Evolution and Implications of Undergraduate Information Science Education at Top US iSchools: A Postprint of the 10-Year Follow-up Curriculum Survey

Authors: Cao Wenzhen, Zhou Qingshan

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Abstract

[Purpose/Significance] A decade later, this study reinitiates the investigation into undergraduate curricula of information science programs at top-tier iSchools in the United States. By examining the evolution and trends of premier overseas undergraduate degree programs over the intervening ten years, it aims to provide valuable experience and reference for the development and educational reform of related undergraduate programs in information management departments in China.

[Method/Process] The study selected the top 10 iSchools from the U.S. News & World Report's Best Library and Information Science Graduate Schools rankings to investigate their undergraduate information science programs. Comprehensive collection of degree program and course information was conducted through official iSchool websites, with examination and analysis performed across multiple dimensions including changes in overall program design and training objectives, modifications to professional core/elective courses, and course classification and trends.

[Results/Conclusions] Compared with 2009, undergraduate programs at top-tier U.S. iSchools in 2019 exhibited new changes in program design, training objective formulation, professional core (required) course configurations, and professional elective course offerings. Through systematic classification and coding of offered courses, these programs' curricula can be categorized into 13 types; however, the distribution across categories is relatively dispersed, demonstrating distinct multi-pathway and diversified characteristics. Furthermore, recent trends in course configurations for each category were individually examined and systematically reviewed. The study also elaborates on five implications for

undergraduate curriculum design in Chinese information management departments.

Full Text

Evolution and Enlightenment of Undergraduate Education in Information Science at Top U.S. iSchools: A Re-investigation of Curriculum Design After 10 Years

Cao Wenzhen, Zhou Qingshan
Department of Information Management, Peking University, Beijing 100871

Abstract

[**Purpose/Significance**] Ten years after the initial investigation, this study re-examines undergraduate curricula in information science at top U.S. iSchools. By exploring the evolution and trajectory of leading overseas undergraduate programs over the past decade, this research provides valuable experience and reference for the development and educational reform of related undergraduate majors in China's information management schools and departments.

[**Method/Process**] This study selected the top 10 iSchools from the U.S. News & World Report rankings of Best Library and Information Science Graduate Schools. We investigated their undergraduate information science programs, comprehensively collecting information on degree programs and courses through official iSchool websites, and conducted examination and analysis from multiple dimensions: overall program design and changes in training objectives, core/elective course changes, and curriculum classification and trends.

[**Result/Conclusion**] Compared with 2009, the 2019 undergraduate programs at top U.S. iSchools have undergone new changes in program design, training objective formulation, core (required) course setting, and elective course configuration. Through classification and coding, courses at top U.S. iSchools can be divided into 13 categories, though distribution across categories is relatively scattered, showing obvious multi-path and diversified characteristics. The study examined and introduced recent trends in each category. Finally, the paper discusses five aspects of implications for undergraduate curriculum design in China's information management schools and departments.

Keywords: iSchool; information science; undergraduate education; library and information science education; curriculum design
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Curriculum design has always been a central issue in iSchool education discussions [1]. However, compared with graduate courses offered by iSchools [2–4], undergraduate programs, which occupy the mainstream position in talent cultivation, have received far less attention. In 2009, the authors conducted a

survey on undergraduate curriculum design in information science programs in the United States, selecting five information science majors offered by top 10 library and information science schools as samples. Ten years later, the information environment in which library and information science education operates has changed dramatically. Emerging concepts such as big data, cloud computing, mobile internet, and artificial intelligence have injected new vitality into information science curriculum design and driven adjustments and reforms in existing course systems to meet the demands of the times. The impact of information technology on iSchool education is not limited to offering new courses but also includes redesigning course content [6]. In 2018, the Ministry of Education convened the National Conference on Undergraduate Education in the New Era, explicitly proposing to adhere to "taking undergraduate education as the foundation" and to strengthen first-class undergraduate education in the "Double First-Class" initiative. The conference also pointed out that building high-level undergraduate education requires efforts to advance curriculum content updates, construct comprehensive, problem-oriented, and interdisciplinary new course clusters, and stop using outdated knowledge to cultivate tomorrow's graduates [7]. Against this "taking undergraduate education as the foundation" backdrop, the exploration and reform of curriculum design for information science majors such as information management and information systems in China will become one of the key tasks in program development. In 2019, the authors conducted a re-investigation of undergraduate education in information science at U.S. iSchools, hoping to discover the evolution and trajectory of professional education through curriculum changes in top overseas undergraduate programs and provide useful references for the construction of library and information science curricula in China in the coming period.

