Construction of a Deeply Embedded Support Service System for Undergraduate Program Teaching in University Libraries: A Case Study of Engineering Education Accreditation Support Services (Postprint)

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Abstract

[Purpose/Significance] Aimed at engineering education professional accreditation, this study constructs a university library support service system that leverages library resources and service advantages to promote discipline construction and cultivate international engineering talents. [Method/Process] By analyzing the areas within the seven general standard indicators of professional accreditation where university libraries can deeply embed support services, the twelve graduate capability requirements are logically categorized. Based on the three-dimension two-level model (3D2L model), a university library support service system for undergraduate education and teaching is constructed from three dimensions, two levels, and six aspects, using Dalian University of Technology as a case study. [Results/Conclusion] The 3D2L model can be applied to university discipline construction and talent cultivation. The university library support service system can be organized and constructed according to this model, with policy solutions proposed for specific implementation.

Full Text

Preamble

Constructing a Deeply Embedded Support Service System for Undergraduate Major Teaching in University Libraries: A Case Study of Engineering Education Professional Certification Support Services

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Abstract: [Purpose/Significance] Oriented toward engineering education professional certification, this study constructs a university library support service system that leverages library resources and service advantages to promote discipline construction and cultivate international engineering talents. [Method/Process] By analyzing the content that university libraries can deeply embed in the seven general criteria of professional certification standards, this paper logically divides the 12 graduation competency requirements. Based on the Three-Dimension Two-Level Model (3D2L Model), it constructs an undergraduate education and teaching support service system for university libraries from three dimensions, two levels, and six aspects, using Dalian University of Technology as a case study. [Result/Conclusion] The 3D2L Model can be applied to discipline construction and talent cultivation in universities, and the university library support service system can be organized and constructed according to this model. Policy-based solutions for specific implementation are proposed.

Keywords: library support service system; engineering education professional certification; reader services; undergraduate major teaching

Engineering education professional certification has become a critical evaluation requirement for first-class disciplines and majors, driving a close connection between professional certification and the "Double First-Class" initiative. On October 20, 2020, the China Engineering Education Accreditation Association held an engineering education summit forum in Beijing, where Director Wu Yan of the Higher Education Department of the Ministry of Education delivered an important speech titled "Thoughts on Engineering Education and Engineering Education Professional Certification Work," proposing to "commit to promoting engineering education professional certification with world-class standards and Chinese characteristics." Against the backdrop of the emerging engineering education initiative, this will greatly accelerate the development of engineering education professional certification in Chinese universities and pose new and higher demands for university libraries to provide substantive support for comprehensive service guarantees in undergraduate education and teaching.

Professional certification originated in the United States in the 20th century as a specialized accreditation implemented by professional accreditation bodies for professional education institutions and programs, conducted jointly by professional associations and educators in the field to provide quality assurance for preparatory education for professionals entering the workforce. It has increasingly gained worldwide attention and gradually become a prerequisite and foundation for national engineer certification systems. Meanwhile, higher engineering education professional certification has become an important means for countries to ensure engineering education quality and a significant indicator of higher education quality.

In the mid-1980s, research on higher education professional certification began in China. In 1986, a Chinese higher engineering education evaluation delegation conducted a thematic investigation on higher education evaluation in the United States and Canada, compiling the four-volume book *Higher Education Evaluation in the United States and Canada*, which became an early Chinese monograph introducing foreign university professional certification systems and their implementation. Since the 1990s, China's higher education industry has experienced rapid development, attracting considerable social attention to higher education quality. The Ministry of Education organized a series of large-scale evaluation activities for university education quality.

