate/library-and-information-science-licensure-ba/degree-plan, accessed on May 25, 2014), courses CIVC 101 (Introduction to Civic Engagement) and COOP 101 (Career Management and Professional Development), the B.S. in Informatics at Drexel University (http://catalog.drexel.edu/undergraduate/collegeofinformationscienceandtechnology/informatics/#degreerequirementstext, accessed on May 1, 2014), and course IS 200 (Information Literacy and Critical Thinking), the School of Library and Information Science, University of Kentucky (http://ci.uky.edu/lis/undergraduate/courses, accessed on May 25, 2014)

[7]See the University of North Texas's Core Curriculum requirements (http://catalog.unt.edu/content.php? catoid=9&navoid=533, accessed on May 1, 2014), Drexel University, *op. cit.*, and the University of Pittsburg, *op. cit.*

[8]Mathematics is a product of the human intellect therefore it is part of humanities even though in many universities worldwide it is traditionally classified as a natural science. Courses on mathematics and statistics are offered by many programs, see, for example, the core requirements of the BA program at Cornell University (http://infosci.cornell.edu/academics/degrees/ba-college-arts-sciences/degree-requirements/core-requirements, accessed on May 1, 2014).

[9]See Drexel University, *op. cit.*, University of North Texas, *op. cit.*, University of Pittsburgh, *op. cit.*, and the University of Southern Mississippi, *op. cit.*

[10]History focuses on the past of human societies and social life; therefore it is part of social sciences rather than humanities, as it is traditionally classified.

[11]See Drexel University, *op. cit.*, University of North Texas, *op. cit.*, and University of Pittsburgh, *op. cit.*

[12]See courses BIOL10004 (Biology of Cells and Organisms) and BIOL10005 (Genetics & the Evolution of Life), and GENE 30005 (Human and Medical Genetics), Melbourne School of Information, University of Melbourne (http://www.msi.unimelb.edu.au/study/undergraduate/informatics, accessed on May 1, 2014). Note that the program is offered as part of the Bachelor of Science degree. For other examples see the programs of the University of North Texas, *op. cit.*

[13]See the undergraduate programs, the School of Information, Florida State University (FSU) (http://ischool.cci.fsu.edu/academics/undergrad, accessed on May 1, 2014).

Table 2. Contents.

Content	General Education (GE)	Literacy Studies		1	B[1] / A[2]	Exemplary contents: language skills, communication skills, learning skills, computer literacy, and Internet literacy.
		Humanities		2	B / A	Exemplary contents: art, literature, and mathematics[3].
		Social Sciences		3	B / A	Exemplary contents: anthropology[3], economics[3], and history[3].
		Natural Sciences		4	B / A	Exemplary contents: chemistry[3], physics[3], and geography[3].
		Life Sciences		5	B / A	Exemplary contents: biology[3], and psychology[3].
		Technology Studies		6	B / A	Exemplary contents: computer science.
	Information Science (IS)	Foundations	GIS	7	B / A	Exemplary contents: philosophy of information, history of information science, research methodologies, and epistemology[3], ethics[3], and mathematics[3].
			SP	8	B / A	Exemplary contents: archival studies theory (AS), library studies theory (AS), and museum studies theory (LS).
			PR	9	B / A	Exemplary contents: research methodology, and research evaluation.
		Resources	GIS	10	B / A	Exemplary contents: information quality, and information services.
			SP	11	B / A	Exemplary contents: archival resources (AS), and library resources (LS).
			PR	12	B / A	Exemplary contents: information services.
		Knowledge Workers	GIS	13		
			SP	14		
			PR	15	B / A	Exemplary contents: professional development, and ethical education.
		Contents	GIS	16	B / A	Exemplary contents: knowledge organization, and knowledge representation.
			SP	17	B / A	Exemplary contents: educational informatics, business informatics, legal informatics, and medical informatics.
			PR	18	B / A	Exemplary contents: collection development, and quality evaluation.
		Applications	GIS	19	B / A	Exemplary contents: information retrieval, and social networking.
			SP	20	B / A	Exemplary contents: electronic publishing (IT), electronic commerce (IT), and gaming (game studies) (IT).
			PR	21	B / A	Exemplary contents: information retrieval, and social networking.

(continued)

Table 2. Contents (continued).

Content	Information Science (IS) - Continued	Operations & Processes	GIS	22	B/A	Exemplary contents: information retrieval, knowledge representation, and knowledge organization.
			SP	23	B/A	Exemplary contents: digital preservation (LS), (AS), (MS).
			PR	24	B/A	Exemplary contents: digital preservation, information retrieval, knowledge representation, and knowledge organization.
		Technologies	GIS	25	B/A	Exemplary contents: information technology.
			SP	26	B/A	Exemplary contents: software engineering (IT), information security (IT), information systems (IT), digital libraries (IT), information architecture (IT), digital curation (IT), and game studies (IT).
			PR	27	B/A	Exemplary contents: Internet literacy, and programming.
		Environments	GIS	28	B/A	Exemplary contents: information culture, information economics, information ethics, and information policy.
			SP	29	B/A	Exemplary contents: community history (AS & LS), and business management (KM).
			PR	30	B/A	Exemplary contents: social competencies.
		Organizations	GIS	31	B/A	Exemplary contents: information economics, and information policy.
			SP	32	B/A	Exemplary contents: management studies, business management, and sociology of organizations.
			PR	33	B/A	Exemplary contents: organizational competencies.
		Users	GIS	34	B/A	Exemplary contents: user studies.
			SP	35	B/A	Exemplary contents: social psychology (KM).
			PR	36	B/A	Exemplary contents: users' competencies.