2 Survey Sample and Methods

In the 2009 survey, the authors selected data from the 2006 edition of U.S. News & World Report's Best Library and Information Science Graduate Schools rankings. Among the top 10 universities, five offered relevant undergraduate information science majors, and the study collected and analyzed data from these five institutions. In the latest 2017 edition of the U.S. News rankings [8], the basic landscape of leading U.S. iSchools has not changed significantly compared with the 2006 rankings (see Table 1). Although some ranking changes occurred, nine of the top 10 universities remained the same, with only Florida State University dropping out of the top 10 and being replaced by the University of Maryland, College Park. The ranking changes of the remaining universities were all within three positions.

Since U.S. iSchools' official websites provide comprehensive and timely updates on degree programs and course information, this study adopted the same data collection method as previous research [9], collecting online data from the current top 10 iSchools by visiting school official websites and external links provided on the sites (such as university course centers). Data collection was con-

ducted in October 2019. The results showed that six universities currently offer undergraduate majors related to information science, and the curriculum plans and configurations of these six universities' relevant programs were included in this study. American universities have full autonomy in program setup. Compared with the 2009 survey results, three universities offered information science-related majors in both surveys: the University of Washington, the University of North Carolina at Chapel Hill, and the University of Pittsburgh. Three universities have newly established information science-related majors: the University of Illinois at Urbana-Champaign, the University of Michigan, and the University of Maryland, College Park. One university (Syracuse University) has canceled its information science-related major.

3 Overall Changes in Curriculum Design at Top U.S. iSchools

3.1 Changes in Program Design and Training Objectives

Compared with 2009, the most significant change in U.S. iSchools' program guidelines for curriculum design in 2019 is the increased emphasis on cultivating students' ability to generate positive social impact. In 2009, U.S. iSchools' training objectives were more specific, aiming to cultivate graduates who could fill positions such as business analysts, database administrators, Web developers, user interaction designers, and user research experts. By 2019, objectives have shifted toward cultivating well-rounded information and technology professionals who can provide solutions for global information challenges and possess the ability to use knowledge to positively impact organizations, communities, and society, as exemplified by the University of Washington's training objectives. Second, programs now propose that information science degrees should lay the foundation for careers in a richer and more diverse range of fields, including technology, financial services, healthcare, the justice system, private enterprises, government agencies, education, and communication, as illustrated by the University of Pittsburgh's training objectives. Third, programs have established timely research directions for students. Taking data science/data analytics as an example, all six schools have set up this specialization in 2019. The University of Illinois at Urbana-Champaign's description of this direction states: understanding the data lifecycle and being able to analyze, transform, interpret, authorize, and connect large-scale data.

3.2 Changes in Core (Required) Courses

In the American university curriculum system, required courses are often listed as core courses. In the 2009 survey, four courses were commonly offered as core courses across all iSchools: "Information Retrieval and Information Analysis," "Information Systems Analysis and Design," "Database Concepts and Applications," and "Introduction to Computer Networks." By 2019, with the deepening of institutional characteristics and specializations, core course configurations

have further differentiated. The investigation found that no single course was offered as a core course by all schools. Even when grouping courses with similar content, the most common core course was offered by only five schools (and there was only one such course): database fundamentals courses, including "Introduction to Database Concepts and Applications" at the University of Illinois at Urbana-Champaign, "Database Design and Modeling" at the University of Maryland, College Park, "Introduction to Database Concepts and Applications" at the University of North Carolina at Chapel Hill, "Database Management Systems" at the University of Pittsburgh, and "Databases and Data Modeling" at the University of Washington. Because core course settings have become more heterogeneous, each school's core courses reflect their own training characteristics. For example, the University of Illinois at Urbana-Champaign's course "Race, Gender, and Information Technology" critically examines how information technology is shaped by race, gender, and other social relations while also helping to shape these relationships. The University of Pittsburgh's course "Human Factors in System Design" focuses on how to analyze, create, and improve devices and environments to make them compatible with human capabilities and expectations.