1. Status of Engineering Education Professional Certification in Chinese Universities

China's higher engineering education professional certification started late but has developed rapidly. In June 2013, China joined the Washington Accord as a signatory member, marking the beginning of internationally substantially equivalent engineering education professional certification in China. On June 2, 2016, China became a formal member of the Washington Accord. Undergraduate engineering degrees awarded in China are now "substantially equivalent" to those awarded by the other 17 Washington Accord members, including the United States, United Kingdom, Canada, Japan, and Russia. The results of China's engineering education certification and the degrees of graduates from accredited programs have achieved international mutual recognition, enhancing the "gold content" of degrees obtained by students from accredited programs and attracting significant attention from Chinese universities. In 2016, 205 majors nationwide passed engineering education professional certification. In 2017, the China Engineering Education Accreditation Association accepted certification applications for 375 majors from 170 universities. On July 15, 2020, the "Announcement on the Release of the List of Majors that Have Passed Engineering Education Certification" by the Higher Education Teaching Evaluation Center of the Ministry of Education and the China Engineering Education Accreditation Association revealed that by the end of 2019, 1,353 majors from 241 ordinary higher education institutions had passed engineering education professional certification. Over the past decade, engineering professional certification has benefited millions of Chinese higher education graduates and engineers in their global mobility.

Domestic research on library-related professional certification services is limited, with fewer than 10 published articles. Among them, Shen Yaqi from Shanghai Jiao Tong University Library and colleagues extracted and summarized several aspects of library support for professional certification in a relatively comprehensive manner. Xu Yue from Wuxi Taihu University Library and Gao Yunmei from Changshu Institute of Technology Library also reflected on library resource and team construction and proposed suggestions for embedding library services in solving complex engineering problems for professional certification.

2. The Role of University Libraries in Professional Certification

2.1 Elements Involving Libraries in Engineering Education Accreditation

Engineering education professional certification follows three basic concepts: outcome-based education, student-centeredness, and continuous improvement. These concepts are crucial for guiding and promoting major construction and teaching reform and ensuring engineering education quality. Participating in engineering education professional certification, continuously improving deficiencies, and enhancing professional talent cultivation quality have become widespread consensus among relevant domestic universities. The certification explicitly involves libraries in two parts: First, under "7 Support Conditions" in the "Engineering Education Certification Standards" general criteria: "7.2 Computer, network, and library resources can meet student learning and faculty daily teaching and research needs. Resources are managed in a standardized manner with high sharing degree." Second, in the "Engineering Education Certification Measures" under "3.4.2 On-site Examination Procedures: (2) Meeting. The expert group introduces the examination purpose, requirements, and detailed plan to the university and relevant units, and exchanges opinions with them. (3) On-site examination. The examination content includes teaching hardware facilities such as experimental conditions and library resources." Generally, university professional certification application preparation and evaluation processes require library participation and support based on these two requirements.

2.2 US University Library Participation in Engineering Accreditation

The Accreditation Board for Engineering and Technology (ABET) develops accreditation policies, criteria, and procedures for engineering education programs and evaluates and accredits relevant engineering programs. It currently conducts professional accreditation in four major fields: engineering, technology, computer science, and applied science, and is responsible for accrediting 60 majors. Taking Yale University and Purdue University as examples, Yale University has three undergraduate majors accredited by ABET in chemical engineering, electrical engineering, and mechanical engineering, while Purdue University has 15 majors such as aerospace engineering, agricultural engineering, and biological engineering accredited. The libraries of Yale University and Purdue University provide professional guarantees in terms of total resources, professional librarians, location and access of professional resources, learning spaces, and information literacy courses based on their respective institutional characteristics. In addition to these services, based on standard requirements, services can extend to resource usage, resource recommendation methods, location and use of professional resources, and multi-dimensional development of information literacy courses.

2.3 Substantive Participation of Domestic University Libraries in Professional Certification Support

Between 2007 and 2018, among China's first-class university construction institutions, only 15 universities (35.7%) had an average of one or more accredited majors per year, represented by Dalian University of Technology, Southeast University, and Jilin University. Eighteen universities (42.9%), represented by Shanghai Jiao Tong University and China Agricultural University, had an average of fewer than one accredited major per year. As of December 2020, Dalian University of Technology had 25 majors that passed national engineering education certification and evaluation, ranking first nationwide in total number of accredited majors. Correspondingly, its preparation, application, and approval work for certification is also at the forefront, with scholars such as Li Zhiyi producing in-depth research on professional certification.