Note. Basic[1] (30 academic hours)/Advanced[2] (60 academic hours)/Non information science subfields[3].

Each of the sections is further divided into three categories designed to meet the GIS, SP, and PR content groups. The GIS categories (categories 7, 10, 13, 16, 19, 22, 25, 28, 31, 34) include core contents common to all undergraduate programs. The SP categories (categories 8, 11, 14, 17, 20, 23, 26, 29, 32, 35) include contents designed for specific areas of expertise (e.g., librarianship (LS), archival studies (AS), museology (MS), knowledge management (i.e., managing knowledge in organizations) (KM),[14] and information technologies/systems (IT)). The PR categories (categories 9, 12, 15, 18, 21, 24, 27, 30, 33, 36) include contents designed for developing skills and professional proficiency, and providing work experience. Note that theoretical knowledge and practical knowledge are often intermingled and covered in the same courses.

Departments and schools of information science differ by their underlying conceptions of the field. The conceptual divide is between the two competing approaches, the social approach and the technological approach. The social approach is centered in the social conditions and meeting the information needs of prospective users,[15] while the technological approach is centered in developing and using knowledge and communication technologies.[16] The conceptual divide explains the divergence among schools on what should be taught in all programs (GIS contents) and what should be taught only in specialization programs (SP contents). Note that in this chapter we ground the exemplary GIS contents in the social approach. The conceptual divide is often implemented in the academic degrees awarded by academic institution. The Bachelor of Arts (BA) is usually grounded in the social approach, as well as the Bachelor of Social Science (BSocSc),[17] while the Bachelor of Science (BS) is usually grounded in the technological approach. Many universities resolve the conceptual obstacle by awarding more than one degree.[18]

Information science is related to other fields that are necessary for understanding the diversified aspects of the multifaceted information phenomena; among them anthropology, art, communication, computer science, economics, education, engineering, law, linguistics, philosophy (especially, epistemology and ethics), psychology (especially, cognition and social psychology), semiotics, sociology, and statistics. These fields differ in their importance for understanding the various aspects of information science. A few of them are essential for understanding the theoretical basis of information science and they are part of the *foundation* section. Most of them are only relevant for understanding specific aspects of the field and they are part of the relevant sections according to their thematic contexts.

The *foundation* section (categories 7–9) focuses on the philosophical, historical and methodological basis of information science. Category 7[19] encompasses, (e.g. philosophy of information, history of information science, and research methodology[20]). The category also represents core

[14]The term "knowledge management (KM)" is used here as an umbrella name for various programs that focus on management of organizational knowledge (knowledge in organizations). See, for example, the Bachelor of Information Studies (information and knowledge management) Specialization, the School of Information Studies, Charles Sturt University (http://www.csu.edu.au/courses/undergraduate/information _studies/course-structure#.U2dRpvmSxg, accessed on May 20, 2014), and the Bachelor of Science in Information Management and Technology, the School of Information Studies, Syracuse University (http://coursecatalog.syr.edu/pdfs/2013/ischool_undergraduate.pdf, accessed on June 2, 2014).

[15]This is the mainstream of the field and it is shared by many universities worldwide, see, for example, the Berlin School of Library and Information Science, Humboldt University of Berlin (http://www.ibi.hu-berlin.de/teaching/bachelor, accessed on May 26, 2014), and the Department of Information Studies, the University of California, Los Angeles (http://is.gseis.ucla.edu/academics/undergrad/index.htm, accessed on May 4, 2014).

[16]See the Graduate School of Information Science and Technology at the University of Tokyo, which offers an undergraduate program (in Japanese) that embodies the technological approach. The IS school is part of the School of Science. It has six departments: Computer Science, Mathematical Informatics, Information Physics & Computing, Information & Communication Engineering, Mechano Informatics, and Creative Informatics (http://www.i.u-tokyo.ac.jp/index_e.shtml, accessed on May 4, 2014).

[17]The Bachelor of Social Science (BSocSc) is awarded by the School of Information & Library Studies, University College Dublin (http://www.ucd.ie/sils/undergraduateprogrammes, accessed on June 8, 2014).

[18]Cornell University, e.g., offers three degrees: a BA in Information Science through the College of Arts and Sciences, a BS in Information Science offers through the College of Agriculture and Life Sciences, and a BS in Information Science through the College of Engineering in Information Science, Systems, and Technology. (http://infosci.cornell.edu/academics/degrees, accessed on June 8, 2014).

[19]See courses INFO 200 (Intellectual Foundations of Informatics), the Information School, University of Washington (http://www.washington.edu/students/crscat/info.html, accessed on June 1, 2014).

[20]See course CINF 023 (Research Methodology), Faculty of Engineering, University of Porto (http://sigarra.up.pt/flup/pt/cur_geral.cur_planos_estudos_view?pv_plano_id=1575&pv_ano_lectivo=2013&pv_tipo_cur_sigla=L&pv_origem=CUR, accessed on May 5, 2014), and course 04:547:300 (application of research in information technology), School of Communication and Information, Rutgers University (http://comminfo.rutgers.edu/component/cur,547/option,com_courses/sch,04/task,listing, accessed on May 12, 2014).

related disciplines that are essential for establishing the foundations of information science; among them epistemology, ethics, mathematics[21], statistics, and computer science. Category 8 encompasses the theory and history of the specializations, for example, LS theory, AS theory,[22] and MS theory. Category 9 encompasses practical knowledge related to the foundations of information science; especially mastery of research practices.