3.3 Changes in Elective Courses

The 2009 survey found that many American schools provided undergraduate students with a rich selection of elective courses, allowing them to focus on more specialized research areas during their undergraduate studies. This has remained largely unchanged in 2019. The diverse and content-rich elective courses provide possibilities for students following different paths to build a solid knowledge foundation. However, compared with 2009, each iSchool has made substantial updates to curriculum design based on differentiated and characteristic training directions and continuously evolving social demands. Examples of new elective courses at various schools include: "New Media, Culture, and Society" at the University of Illinois at Urbana-Champaign, "Privacy, Security, and Ethics of Big Data" at the University of Maryland, College Park, "Online Communities: Analysis and Design of Online Interaction" at the University of Michigan, "Smart Cities Freshman Seminar" at the University of North Carolina at Chapel Hill, and "Python Programming for Data Management and Analysis" at the University of Pittsburgh.

4 Course Classification and Trends at Top U.S. iSchools

4.1 Course Classification and Coding

Based on information from course catalogs, course descriptions, and curriculum sections on each iSchool's public website, and excluding courses not designed for information science undergraduates, the authors obtained a total of 310 courses offered to undergraduates pursuing bachelor's degrees in information science at six iSchools. By examining course titles, descriptions, and syllabi (when titles and descriptions were insufficient for classification), and using a method

of assigning each course to a higher-level category while continuously adjusting the classification system during the process, a final classification system of 13 categories was obtained, including "Introduction and History of the Discipline," "Information Environment and Information Society," "Information Ethics and Information Law," etc. All 310 courses could be assigned to one unique category within this system. The specific course classification system is shown in Table 2 .

4.2 Course Offerings by Category

As seen in the classification statistics in Table 3 , the most frequently offered course type at top U.S. iSchools is "Information Technology and Programming," accounting for approximately one-fifth (21.94%) of all courses. This demonstrates that information science majors have always had a profound technical background and have grown and developed alongside technology. Whether for skill preparation for future information professions or for enhancing students' understanding of the information world, these courses are widely offered and available for students to choose based on their interests. The second most common type is "Information Services and User Research," representing 11.29% of courses. This reflects information science's inherent nature as an applied discipline that emphasizes the application of information technology in real-world scenarios, particularly how to deliver information services to end users. The proportions of remaining categories do not exceed 10% and are relatively dispersed. Moreover, the top three course types offered at each iSchool involve 10 of the 13 categories, meaning that different iSchools have different course types that they offer more extensively. This again reflects the multi-path and diversified characteristics of top foreign iSchools' research directions and academic pathways. The two least offered categories are "Research Methods and Thesis Writing" and "Other (Seminars, etc.)" (both at 2.58%), which aligns with the curriculum orientation of primarily cultivating non-academic talent at the undergraduate level. Consequently, the overall curriculum system involves fewer courses related to conducting information science research. Undergraduates with research interests are often encouraged to take relevant graduate courses or make up for this content during graduate studies.

4.3 Trends in Different Course Categories

U.S. iSchools have always provided students with abundant and rich courses far exceeding the credit requirements for degree completion [10]. Based on the curriculum information obtained from top U.S. iSchools' information science undergraduate programs, the authors examined each category individually and identified new trends in course configuration.

4.3.1 Information Technology and Programming Courses in "Information Technology and Programming" rank first, with an offering proportion of 21.94%. The most prominent feature of this category is the timely follow-up

and adjustment to changes in information technology, enabling students to acquire skills adapted to societal needs. One major trend is the offering of courses on emerging programming languages and development tools, such as "Python Programming" at the University of Illinois at Urbana-Champaign, "Python Programming for Data Management and Analysis" at the University of Pittsburgh, and "Mobile Application Development: iOS" at the University of Washington. This survey found that before these courses are officially offered, they undergo advance planning and complete development to ensure that in the year they are launched, they can provide students with quality content and learning materials. For example, the University of Illinois at Urbana-Champaign's website previews more than 20 courses under development (Courses in Development), including "Computing in the Humanities," "Ethics and Policy of Data Science," "Strategic Communication," "IT Business Analysis," and many other new or improved courses, some of which are explicitly scheduled to launch in 2020. Another major trend is guiding students to think about how to apply information technology throughout the entire lifecycle of data curation. For example, the University of Washington's "Technology Fundamentals" course actually teaches the basic tools and techniques needed to transform data into knowledge, covering the entire information lifecycle including data acquisition, storage, analysis, and visualization.