Dalian University of Technology Library has participated in approximately 30 certification (or evaluation) processes for 25 disciplines/majors, mainly undertaking three tasks:

2.3.1 Construction and Preparation of Relevant Literature Resources

As a service department ensuring literature resource needs for teaching and research, the library conducts literature resource construction closely around education, teaching, research, and university development. Each year, the library submits budget and procurement plans based on actual collection resources, literature utilization, and discipline development needs of various departments. Within the budget framework, procurement is conducted according to appropriations, university discipline settings, Ministry of Education evaluation requirements (such as per capita annual purchase of new paper books), and current publishing market conditions, as well as the proportional allocation between electronic and paper resources. However, explicit adjustments to literature resource construction based on professional certification needs are rarely made. Since collection resource structure construction involves numerous entities that directly or indirectly influence the collection structure—such as university factors, library factors, user factors, literature resource factors, and acquisition factors—scientifically setting up a collection resource structure construction framework based on these influencing factors and strictly implementing scientific and professional construction according to clear, discipline-quantified overall and annual targets remains a lengthy process.

2.3.2 Providing Statistical Data on Resources, Service Guarantees, and Resource Utilization Required for Certification

In professional certification evaluation self-assessment reports, according to requirements for library resources in certification support conditions, libraries submit supporting materials including: basic library information, service guarantee status, reading seats, software and hardware support for resource utilization, resource training, total collection statistics, major-specific collection statistics, total library books and per-student book statistics, statistics on paper litera-

ture and e-book increments over the past three years, and detailed statistics on book utilization and major-specific book utilization. Taking the case of Dalian University of Technology Library's 2018 service for the "Measurement and Control Technology and Instrument" major certification (data as of end of 2017) as an example, the library provided not only basic supporting service guarantee introduction materials but also some statistical data required for professional certification, as shown in through .

2.3.3 Participating in Certification Meeting Q&A, Hosting On-site Expert Visits and Inspections

When professional certification experts evaluate relevant university majors, there is an on-site examination component that requires library cooperation with the university and the college applying for certification to complete necessary work. (1) Participating in certification meetings. These meetings are organized at the university level, attended by university leaders, relevant functional departments, and library representatives. During this period, if necessary, library participants need to answer questions from certification experts about "library resources" and exchange opinions. (2) Hosting on-site visits by certification expert groups. The library is an essential part of the expert on-site examination process and requires a library director or deputy director to receive and accompany expert group members. The library needs to provide an overall introduction to the library, including facilities, services, collection overview, resource utilization, reading seats and usage, and software and hardware infrastructure. Simultaneously, they accompany certification experts to examine major-specific literature collections on-site, answer expert inquiries about major-specific book utilization and collection, and provide requested data and other information as needed.

3. Problems in University Library Participation in Professional Certification

3.1 Information Asymmetry Between Library and Professional Certification Departments (Schools/Colleges)

As a university teaching support department, the library has certain limitations in its connection with relevant university functional departments and schools/colleges, with a gap between actual closeness and expectations. During professional certification, departments request data support from the library based solely on the explicitly library-related parts of certification requirements. They are unclear about what additional services the library can provide to enhance undergraduate education and teaching and to support the entire student cultivation process for professional certification. The relationship remains at a self-exploration and resource development stage, with insufficient awareness of leveraging public university resources. Libraries also lack understanding of professional certification indicator requirements, unclear about which service items can be integrated or embedded into which stages of undergraduate education and teaching, and merely provide basic data output services upon request.

Communication channels between libraries and departments are insufficient and relatively single.

3.2 Professional Certification Service Teams and Departmental Collaboration Need Further Standardization

The construction of library professional certification service models requires standardization and proceduralization. According to certification requirements, accredited majors require re-evaluation after six years. Currently, providing data services and hosting visits for one certification major requires approximately repetitive data updating work every six years. In 2020, the authors' university already had 25 accredited majors, with another 8 majors completing 2021 engineering education professional certification applications. The tasks facing library work are becoming increasingly heavy, making it necessary to establish specialized teams for departmental collaboration and systematic, procedural response mechanisms. Personnel management needs to be de-administrativized, talent utilization de-departmentalized, work allocation specialized, and departmental collaboration seamless.