The *resources* section (categories 10–12) focuses on issues related to knowledge resources. Resource-related issues are mainly centered on quality issues, relevancy issues, as well as theoretical and practical knowledge related to developing, maintaining, and managing information resources.[23] Category 10 encompasses information quality and management of information services and the like. Category 11 encompasses, for example, (types of) archival resources (governmental, public and private) (AS), and types of library resources (LS). Category 12 encompasses, for example workshop on international standards (modules for each standard, e.g. Dublin Core) and familiarity with information resources.

The *knowledge worker* section (categories 13–15) focuses on information science education. These issues are highly relevant for shaping the nature of the information professions. They are also subject to research, but we have not found any reflective courses that focus on information science education per se. However, universities do offer courses that are aimed at developing personality traits and fostering professional and ethical conduct.[24] These professional development and ethical education courses are represented in category 15.

The *contents* section (categories 16–18) addresses content based issues. Content based issues are interrelated to resource based issues (categories 10–12) and they often intermingle. Still, they differ and should be regarded as complementary in nature—two sides of the same coin. Content issues related to various types of structures (e.g., knowledge maps, subject classification schemes, taxonomies, ontologies, and thesauri), library classification systems (e.g., LCC, DDC, UDC, CC, and BC), types of contents (e.g., academic and scientific, business, educational, legal, medical, and social information), and subjects (i.e., archeology, biology, computer science). Category 16 encompasses core fields that are centered in contents. Two of the main fields are knowledge organization[25] and knowledge representation.[26] These two broad fields are essential for understanding the various phenomena of

[21]See course INFO I201 (Mathematical Foundations of Informatics), the School of Informatics and Computing, Indiana University (http://www.soic.indiana.edu/undergraduate/degrees/bs-informatics/ curriculum.shtml, accessed on May 5, 2014).

[22]See course INF 335 (Records, Archives and Society), Charles Sturt University, *op. cit.*

[23]See course CINF 010 (Information Sources and Reference Services), University of Porto, *op. cit.*, course INF 209 (Describing and Analyzing Information Resources), Charles Sturt University, *op. cit.*, course Special Resource Cataloguing, Sungkyunkwan University, Department of Library and Information Science (http://ischool.skku.edu > academics > undergraduate, accessed on May 20, 2014), and course 04:189:152 (The Structure of Information), Rutgers University (http://comminfo.rutgers.edu/component/cur,189/option,com_courses/sch,04/tagname,digital+minor/task,listing, accessed on June 16, 2014).

[21]See course INFO I201 (Mathematical Foundations of Informatics), the School of Informatics and Computing, Indiana University (http://www.soic.indiana.edu/undergraduate/degrees/bs-informatics/ curriculum.shtml, accessed on May 5, 2014).

[22]See course INF 335 (Records, Archives and Society), Charles Sturt University, *op. cit.*

[23]See course CINF 010 (Information Sources and Reference Services), University of Porto, *op. cit.*, course INF 209 (Describing and Analyzing Information Resources), Charles Sturt University, op. cit., course Special Resource Cataloguing, Sungkyunkwan University, Department of Library and Information Science (http://ischool.skku.edu > academics > undergraduate, accessed on May 20, 2014), and course 04:189:152 (The Structure of Information), Rutgers University (http://comminfo.rutgers.edu/component/cur,189/option,com_courses/sch,04/tagname,digital+minor/task,listing, accessed on June 16, 2014).

[24]See course IST 466 (Professional Issues), Syracuse University, *op. cit.*, and course INFO 386 (Professionalism in Informatics), University of Washington, *op. cit.*, that "examines professionalism, communication, teamwork, leadership, and interpersonal networking to strengthen students as they seek to excel professionally, covers developing and presenting business cases and project plans, personal branding, conducting informational interviews, and effective written and oral communication." Another example is course 04:189:151 (Organizational Communication Dynamics Online) at Rutgers University, *op. cit*. The course focuses on strengthening students' communication competencies.

[25]See courses Information Classification 1 and 2, Sungkyunkwan University, *op. cit.*, and course 406 (Advanced Cataloging and Classification), University of Southern Mississippi, *op. cit.*

[26]See course INFO 430 (Knowledge Organization and Representation), University of Washington, *op. cit.*

mediating knowledge. For this very reason they are common to all programs. Category 17 covers specialized-based fields that are centered in specific contents and subjects, such as educational informatics, business informatics, legal informatics, and medical informatics.[27] Category 18[28] encompasses practical knowledge related to collection development and quality evaluation.

The *applications* section (categories 19–21) addresses issues related to the functions and purpose that information resources are designed to meet. It encompasses information searching (or retrieval), shopping, social networking, and promoting human well-being, education, health, and security. The term "application" refers to the functions and purposes of using information resources and acquiring knowledge; not to be confused with the common use of "application" that refers to software designed to perform specific tasks. Category 19[29] encompasses core fields such as information searching and social networking.[30] Category 20 includes applications such as electronic publishing[31] electronic commerce,[32] and gaming[33] that are taught in IT programs. Category 21[34] covers practical knowledge related to these fields.