4.3.2 Information Services and User Research Courses in "Information Services and User Research" rank second, with an offering proportion of 11.29%. Unlike similar courses in China, top U.S. iSchools segment service populations and offer corresponding information service courses rather than only teaching generic information services for mainstream populations. Taking the University of Illinois at Urbana-Champaign as an example, the school alone has developed multiple courses for the children and youth segment, including "Literature and Resources for Children," "Literature and Resources for Young Adults," "Information Books and Resources for Young Adults," "Fantasy Literature and Media for Young Adults," and "Youth Information Technology Services." Second, curriculum design fully demonstrates concern for vulnerable groups and information-poor populations, leading students to focus on the special challenges of providing information services to marginalized groups in an increasingly digital world. For example, the University of North Carolina at Chapel Hill's "Going the Last Mile: Information Access for Underserved Populations." Third, course design emphasizes cultivating students' understanding and practical abilities in information service methods that keep pace with the times. For example, the University of Michigan's "Social Media Engagement Project Design" focuses on researching, designing, and strategically implementing social media projects for local organizations, requiring students to apply user-centered design principles combined with professional knowledge of social media communication and social group theory to complete social media projects.

4.3.3 Information Systems and Information Product Design Courses in "Information Systems and Information Product Design" rank third, with an offering proportion of 9.03%. Top U.S. iSchools provide courses covering rich forms of information product design, including Web information products, games, mobile applications, and online communities. Specific examples include "Introduction to Top-Down Video Game Design" at the University of Illinois at Urbana-Champaign, "Mobile Application Design" at the University of Washington, "Building Interactive Applications" at the University of Michigan, and "Online Communities: Analysis and Design of Online Interaction" at the University of Michigan. Additionally, the curriculum system integrates UI design, visual design, information architecture design, and product design to help students develop more sophisticated information products. For example, the University of Pittsburgh's "Graphical Display" studies how to use computers to achieve good graphical displays, providing students with the artistic and technical knowledge needed to create graphics. The University of Michigan's "Graphic Design" helps students learn elements such as color, layout and grid, typography, illustration, and Web/digital design, exploring the intersection of visual information and information technology.

4.3.4 Information Organization and Information Retrieval Courses in "Information Organization and Information Retrieval" rank fourth, with an offering proportion of 8.39%. Courses in this category now comprehensively cover every process of describing, preserving, managing, and utilizing information in different media formats. They comprehensively examine the principles, techniques, and issues of acquiring, organizing, controlling, managing, preserving, and administering records, manuscripts, archives, and other cultural and documentary resources in paper, electronic, and other media formats. For example, the University of North Carolina at Chapel Hill's "Introduction to Archives and Records Management." Furthermore, these courses emphasize cultivating students' ability to develop information curation strategies and principles in different contexts rather than focusing solely on operational methods. For example, the University of Maryland, College Park's "Digital Curation in Science, Humanities, and Social Sciences" course teaches how to apply principles, tools, and strategies of digital curation in different disciplines and explores differences in data curation principles and practices across various environments, covering scientific organizations, humanities institutions, and social science institutions.