3.3 Targeted Professional Certification Support Services Need Improvement

The mission of university libraries is to serve university teaching, learning, and research. In university libraries, especially those in "985" universities, research services are heavily emphasized in terms of funding, service direction, team building, and service guarantees, with a tilt toward research services. However, in supporting undergraduate education and teaching, particularly in supporting undergraduate major certification evaluation and assurance, systematic and targeted service plans and policies still need further improvement.

4. Construction of Library Support Service System for Professional Certification

4.1 Constructing the Support Service System Based on Certification Indicator System

China's engineering education professional certification general standards have seven indicators: training objectives, curriculum system, faculty, support conditions, student development, graduation requirements, and continuous improvement. Student development is the center; training objectives and graduation requirements are the specific manifestations and requirements for achieving student development and play a guiding role; curriculum system, faculty, and support conditions provide resource, technical, and material guarantees for student development; and continuous improvement plays a supervisory and controlling role in achieving student development goals. Graduation requirements refer to 12 basic competencies students need upon graduation: engineering knowledge, problem analysis, design/development of solutions, scientific research, engineering and society, modern information tool usage, professional ethics and norms, environment and sustainable development, communication and understanding,

project management, teamwork, and lifelong learning.

These 12 competencies can be logically divided into three dimensions—knowledge, quality, and capability—with each dimension reflecting both general and professional levels. This paper proposes the Three-Dimension Two-Level Model (3D2L Model), as shown in . The 3D2L Model reveals the content structure of discipline construction and international engineering talent cultivation. Libraries can provide direct and explicit auxiliary support services in five aspects: general knowledge, professional knowledge, general quality, professional quality, and general capability. For cultivating graduates' professional capabilities, libraries currently lack explicit support conditions beyond resource support and guarantee.

4.1.1 Knowledge Dimension

Knowledge results from human exploration, cognition, summarization, and accumulation of the physical and information worlds, manifested as concepts, rules, laws, and contexts—all essentially semantic encoding of information. University education must cultivate professional technical talents who learn, master, and create professional knowledge, while also understanding and acquiring basic natural science knowledge, universal social science knowledge, and real-life oriented knowledge, namely general knowledge.

4.1.2 Quality Dimension

Talent quality composition has diverse characteristics, mainly divided into professional quality and general quality. Professional quality refers to knowledge reserves, basic skills, and thinking patterns related to professional technology for solving professional technical problems. However, professional quality alone cannot integrate individuals into society and professional teams. General quality refers to non-professional-related qualities, including moral sentiment, character, ideal pursuit, and behavior.

4.1.3 Capability Dimension

Human capability refers to the scope and degree to which people achieve target tasks through their intelligence and physical abilities. Individual capabilities are always limited; people maximize team members' abilities through mutual support and collaboration to achieve organizational goals and complete relevant tasks. Capabilities can be divided into general capability and professional capability. General capability refers to common abilities most people possess, such as interpersonal communication, arithmetic operation, and difference identification. Professional capability refers to the ability to solve specific professional field problems and complete professional work based on professional knowledge and skills, requiring specialized training and practice.

4.2 Support Service System Model

Based on the three-dimensional indicators and two-level indicators, crossing them forms six aspects, thereby constructing the library professional certification support service system model as shown in [Figure 1: see original paper],

called the Three-Dimension Two-Level (3D2L) Service Model. Traditional libraries are characterized by book management and passive knowledge resource supply, lacking active service support for talent cultivation, discipline construction, and research innovation. In the new era of artificial intelligence development, library services must inevitably become informational, diversified, and intelligent.

For current students, cultivating general knowledge, general quality, and general capability are feasible areas for library service support: (1) Library support services for general knowledge: general knowledge literature resource guarantee (paper collection resources, general education databases), service guarantee (information literacy education, general knowledge education, knowledge push, literature exhibitions). (2) Library support services for general quality: professional ethics training, work-study practice, lifelong readers. (3) Library support services for general capability: resource utilization and modern information technology tool training, interactive experiences, reading clubs, salons, lectures, group study rooms, team retrieval competitions, new technology experience spaces, maker spaces, and cultural art spaces.