The *operations and processes* section (categories 22–24) encompasses issues related to the various activities involved in mediating human knowledge; among them documentation, representation, visualization, organization, processing, storage, digitization, dissemination, publication, searching, manipulation, evaluation, and measurement. Since human activities may relate to several intermingled aspects of the information phenomena some of these processes may be represented by other sections of the model$_{1.2}$ as well. Category 22 encompasses core operations and processes that are common to all programs, such as information searching,[35] knowledge representation and knowledge organization. Category 23 represents specialized based activities. Digital preservation,[36] for example, is included in LS, AS, and MS programs that teach the preservation of documents, books, artifacts, and digital materials in the specialized contexts. Category 24[37] encompasses mastery of practices in information based activities.

The *technology* section (categories 25–27) focuses on information technologies. These are technologies that are aimed at facilitating the mediation of knowledge, through documentation, representation, organization, processing, dissemination, publication, storage, manipulation, evaluation, measurement, searching, and retrieving knowledge, among them paper-based and printing-based technologies, digital technologies, as well as communication-based technologies and media, network technologies, and the like. Category 25[38] encompasses the broad field of information technology, which is a fundamental building block of information science and common to all the programs. The scope of the coverage varies by the field of ex-

[27]See course ICT 539 (Medical Informatics), University of Kentucky, *op. cit.*

[28]See course Collection Development, Sungkyunkwan University, *op. cit.*

[29]See course INLS 509: (Information Retrieval), University of North Carolina at Chapel Hill, School of Information and Library Science, (http://sils.unc.edu/courses, accessed on May 20, 2014).

[30]See courses 124 (Network Thinking), School of Information, University of Michigan (https://www.si. umich.edu/programs/CourseCatalog, accessed on June 2, 2014) and course IST 488 (Social Web Technologies) at Syracuse University, op. cit. that represent two approaches to social networking. The course at UM reflects a social approach ("You'll learn how groups behave and function from technical and non-technical perspectives."). The course at SU reflects a technological approach ("This course will educate students in the concepts and mechanisms of social networking in technologies through hands-on system design, development, implementation and management of these systems.").

[31]See course 685 (Electronic Publishing and Web Design), School of Information Studies, University of Wisconsin-Milwaukee (http://www4.uwm.edu/academics/undergraduatecatalog/SC/C_540.html, accessed on June 10, 2014).

[32]See course 04:547:410 (Electronic Commerce), Rutgers University, *op. cit.*

[33]See course 04:547:215 (Social Impacts of Video Gaming), Rutgers University, *op. cit.*

[34]See course INF 337 (Information Retrieval Systems and Practice), Charles Sturt University, *op. cit.*

[35]See course IST 441 (Information Retrieval and Organization), College of Information Sciences and Technology, Pennsylvania State University (http://bulletins.psu.edu/undergrad/courses/I/IST, accessed on June 15, 2014).

[36]See course INF 319 (Preservation of Information Resources), Charles Sturt University, *op. cit.* The course is part of LS and AS specialization studies.

[37]See, for example, course IS 310 (Information Seeking: Resources & Strategies), University of Tennessee, Knoxville, *op. cit.*

pertise. Category 26[39] covers technology based subjects relevant for specialized programs. Software engineering, information security, (development and management of) information systems, digital libraries, information and knowledge architecture, digital curation, and game studies are a few exemplary subfields of expertise for students specializing in IT. Category 27[40] encompasses technology based practical knowledge. Internet literacy and programming are two requirements for all students in all programs. The programs differ by the level of expertise and professionalism.

The *environment* section (categories 28–30) encompasses studies of social, economic, ethnic and cultural, legal, ethical, and professional aspects of the information environment. Category 28[41] covers environment-based core fields; among them information culture, information economics, information ethics, and information policy. Category 29 covers subfields relevant to specialization areas, for example, community history (AS and LS),[42] and business management (KM).[43] Category 30 covers social competencies; these are skills associated with Internet diversified cultural milieus and the ability to professionally function in the digital environments.[44]

The *organization* section (categories 31–33) focusses on the organizational aspect of the information work. It encompasses studies of organizational settings, information organizations, and management of organizational knowledge. The organizational settings set the social conditions that affect social interactions and interpersonal relations among users and information professionals. They shape information policies, users' behavior, and professional practices regarding information technology, information accessibility, freedom of information, copyright, privacy, security, and computer crimes. The information organizations set the organizational conditions in which most of the information work takes place. The term refers to organizations that function either as memory organizations (libraries, archives, and museums) or as providers of information services (libraries, reference services, patent search services, and information centers) in the government, the public, and the private sectors. The management of organizational knowledge is implemented by information professionals who work in organizations and engage in managerial activities. It is aimed at promoting the organizational agenda by effectively capturing, developing, sharing, and using organizational knowledge and organizational knowledge resources.

These three areas highlight three interrelated basics of the organizational building block; people, social entities, and knowledge. Our primary interest in organizational settings is centered on people, users and information professionals, and their conduct. Our primary interest in information organizations is centered on their role as social entities and their effective operation. And our primary inter-

[39]See the undergraduate major in Informatics offered by the University of California, Irvine: The Donald Bren School of Information and Computer Sciences, which is specialized in information technology (http://catalogue.uci.edu/donaldbrenschoolofinformationandcomputersciences/departmentofinformatics, accessed on May 11, 2014).

[40]See course I&C SCI 31 (Programming), University of California, Irvine, *op. cit.*, and courses Programming 1 & 2, Department of Information Studies, University College London (http://www.ucl.ac.uk /dis/taught/ug, accessed on May 11, 2014).