4.3.5 Information Analysis and Data Mining Courses in "Information Analysis and Data Mining" rank fifth, with an offering proportion of 7.74%. In recent years, top U.S. iSchools have generally responded to and emphasized the development trend of data science, offering a large number of courses in this category, with each iSchool providing such courses. Examples include "Modeling and Learning in Data Science" at the University of Illinois at Urbana-Champaign, "Advanced Methods in Data Science" at the University of Washington, "Introduction to Big Data and NoSQL" at the University of North Car-

olina at Chapel Hill, "Data Exploration" at the University of Michigan, "Data Science Techniques" at the University of Maryland, College Park, and "Data Visualization" at the University of Pittsburgh. V. Ortiz-Repiso et al. surveyed 65 iSchools in 2018 and found that 56.9% offered some form of data-related education [11]. In this survey of top U.S. iSchools, this proportion is 100%, perhaps reflecting that higher-level iSchools place greater emphasis on data science education. Simultaneously, courses in this category emphasize using data analysis to solve real-world application problems while considering corresponding data privacy and system design issues. For example, the course description for "Data Science Discovery" at the University of Illinois at Urbana-Champaign explicitly states that the course is at the intersection of statistics, computing, and their relevance to the real world. As a project-driven course, it requires students to conduct hands-on analysis of real-world datasets and learn to think about social issues arising from data analysis. Similarly, the University of Michigan's "Information Analytics Project" course helps students apply learned skills to create a concrete data-centric project, including client needs analysis, data processing and analysis, and evaluation requirements.

4.3.6 Information Environment and Information Society Courses in "Information Environment and Information Society" rank sixth (tied), with an offering proportion of 6.45%. The increasing emphasis by U.S. iSchools on the interaction among information, technology, and people has become a major characteristic in establishing disciplinary identity [12]. Enhancing students' understanding of technology-society interactions in the new information environment is also a major curriculum trend, with particular emphasis on the widespread changes brought by new media, social media, and social networks to social life. For example, the University of Maryland, College Park's "Social Networks: Technology and Society" course is dedicated to analyzing and understanding how people use social media technologies and the social impacts generated by social media. On the other hand, top U.S. iSchools have offered courses with more international perspectives that focus on global information connectivity, examining recent and current global events characterized by changes in information technology and constructing students' personal understanding of technology and society through discussion and reflection. For example, the University of Michigan's "Information Technology and Global Society."

4.3.7 Information Ethics and Information Law Courses in "Information Ethics and Information Law" rank sixth (tied), with an offering proportion of 6.45%. Newly offered courses in this category emphasize emerging information ethics and legal issues in the context of data science. They evaluate major privacy and security issues arising from big data, the Internet of Things (IoT), wearable devices, ubiquitous sensor networks, social platforms, and other AI-driven systems, and consider building reasonable ethical frameworks for digital information. For example, the University of Maryland, College Park's "Privacy, Security, and Ethics of Big Data." Simultaneously, these courses strengthen the

cultivation of ethics and legal awareness for students as future information professionals, focusing on the most prominent issues for information professionals, including intellectual property, privacy, access/censorship, impacts of digitalization, and ethical guidelines for information management practices. For example, the University of North Carolina at Chapel Hill's "Information and Computer Ethics."

4.3.8 Flipped Learning and Project Internships Courses in "Flipped Learning and Project Internships" rank sixth (tied), with an offering proportion of 6.45%. Flipped learning courses encourage students to conduct independent or exchange learning on topics of interest, often setting up separate credit-bearing courses to supplement classroom instruction. This type of course is considered beneficial for cultivating students' self-directed and lifelong learning attitudes and behaviors [13]. For example, the University of North Carolina at Chapel Hill's "Independent Study in Information Systems" allows individual students to conduct research on a specific topic under the guidance of a particular faculty member. Before registering for the course, students must provide a research proposal. "Problem-centered" education can provide problem situations with task characteristics, placing specific teaching tasks in a progressive problem-solving context [14]. Project internship courses represent this educational approach, typically requiring students to participate in project practice to connect classroom knowledge with practical skills and understand information science knowledge and techniques through hands-on participation. For example, the University of Maryland, College Park's "Integrated Project Practice" requires students to solve a series of information problems in various contexts and environments, including identifying stakeholders and researching their information needs and behaviors, assessing the impact of information infrastructure, interventions, and policies, and analyzing, designing, developing, and deploying information systems.