Professional knowledge, professional quality, and professional capability require expert support in professional fields, professional environment nurturing, and specialized practical training. Obviously, except for professional capability cultivation which is beyond library service capacity, library services for professional knowledge and professional quality are still viable: (1) Library support services for professional knowledge: professional knowledge literature resource guarantee (paper collection resources, professional databases, electronic teaching reference databases, dissertations), professional service guarantee (professional literacy education, professional knowledge push, professional literature exhibitions). (2) Library service support for professional quality: thematic lectures, specialized training, retrieval and utilization courses, customized services, and subject librarian allocation.

4.3 Construction and Implementation of the Support Service System

In engineering education professional certification, based on existing traditional statistics and expert on-site examinations, university libraries should comprehensively construct a library professional certification support service system oriented toward the engineering education professional certification indicator system and based on the library support service system model. They should take the initiative around key discipline construction, strengthen top-level work mechanism construction at the organizational level, and at the business level, conduct targeted literature resource construction planning, reading promotion planning, and reader service objectives to assist first-class discipline and major construction, fulfill educational and information service functions, and serve the cultivation of morally, intellectually, physically, aesthetically, and labor-wise developed talents and the development of education, science, and culture.

4.3.1 Work Mechanism Promotion, Construction, and Guarantee

Library subject services require multi-party support and collaboration. At the university level, this includes collaboration with university and functional departments and communication and cooperation with schools and colleges. It also involves internal library organizational structure coordination and cooperation.

(1) Establish university-level organization, communication, and collaboration mechanisms. Professional certification is an important task for promoting undergraduate education and teaching. However, overall work promotion requires establishing an engineering education professional certification working group led by the Academic Affairs Office, including undergraduate education vice deans from schools, and deputy division-level cadres from relevant functional departments (including the library). A stable work collaboration mechanism should be established with regular meetings to deeply understand certification requirements and shared work content, communicate work progress and new work content that functional departments can integrate, and collaboratively integrate university-wide resources to improve undergraduate education and teaching and professional certification quality.

(2) Establish a library support service working group. Driven by the overall goals and tasks of serving the university's "Double First-Class" construction, university library work content expands deeply toward subject services. In intellectual property information services, talent introduction evaluation, and discipline development trend analysis, libraries show cluster development patterns, with personnel allocation tilting toward these core positions according to business development needs. However, organizational structures and departmental settings are still mostly based on traditional library workflows: acquisition, classification, cataloging, collection, circulation, and reference, supplemented by administrative offices and information technology development and maintenance departments. In the current context of deepening university discipline construction and accelerated advancement, libraries need to break through compartmentalized, framework-based management methods, flexibly allocate human resources according to actual needs of subject service and scientific service activities, establish stable, clearly responsible, and effective support service working groups, and form systematic and sustainable support service guarantees.

The library support service working group is headed by a deputy director assigned by the director, responsible externally for familiarizing with professional certification work mechanisms, requirements, and procedures with the Academic Affairs Office and schools/colleges, and promoting library support service items (library software and hardware support, resource and utilization data, etc.). Internally, the group is responsible for organizing overall library work serving professional certification: beyond original work such as data statistics and ex-

pert reception, it identifies and explores work connotations and breakthrough points that can serve the entire undergraduate education and teaching process based on the 3D2L service model, enhances the library's actual effectiveness in actively integrating into the university's "Double First-Class" construction, and ensures the promotion and implementation of innovative methods, systems, and concepts during support system realization.

4.3.2 Establishing Targeted Literature Resource Construction Planning Support

(1) Scientifically quantify collection literature resource construction structure. University libraries conduct literature resource construction based on university education, teaching, and research needs and development policies. Although collection resource structure construction involves numerous entities that directly or indirectly influence the structure—such as university factors, library factors, user factors, literature resource factors, and acquisition factors—and there are many deviation factors in actual construction, literature resource construction must scientifically establish a collection resource structure construction framework based on influencing factors. With clear, discipline-quantified overall and annual targets, strict implementation, scientific construction, and professional construction ensure that the collection resource structure system aligns with discipline and major construction development.