[41]See course 04:547:200 (Social Informatics), Rutgers University, *op. cit.* This is an integrative course that focuses on "the critical analysis of social, cultural, philosophical, ethical, legal, public policy and economic issues relating to information technologies, and how these interactions shape workplace decisions and technology use." Other examples are course INF 315E (Information and Culture), the University of Texas at Austin School of Information (https://www.ischool.utexas.edu/programs/minor, accessed on May 11, 2014), course IS 10040 (Information Society: From Papyrus to Cyberspace), the School of Information & Library Studies, University College Dublin, and courses IST 431 (Information Environment) and IST 341 (Human Diversity in the Global Information Technology), Pennsylvania State University, op. cit., which deals with globalization, human diversity and their impacts on IT products, work, workforce, and the knowledge economy and social inclusion in general.

[42]See course INF 318 (Community Histories), Charles Sturt University, *op. cit.*

[43]See course IS 101 (Seminar on Information Systems Management), Singapore Management University, School of Information Systems (http://sis.smu.edu.sg/programmes/bsc-management/bsc-ism-curriculum/curriculum-detail-intake-ay2011-onwards, accessed on May 26, 2014).

[44]See course IS 10050 (Digital Judgment: Truth, Lies, and the Internet), University College Dublin, *op. cit.*

est in knowledge management is centered on the effective use of the organizational knowledge. Studies of organizational settings and information organizations are usually part of LIS core education while knowledge management studies are part of specialization. In some universities KM programs are offered jointly with departments of management studies.[45]

Category 31 represents fields that are relevant for the study of organizational settings[46] and information organizations;[47] among them information economics, information policy,[48] and the like. Category 32[49] includes, for example, fields relevant mainly for KM specialization; among them management studies, business management, and sociology of organizations.[50] Category 33[51] represents practical knowledge associated with the organizational conditions. The ability to map the organizational players and the hidden relations among them is an example of the invaluable organizational competencies or skills necessary for all graduates.

The *user* section (categories 34–36) encompasses the various perspectives related to the end users and their information needs and interests. Users can be classified into three major categories: individuals, groups, and communities, each of which entails different foci. Users can be characterized by their need and interest, gender, age, cultural and ethnic identity, profession, information literacy, and information behavior. Category 34 represents the core field of user studies.[52] Category 35 is exemplified by the field of social psychology, which is taught in KM programs. Category 36 represents practical knowledge related to users. The ability to understand user behavior and identify users' informational needs are exemplary competencies or skills important to all graduates.

Structure

The structure is composed of three elements: the duration of the program, the format of the program, and the order of the courses. In most countries bachelor studies are planned for three years[53] or four years.[54] The format is based on the combination of general studies and specialization modules. There are four optional formats for three years studies and five optional formats for four years studies; a total of nine optional formats. They are depicted in Table 3. The order of the courses was not studied in this study.

The Model$_{1.2}$

The integration of the content categories and the structure of the program forms a structured model$_{1.2}$ for selecting the

[45]See the BA in Business Management and Informatics program, University of Sheffield, Information School (http://www.sheffield.ac.uk/is/ug/bminformatics, accessed on May 14, 2014). The program is taught jointly by the Information School and the Management School. Another example is the BSc Information Management for Business program at University College London, *op. cit.* The program is taught jointly by the Department of Management Science and Innovation, the Department of Information, and the Department of Computer Science.

[46]See course IS20030 (Information & Collaboration in Organizations), University College Dublin, *op. cit.*

[47]See course INF 317 (Government, Organizational and Private Records), Charles Sturt University, *op. cit.* The course studies government, commercial (business), organizational (non-commercial) and private record-keeping agencies (archives).

[48]See course 04:547:400 (Information Policies, Politics, and Power), Rutgers University, *op. cit.*, which prepares students for policy development in organizations.

[49]See course INF 336 (Principles of Knowledge Management), Charles Sturt University, *op. cit.*, course 04:547:210 (Management of Technological Organizations), Rutgers University, *op. cit.*, and IST 422 (Enterprise Architecture), Pennsylvania State University, *op. cit.*

[50]See courses CINF 032 (Sociology of Organizations), University of Porto, *op. cit.*

[51]See course INLS 393 (Information Science Internship), School of Information and Library Science, University of North Carolina at Chapel Hill, *op. cit.*, which offers BS students a supervised internship in an information organization. Other examples are course 644 (School Library Practicum), University of Wisconsin-Milwaukee, *op. cit.*, which is a field experience of 210 hours in elementary and secondary school library media services under faculty and field supervisor guidance, and course IST 440W (Information Sciences and Technology Integration and Problem Solving), Pennsylvania State University, *op. cit.*.

[52]See course Information User Study, Sungkyunkwan University, *op. cit.*, course IS20050 (Theories of Information Behavior) at the University College Dublin, *op. cit.*, and course 04:189:352 (Self and Society in Virtual Contexts), Rutgers University, *op. cit.*

[53]See Nova University (http://www.isegi.unl.pt/Cursos/Licenciaturas/Gestao-Informacao/detalhe-de-curso/plano-de-estudos.asp, accessed on May 18, 2014) and Bar-Ilan University (http://is.biu.ac.il/en/node/1148, accessed on May 18, 2014).

[54]See São Paulo State University (http://www.marilia.unesp.br/#!/graduacao/cursos/biblioteconomia/grade-curricular/quadro-de-disciplinas-2013, accessed on May 18, 2014).

Table 3. Nine Formats of LIS Programs.