4.3.9 Information Organization Operations and Management Courses in "Information Organization Operations and Management" rank ninth (tied), with an offering proportion of 5.81%. A major feature of this category is teaching students to understand when organizational informatization is effective rather than blindly pursuing organizational information transformation. For example, the University of North Carolina at Chapel Hill's "Information Use and Organizational Effectiveness" course explores fundamental concepts of how information, people, and technology interact and affect organizational effectiveness, as well as principles of problem-solving, teamwork, leadership, and organizational change/innovation. On the other hand, as some scholars have proposed, cultivating information professionals from an entrepreneurial perspective to prepare them to create their own enterprises in the future is an important strategy [15]. Top U.S. iSchools provide opportunities for students interested in entrepreneurship to acquire corresponding knowledge and participate in project practice in this category of courses. For example, the University of Michigan's "Successful

Business Models: The Science of Entrepreneurship in the Information Age" applies relevant entrepreneurship theories and practices, particularly principles of business model formation, to help students learn how to find, respond to, and utilize recurring waves of technological change as entrepreneurial opportunities.

4.3.10 Information Science Interdisciplinary Studies Courses in "Information Science Interdisciplinary Studies" rank ninth (tied), with an offering proportion of 5.81%. Interdisciplinary subjects with courses offered by two or more iSchools mainly include digital humanities, Geographic Information Systems (GIS), and health informatics, but interdisciplinary courses also have their own characteristics. Taking digital humanities as an example, courses include "Computing in the Humanities" at the University of Illinois at Urbana-Champaign, "Digital Curation Research in Cultural Big Data Collection" at the University of Maryland, College Park, and "Computational Methods in the Humanities" at the University of Pittsburgh. Moreover, this category emphasizes introducing practical interdisciplinary courses in management, psychology, sociology, etc., to improve students' insight and leadership in future information professions. Analysis of information professional job postings over four consecutive years shows that recruiting institutions consistently demand both hard and soft skills [16]. Top U.S. iSchools' efforts in this regard may be seen as a response to societal needs. For example, the University of Michigan's "Persuasion and Social Influence" course uses perspectives from economics and social psychology to learn why and under what conditions a person's thoughts and behaviors are influenced by those around them. In addition to introducing some theories and key research findings in the field of persuasion and social influence, the course provides students with opportunities to practice some social influence theories and techniques.

4.3.11 Introduction and History of the Discipline Courses in "Introduction and History of the Discipline" rank eleventh, with an offering proportion of 5.48%. Top U.S. iSchools currently place more emphasis on critical analysis of information science-related issues when setting up such courses, helping students understand the creation, use, and distribution of information in business, policy, education, government, health, and other sectors. For example, the University of Illinois at Urbana-Champaign's "Introduction to Information Science." Another trend is increasing emphasis on the role of freshman seminars in inspiring students' understanding of information science concepts and issues. For example, the University of North Carolina at Chapel Hill uses the "Smart Cities Freshman Seminar" to showcase relevant themes and trends in sustainable smart cities and explore the role of information in urban network design and its impact on urban design, development, and life.

4.3.12 Research Methods and Thesis Writing Courses in "Research Methods and Thesis Writing" rank twelfth (tied), with an offering proportion of 2.58%. Very few courses on research methods and thesis writing are offered

to undergraduates, and often only one or two courses cover overview content from research design, data analysis, research methods to thesis writing. For undergraduates with surplus capacity and research interest, top U.S. iSchools often encourage them to take graduate courses to balance the limited setting of this content in undergraduate programs. For example, the University of North Carolina at Chapel Hill's "Research Methods Overview" course leads students to explore the design, interpretation, analysis, and application of published research and introduces research methods used in information science and library science.

4.3.13 Other (Seminars, etc.) Courses in "Other (Seminars, etc.)" rank twelfth (tied), with an offering proportion of 2.58%. These courses are mainly topical seminars and lecture courses sharing cutting-edge advances. They primarily supplement some emerging topics and recent research themes not covered in more systematically taught courses, with content often determined based on actual circumstances. Typical forms include the University of Illinois at Urbana-Champaign's "Undergraduate Open Seminar" and "Advanced Topics in Information Studies," the University of Washington's "Topics in Informatics," the University of North Carolina at Chapel Hill's "Intermediate Selected Topics," and the University of Michigan's "Topics in Information."