(2) Formulate special resource construction plans to support professional certification disciplines. In structured literature resource construction, establish special resource guarantee plans for university professional certification disciplines, particularly targeted general knowledge literature guarantees. Professional certification itself does not have explicit quantitative requirements for literature materials. Professional knowledge literature resource construction needed for professional certification disciplines has always been a focus of library resource construction, and conventional collection reserves and procurement can meet discipline construction needs without special arrangements for certification. However, it is necessary to explicitly plan the construction proportion of general knowledge literature resources in terms of variety and base quantity. The cultivation objectives of higher engineering education focus on avoiding "disciplinary knowledge structure" and "utilitarian professional education" and "should increase the proportion of basic knowledge." During professional certification onsite examinations, certification experts pay attention not only to relevant professional literature resource guarantees but also to general knowledge materials such as "problem analysis," "engineering and society," and "environment and sustainable development."

4.3.3 Systematic and Subject-Based Reading Promotion Service Innovation

(1) Systematize resource utilization tracking by "major," strengthening re-

source utilization analysis, library reading guidance, and effectiveness for "certified major" students. In recent years, university reading promotion has mostly used reader questionnaires to understand reader needs and promote classic literature, bestsellers, and psychological leisure books. The "Tsinghua University Recommended Bibliography," represented by Tsinghua University, was formed by the Academic Affairs Office and the School of Humanities and Social Sciences with reference to opinions from Tsinghua University and external experts, conducting reading guidance from the perspective of general and quality education through published recommended bibliographies. Current reading promotion mainly targets "universal" reading promotion for college student groups. Even the few reading promotion studies based on empirical analysis of borrowing by different undergraduate grades have insufficient depth to meet the needs of the entire talent cultivation process. There is a lack of longitudinal resource utilization statistics tracking and analysis of the same discipline and major group throughout the entire undergraduate study stage across different years and grades; a lack of horizontal comparative analysis with related tracking statistics of other certified discipline and major groups; and a lack of "professional knowledge" subject-based reading promotion plans based on longitudinal and horizontal comparative analysis. There is also a lack of evaluation and improvement planning after library reading guidance, and correspondingly, a lack of four-year phased reading process data analysis and comparison for certified discipline and major students, resulting in limited service support depth and intensity for certified discipline and major talent cultivation.

(2) Participate in school/college platform co-construction and collaboration, embedding reading promotion methods into subject-based professional service entities. Embedding library services into engineering education certification through innovative services is of great significance. As shown in [Figure 1: see original paper], libraries have solid foundations in professional literature resource guarantees and professional service guarantees for their functions in serving undergraduate education and teaching. General education support services are also carried out effectively. However, undergraduate education and teaching construction schools/colleges participating in engineering professional certification have limited understanding and utilization of library general education support services. Libraries need to change their promotion service methods and actively integrate into the undergraduate education and teaching system.

Embedding library services into school/college platforms through co-construction or linking library professional service URLs to school/college platforms can break through the "last mile" of library services for school/college development. Embedding reading promotion methods into school/college professional services can solve the bottleneck 困扰 of library subject-based reading promotion services, ensure that various support services applicable to professional certification can be fully understood and widely recognized by

schools/colleges, and be utilized timely. Currently, libraries mainly provide readers with resource and service navigation through official websites, offering unified resource discovery platform search entrances in prominent homepage positions for readers to quickly cross-database search for needed resources, and concentrating some commonly used service columns in separate homepage areas for reader convenience. Libraries such as Chongqing University Smart Library Portal also set up "School Digital Libraries" on their homepages, providing by school/college settings: branch library resources and monthly borrowing status, professional databases, journal recommendations, book recommendations, reader borrowing rankings, latest school achievements, core journal publication status, and subject librarian information. Through the unified school/college platform, teachers and students can easily browse and follow, enabling one-stop promotion to meet personalized school/college needs and utilization. Effective communication and cooperation and continuous innovation in promotion service methods are key to new era library construction and development and determine the future direction of university library subject-based service development.