	Year 1	Year 2	Year 3	Year 4
Format 1	General studies			
Format 2	General studies	Specialization		
Format 3	General studies		Specialization	
Format 4	General studies			Specialization
Format 5	Specialization			
Format 6	General studies			
Format 7	General studies			Specialization
Format 8	General studies	Specialization		
Format 9	Specialization			

planned contents. It comprises 36 pairs of core categories and respectively spans over three to four years; a total of 288 content categories (36 × 2 × 4) (see Table 4). The planned contents (i.e., fields and courses) are not part of the model$_{1.2}$. They are represented in the model$_{1.2}$ by placing them in the relevant categories. The model$_{1.2}$ is valid as long as any relevant content can be placed in at least one of the 288 content categories.

Discussion and Conclusion

Models

This chapter presents two complementary models for developing academic programs. The first model$_{1.1}$ is the systematic developing process, which is composed of four successive phases: defining the academic goals, specifying the derived contents, organizing the contents in the structured plan, and evaluating the program. The second model$_{1.2}$ is a structured plan of 288 content categories. The two complementary models are combined into an integrated model$_1$ by using the structured plan while selecting and ordering the contents. The models lay the foundations of systematic curricular and pedagogical reasoning involved in the four-step development process and in the content selection process. They are intended to be constitutive models grounded on theoretical foundations rather than an empirical mirror of a developing process that occurs in a real academic institution.

Ad-hoc Adjustments

These exemplary models need ad-hoc adjustments. They should be critically reviewed and implemented in the real world by the faculty members of each institution. An academic program is grounded in the conception of the field and the specific academic goals that it aims to achieve. It is planned for given academic settings, bound by given social conditions and academic milieus, designed for given students, intended to be taught by given staff, and utilize specific teaching methods.

Categories Versus Contents

The structured 288 category plan of contents (model$_{1.2}$) makes it possible to present the complicated thematic relations among the various contents (fields and courses) by differentiating among the categories and the contents. The contents are not part of the model$_{1.2}$ but are represented in the various categories.

Developing Versus Evaluating

The model$_{1.2}$ is a powerful tool for de-

Table 4. Universal Model.

Year						1st Year	2nd Year	3rd Year	4th Year
Content	General Education (ED)	Literacy Studies		1	B[1] / A[2]				
		Humanities		2	B / A				
		Social Sciences		3	B / A				
		Natural Sciences		4	B / A				
		Life Sciences		5	B / A				
		Technology Studies		6	B / A				
	Information Science	Foundations	GIS	7	B / A				
			SP	8	B / A				
			PR	9	B / A				
		Resources	GIS	10	B / A				
			SP	11	B / A				
			PR	12	B / A				
		Knowledge Workers	GIS	13	B / A				
			SP	14	B / A				
			PR	15	B / A				
		Contents	GIS	16	B / A				
			SP	17	B / A				
			PR	18	B / A				
		Applications	GIS	19	B / A				
			SP	20	B / A				
			PR	21	B / A				

(continued)

Table 4. Universal Model (continued).

Year						1st Year	2nd Year	3rd Year	4th Year
Content	Information Science - Continued	Operations & Processes	GIS	22	B/A				
			SP	23	B/A				
			PR	24	B/A				
		Technologies	GIS	25	B/A				
			SP	26	B/A				
			PR	27	B/A				
		Environments	GIS	28	B/A				
			SP	29	B/A				
			PR	30	B/A				
		Organizations	GIS	31	B/A				
			SP	32	B/A				
			PR	33	B/A				
		Users	GIS	34	B/A				
			SP	35	B/A				
			PR	36	B/A				

Note. Basic[1] (30 academic hours)/Advanced[2] (60 academic hours or more).

veloping and evaluating LIS academic programs and courses. Developing and evaluating may be viewed as two complementary activities. Still, they are based on different thinking. Developing is based on synthetic thinking while evaluating is based on analytic thinking. Programs and courses are the products of content syntheses. They are composed of various series of interrelated contents. While using the model$_{1.2}$ for developing a course, the developer assembles the relevant contents from various categories, but while using the model$_{1.2}$ for evaluating a course the evaluator separates the contents and places them in the relevant categories. Evaluating a course on information ethics demonstrates the ability of the model$_{1.2}$ to present thematic complexity. Courses on ethics may address several aspects, and they can be placed in categories, 2, 7, 15, and 28 based on their prime foci. Courses that are taught within the framework of general education are represented in category 2 (humanities). Courses that focus on the philosophical perspectives of information ethics are placed in category 7 (foundations of information science).[55] Courses that focus on the social aspects of etiquettes, norms, ethical codes and conduct in information based societies are represented in category 28 (social aspects of information),[56] while courses that are designed to foster ethical values and personal conduct of the students are presented in category 15 (knowledge worker). Many information science subfields and courses encompass different perspectives and they can be represented in several categories.

Directions of LIS Education

We initiated the study realizing that the divergence among programs offered by schools of information science at the bachelor's level is striking. In the course of the study we reviewed more than 100 programs in 70 universities from 12 countries. Evidently, the field of LIS is changing, followed by changing of LIS education. We are in the midst of an era that will probably result in new fields of expertise. We cannot predict the future. We can just envision future directions. While reviewing the academic programs we have identified seven main interrelated nonexclusive directions. In fact, most of the programs that were reviewed embody more than one direction.