5 Implications for Undergraduate Curriculum Design in China's Information Management Schools and Departments

5.1 Continuously Develop and Highlight Distinctive Features and Advantages of Different Universities' Information Management Talent Cultivation

This survey found that although most top U.S. iSchools offer the most courses in the "Information Technology and Programming" category, the University of Illinois at Urbana-Champaign and the University of Michigan offer the most courses in the "Information Services and User Research" category, and the University of Michigan also offers the most courses in the "Flipped Learning and Project Internships" category. In terms of core curriculum design, no single course is a common core across all schools. Each school has differentiated specialization directions with certain advantages for students to choose their own learning paths and corresponding courses. For example, the University of Illinois at Urbana-Champaign's "Information and Culture" direction, the University of Washington's "Information Architecture" direction, the University of North Carolina at Chapel Hill's "Digital Cultural Heritage" direction, the University of Maryland, College Park's "Cybersecurity and Privacy" direction, and the University of Pittsburgh's "Game and Simulation Development" and "Human-Centered Computing" directions all have distinctive features. Reviewing the cultivation of information professionals in China, most universities' training characteristics and advantages are not prominent, and differentiation in talent

cultivation at the school and departmental level is not obvious. The formation of "characteristic education" and "advantageous education" is not achieved overnight; foreign top iSchools have also undergone a period of accumulation and 沉淀 (sedimentation). China's information management schools and departments should consider their own advantages in program development, whether internal resource advantages, faculty advantages, or external geographical advantages, industrial advantages, etc., to design competitive training directions that represent their own educational characteristics for undergraduates.

5.2 Accelerate the Pace of Curriculum Catalog Adjustment in the Rapidly Changing Information Environment and Application Context

As repeatedly mentioned earlier, top U.S. iSchools have closely integrated with the information environment and specific application contexts in recent years, adding or readjusting many courses. In response to big data, which has triggered tremendous changes in the information society, the University of North Carolina at Chapel Hill added the course "Introduction to Big Data and NoSQL." For artificial intelligence, an emerging interdisciplinary field currently developing vigorously, the University of Washington offers the course "Intelligent Foundations of Informatics." For social media with rapidly growing user numbers, the University of Illinois at Urbana-Champaign offers the course "Social Media and Global Change." For online communities built based on similar interests, backgrounds, or real-world connections, the University of Michigan offers the course "Online Communities: Analysis and Design of Online Interaction." For mobile applications in mobile information scenarios, the University of Pittsburgh designed the course "Mobile Device Application Development." However, the sensitivity of China's information management schools and departments to the information environment and application scenarios does not yet seem to be reflected in curriculum changes. At least compared with U.S. iSchools, the speed and intensity of response still show signs of weakness. Previous research also shows that between 2009 and 2016, the average number of new courses offered by Chinese information management schools and departments was 3.3, about half the number of new courses offered by U.S. iSchools (7.7) [1]. As an applied interdisciplinary field facing society, with the accelerated pace of social informatization, digitalization, and intelligence, China's information management schools and departments should regularly reflect on and revise curriculum plans in their training programs, continuously update outdated content in the curriculum system, promptly incorporate new research and practical achievements, and plan and cultivate new courses in advance to enhance students' sense of learning gain, identification with program development, and sense of achievement in learning outcomes.

5.3 Closely Track Information Society Development and Set Courses for Diverse Employment Positions

As mentioned earlier, today's American information science education faces broader and more complex social needs, and graduates can choose from a rich and diverse range of industries and positions. Top U.S. iSchools provide multiple possibilities for information professionals' future career development directions through curriculum design. For students who want to work as librarians, the University of North Carolina at Chapel Hill offers the course "Youth and Technology in Libraries." For those aspiring to be museum professionals, the University of Illinois at Urbana-Champaign offers the course "Museum Informatics." To cultivate future cultural institution practitioners, the University of Maryland, College Park developed the course "Digital Curation Research in Cultural Big Data Collection." For students who hope to become digital humanities researchers, the University of Pittsburgh offers the course "Computational Methods in the Humanities." For students aiming for business management development, the University of Washington designed the course "Enterprise Risk Management." Even for students who want to become entrepreneurs, the University of Michigan provides the course "Succeeding Through Failure: The Art of Entrepreneurship in the Information Age." In China's curriculum design for information management-related majors, there is relatively little consideration for students' future diverse development paths, and consequently insufficient feedback in curriculum development practice. Courses offered have high similarity in titles, textbooks, and content, and even elective courses make it difficult for students to choose courses based on their own development needs. Building and expanding professional courses by reverse-engineering from career opportunities is considered an effective method [17]. To adapt to new job demands brought by information society development, it is necessary to establish connections with the information industry and related sectors for talent cultivation, researching how to set different courses for different industry needs and employment directions to broaden students' employment paths and advancement channels.