The first is the traditional direction,[57] which is centered on librarianship and archival studies. The second direction is informatics,[58] which is centered on searching and using information in all fields of knowledge. Note that the term "informatics" has different meanings. Here it stands for the praxis of the information work. The third direction is social informatics.[59] It is centered on the social aspects of the information industries. The fourth direction is information systems.[60] It is centered on developing and using technological based information systems. The fifth direction is the new media.[61] It expands the scope of information science and encompasses web, cellular and new media applications, such as video, games, entertainment, and the like. The sixth direction is computer science.[62] It is based on the integration of

[55]See course 661 (Ethics and the Information Society), the Undergraduate Catalog 2013–2014, School of Information Studies, University of Wisconsin-Milwaukee, *op. cit.*, which deals with "ethical traditions, concepts, and principles for the information professions in the global information society."

[56]See course INFO 450 (Information Ethics and Policy), University of Washington, *op. cit.*

[57]See the Librarianship and the Records and Archives Management specialization programs at Charles Sturt University, *op. cit.*

[58]See the Bachelor of Science in Informatics, University of Melbourne, *op. cit.*

[59]See the undergraduate programs of social computing at the University College Dublin, *op. cit.*

[60]See the three undergraduate programs offered by Cornell University, especially the BS program at the College of Engineering in Information Science, Systems, and Technology, Cornell University, *op. cit.* The program "studies the design and management of complex information systems, with an emphasis on information systems engineering in broad application contexts."

[61]See the Interactive Digital Media undergraduate degree program at the University of Toronto, *op. cit.* Another example is the Game Production and Innovation specialization program, Rutgers University (http://comminfo.rutgers.edu/information-technology-and-informatics-major/iti-specializations.html, accessed on June 8, 2014).

[62]See the Graduate School of Information Science and Technology at the University of Tokyo, *op. cit.*

information science and computer science. The seventh direction is management.[63] It is centered on management of organizational knowledge, and encompasses knowledge management, business management, and management studies.

The field of LIS is constantly changing and so is LIS education. Therefore, the models that have been developed in the study should be viewed as part of an ongoing research agenda. The study is focused on the curricular and pedagogical reasoning involved in the content selection of LIS academic programs. The profound insight that comes out of the study is the invaluable impact of how curricular and pedagogical reasoning offers significant improvements to assist with LIS academic education.

Acknowledgement

The JELIS editor wishes to thank Springer for its kind permission to republish this article which was originally published as Zins, C. and Santos, P. L. V. A. C. (2016). Content selection in undergraduate LIS education. In Kelly, M. and Bielby, J. (Eds.) *Information cultures in the digital age: A Festschrift in honor of Rafael Capurro* (pp. 427–453). Wiesbaden, Germany: Springer.

References

Buckland, M., (2012). What kind of science can information science be? *Journal of the American Society for Information Science and Technology*, 63(1), 1–7.

Cox, R. J., & Larsen, R. L. (2008). iSchools and archival studies. *Archival Science, 8*(4), 307–326.

Elmborg, J. K. (2008). Framing a vision for 21st-century librarianship: LIS education in changing times. *The Serials Librarian, 55*(4), 499–507.

Given, L. M., & McTavish, L. (2010). What's old is new again: The reconvergence of libraries, archives, and museums in the digital age. *The Library Quarterly, 80*(1), 7–32.

Hjorland, B. (2000). Library and information science: practice, theory, and philosophical basis. *Information Processing & Management, 36*(3), 501–531.

Singh, V., & Mehra, B. (2013). Strengths and weaknesses of the information technology curriculum in Library and Information Science graduate programs. *Journal of Librarianship and Information Science, 45*(3), 219–231.

Zins, C. (2007a). Conceptions of information science. *Journal of the American Society for Information Science and Technology, 58*(3), 335–350.

Zins, C. (2007b). Conceptual approaches for defining data, information, and knowledge. *Journal of the American Society for Information Science and Technology, 58*(4), 479–493.

Zins, C. (2007c). Knowledge map of information science. *Journal of the American Society for Information Science and Technology, 58*(4), 526–535.

Zins, C. (2007d). Classification schemes of information science: 28 scholars map the field. *Journal of the American Society for Information Science and Technology, 58*(5), 645–672.

Zins, C., & Santos, P.L.V.A.C., (2015). Brazilian model of library and information studies in the Bachelor's level. *Informação & Sociedade: Estudos, João Pessoa, 25*(3), 185–203.

Appendix A

The Panel

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- Dr. Ely Francina Tannuri de Oliveira, São Paulo State University [Univ Estadual Paulista (UNESP)], Marília—SP, Brazil;
- Dr. Guilherme Ataíde Dias, Federal University of Paraíba [Univ Federal da Paraíba (UFPB)], João Pessoa—PB, Brazil;
- Dr. Icléa Thiesen, Federal University of Rio de Janeiro State [Univ Federal do

[63]See the Information and Knowledge Management specialization program at Charles Sturt University, *op. cit.*

Estado do Rio de Janeiro (UNIRIO)], Rio de Janeiro—RJ, Brazil;
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- Dr. Mauricio Barcellos Almeida, Federal University of Minas Gerais [Univ Federal de Minas Gerais (UFMG)], Belo Horizonte—MG, Brazil;
- Dr. Nanci Elizabeth Oddone, Federal University of Bahia [Univ Federal da Bahia (UFBA)], Salvador—BA (round 1) and the Federal University of Rio de Janeiro State [Univ Federal do Estado do Rio de Janeiro (UNIRIO)], Rio de Janeiro—RJ, Brazil (rounds 2 & 3);
- Dr. Patrícia Zeni Marchiori, Federal University of Paraná [Univ Federal do Paraná (UFPR)], Curitiba—PR, Brazil;
- Dr. Renato Rocha Souza, Applied Mathematics School of Getulio Vargas Foundation [Escola de Matemática Aplicada da Fundação Getúlio Vargas (EMAp/FGV)], Rio de Janeiro—RJ and the Federal University of Minas Gerais [Univ Federal de Minas Gerais (UFMG)], Belo Horizonte—MG, Brazil;
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Appendix B

Excerpts from the Three Questionnaires on the Universal Model

Information Science Education in Brazil

First Round

1. *Conception of information science*. Information science is the study of the mediating aspects of human knowledge as they are implemented in the social domain. In other words information science focuses on connecting resources and users. It deals with technological as well as social and cultural perspectives. This conception is the mainstream in Brazil.