5.4 Further Develop Interdisciplinary Courses that Enhance Student Abilities and Cultivate Specialized Talent

The survey found that many courses at top U.S. iSchools integrate interdisciplinary perspectives or adapt relevant courses from other disciplines to become part of the iSchool curriculum system. The University of Michigan's "Persuasion and Social Influence" course draws on economics and social psychology knowledge, enabling students to enhance their leadership. The University of Maryland, College Park's "Information Science Special Topics: Digital Educational Infrastructure" course provides insights into educational technology in a topical format. The University of Washington's "Designing for Personal Health" helps students practice health informatics concepts and knowledge. The University of Pittsburgh's "Geospatial Information Systems" course gives students

opportunities to engage with the GIS field. The University of North Carolina at Chapel Hill's "Usability Testing and Evaluation" course lays a solid foundation for students to engage in product design and evaluation. Some researchers have proposed that in today's information society, more than at any time in history, there is a need to break away from traditional college-based divisions and treat "disciplinary integration" as a method for developing interdisciplinary curricula [18]. To cultivate more information professionals who can enter different fields and have corresponding insights, on the one hand, it is necessary to introduce professional teachers with different research directions or encourage current teachers to conduct more specialized research, thereby having the capacity to lead students with different interests in differentiated development at the faculty level. On the other hand, it is also necessary to enhance understanding and cooperation between information management schools and departments and teaching institutions in social sciences, natural sciences, and engineering sciences, evaluating whether and to what extent relevant courses in related and interdisciplinary fields can help students grow, so that students with different professional interests and identities can flexibly and diversely choose more targeted learning courses.

5.5 Pay Greater Attention to the Social Impact of Courses, Enabling Students to Possess "Soft Skills" for Thinking about and Understanding Information Society Impacts

In the curriculum design practices of top foreign iSchools, increasing concern can be seen for how information affects society, politics, economy, organizations, and individuals. The word "society" even appears more frequently in course titles, such as the University of Pittsburgh's "Information, Systems, and Society Introduction," the University of Illinois at Urbana-Champaign's "Social Aspects of Information Technology" and "New Media, Culture, and Society," and the University of Maryland, College Park's "Technology, Culture, and Society." Through attention to vulnerable groups in information poverty, top U.S. iSchools also help students understand the challenges brought by information inequality from another perspective, such as the University of Washington's "Gender, Race, and Information Technology," the University of Michigan's "Interpersonal Relationships and Psychological Effects of Social Media," and the University of North Carolina at Chapel Hill's "Going the Last Mile: Information Access for Underserved Populations." In China's curriculum system, greater emphasis is placed on what information technology can do, helping students use information technology as a skill or means to achieve goals and tasks, while relatively neglecting to guide students to reflect on the social impact and negative effects of information technology. For students who will assume information professional positions and corresponding management responsibilities in the future, it was proposed long ago abroad that students should be taught to think like anthropologists, viewing information problems from multi-perspective, multi-cultural, and multi-ecological angles [19]. China should learn from foreign iSchools' thinking and practice of integrating social impact into curriculum design, enhancing

students' humanistic and social perspectives on real-world concerns, enabling them to acquire both "hard skills" and "soft skills." This will allow them to have reflexive consideration of social impacts when making corresponding decisions, enhance understanding of different service groups, and regulate their own behaviors in the real world through information ethics and moral judgment.

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Author Contributions:
Cao Wenzhen: Conceived the research ideas and plan, conducted data collection and analysis, wrote and revised the paper.
Zhou Qingshan: Proposed the research topic and writing plan, completed paper revision and finalization.

Note: Figure translations are in progress. See original paper for figures.