(The panel was asked to comment)

Information Science Education in Brazil

Second Round

1. *Conception of information science*. Information science. Evidently, all the

responses represent the conception of IS, as stated in R1. Information science is the study of the mediating aspects of human knowledge as they are implemented in the social domain.

(The panel was asked to comment)

Information Science Education in Brazil

Third Round

Part 1: Universal Model

Model. The term model has two meanings. It is the process of developing an academic program (i.e. this critical and reflective Delphi study), and it is the structured plan of the program. This study demonstrates the process of developing an academic program, and it presents its plan. Let's focus on the structured plan.

Goals, contents, structure. An academic program has three elements: goals, contents, and structure. The goals shape the contents. The contents should fit into the structure. This sets a model for developing, improving, and evaluating the quality of IS BA programs.

1.1 Goals. Achievement vs. activity. Academic goals are formulated as achievements (what the program is expected to achieve), and as activities (what the program is expected to do). We focus on the achievements.

Programs vs. students. Achievements of programs set the basic standards for programs (i.e. what courses they should teach). Achievements of students set the basic requirements from each and every graduated student (i.e. what courses s/he should study).

Achievements of academic programs are divided into:

1. General education (not IS),
2. General IS education,
3. Knowledge of the field of expertise, and
4. Practical knowledge.

Achievements of graduated students are divided into:

1. General education (not IS),
2. General IS education,
3. Knowledge of the field of expertise, and
4. Practical knowledge.

(The panel was asked to comment)

1.2 Contents. Four types. The contents are the core of an academic program. They are divided into four types: General education (GE), general IS education (GIS), specialization (SP), and practical knowledge (PR). The four types are divided into two groups: General education (GE), and information science (GIS, SP, and PR).

General education is divided into four groups of fields/courses: Literacy studies (basic knowledge and skills), humanities & social sciences, natural & life sciences, and technology studies.

Information science is divided into 10 groups of subfields/courses: Foundations, resources, knowledge workers, contents, applications, operations & processes, technologies, environments, and users. The division is based on the knowledge map of information science (see Zins, 2007c).

Basic vs. advanced. Each course has two levels: basic (B), and advanced (A), which indicate the importance of the field in your eyes.

68 content categories. There are 68 content categories.

(The panel was asked to comment)

1.3 Structure. Length, type, process. The structure is composed of three elements: length, type, and process. The length is implemented in the number of years, three or four. The type is implemented in the nature of the program, namely the combination of general studies and specialization. There are nine options:

(The panel was asked to comment on Table 3 (above))

1.4 Model. Based on the combination of the contents and the structure we designed the "structured model."

(The panel was asked to comment on a table similar to Table 4 (above) with 68 categories. Note that the final model is composed of 72 categories. In addition, the panel was asked to propose alternative models.)

Appendix C

Listed Universities

- Bar-Ilan University, Department of Information Science, Israel;
- Charles Sturt University, School of Information Studies, Australia;
- Cornell University, College of Arts and Sciences, Information Science, USA;
- Drexel University, College of Computing and Informatics, USA;
- Florida State University, School of Library and Information Studies, USA;
- Humboldt University of Berlin, Berlin School of Library and Information Science, Germany;
- Indiana University, School of Informatics and Computing, USA;
- NOVA University of Lisbon, School of Statistics and Information Management, Portugal;
- Pennsylvania State University, College of Information Sciences and Technology, USA;
- Rutgers, the State University of New Jersey, School of Communication and Information, USA;
- São Paulo State University, Department of Information Science, Brazil;
- Singapore Management University, School of Information Systems, Singapore;
- Sungkyunkwan University, Library and Information Science Department, South Korea;
- Syracuse University, School of Information Studies, USA;
- University College Dublin, School of Information and Library Studies, Ireland;
- University College London, Department of Information Studies, UK;
- University of Arizona, School of Information: Science, Technology, and Arts, USA;
- University of California, Irvine, The Donald Bren School of Information and Computer Sciences, USA;
- University of California, Los Angeles, Graduate School of Education and Information Studies, USA;
- University of Kentucky, College of Communications and Information Studies, USA;
- University of Melbourne, Melbourne School of Information, Australia;
- University of Michigan, School of Information, USA;
- University of North Carolina, School of Information and Library Science, USA;
- University of North Texas, College of Information, USA;
- University of Pittsburgh, School of Information Sciences, USA;
- University of Porto, Faculty of Engineering, Portugal;
- University of Sheffield, Information School, UK;
- University of South Carolina, School of Library and Information Science, USA;
- University of Southern Mississippi, School of Library and Information Science, USA;
- University of Tennessee, Knoxville, School of Information Sciences, USA;
- University of Texas, Austin, School of Information, USA;
- University of Tokyo, Graduate School of Information Science and Technology, Japan;
- University of Toronto, Faculty of Information, Canada;
- University of Washington, Information School, USA;
- University of Wisconsin, Milwaukee, School of Information Studies, USA.