4.3.4 Reader Service Objectives and Concepts and Professional Certification Talent Cultivation

(1) Establish a Lifelong Readers system. Lifelong learning is one of the basic competency requirements for graduates in professional certification, aligning with library reader service objectives and purposes. The materials describing the overall career and professional achievements that graduates of professional certification disciplines can achieve approximately five years after graduation are weak links in self-assessment reports, often requiring limited graduate tracking information from alumni affairs offices. A lifelong learner is first and fundamentally a lifelong reader. The term "lifelong reader" originates from the EU's "Lifelong Learning Program" launched in 2006 with a €7 billion investment, under which the "Lifelong Readers" (LiRe) reading promotion sub-project was established. For professional certification graduates who will become international engineers, maintaining lifelong learning requires convenient learning resources and environments. Rich learning resources are a significant advantage of university libraries and a powerful condition for increasing graduate stickiness and establishing long-term tracking and feedback mechanisms. Currently, most library services are shallow and single-content-focused, mainly introducing collection resources, guiding facility usage, and conducting database training. Services for deeper-level learning support such as student innovation and entrepreneurship, social survival, and lifelong learning literacy education are generally less effective. Establishing a lifelong reader system for graduates with needs, extending reader service objectives from "current readers" to "lifelong readers," is an effective way to ensure professional students' lifelong learning and form a benign feedback mechanism, as well as a powerful support for participating in school/college discipline development construction and improving professional certification quality and

effectiveness. Currently, on-campus faculty and students are the reader groups of university libraries, and library user permissions generally terminate upon student graduation. Establishing a lifelong reader system in university libraries, constructing corresponding service systems and tracking feedback mechanisms, and processing lifelong reader cards for users with needs before graduation can not only reflect the effective integration of university libraries into the social public service system and promote the full play of collection resource economic and social benefits but also facilitate obtaining graduate tracking information to achieve effective support for school/college professional certification.

(2) Transform reader service concepts. In new era library construction and development planning, besides strengthening cooperation and exchange with domestic and international homogeneous institutions, attention should also be paid to cooperation with heterogeneous institutions with potential cooperation possibilities. In the library support service system model (see [Figure 1: see original paper]), general knowledge education, professional ethics training, and work-study practice for cultivating general knowledge and general quality are not within the usual scope of library support services. However, based on existing service guarantee capabilities, these support services belong to expandable, deepenable, and systematizable service areas that require library service concept adjustment and transformation.

Enhancing on-campus service functions: For "general knowledge education" for the entire undergraduate group, libraries can propose construction intentions and applications to the university. With university coordination and Academic Affairs Office leadership, libraries can collaboratively organize and utilize library space, literature, and stable basic service teams to conduct concentrated and systematic general knowledge education and training for undergraduates.

Cooperating with off-campus heterogeneous institutions: Libraries can cooperate with socially beneficial vocational training institutions to jointly conduct professional ethics training, work-study practice, and other practical training, cultivation, and practical simulation teaching to enhance undergraduates' general quality, highlighting the practical effectiveness of general quality education.

Driven by the national plan to accelerate the establishment of a group of world-class universities and first-class disciplines, undergraduate education has become the foundation of universities. Promoting undergraduate education and teaching development through discipline and major certification will inevitably become a breakthrough point for university discipline construction. The work that university libraries need to do and the roles they must play in university professional certification cannot be ignored. Based on the Three-Dimension Two-Level service model, university libraries can provide practical support and services for discipline construction, talent cultivation, and engineering education professional certification from six aspects, accelerating innovation in collection resource construction, reading promotion innovation, and reader service objec-

tive reshaping, and deepening library soft service connotations and expanding service extensions. Libraries should not only be data statisticians during university evaluations and escorts for on-site inspections but also actively play greater practical roles in discipline construction, talent cultivation, and engineering education professional certification.

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Liu Fanru: Determined the paper topic and framework, wrote and revised the paper;
Zhang Chengwei: Constructed the 3D2L model, wrote the paper, and translated the abstract;
Zhu Mengru: Organized data.

A Case for the Service to the Professional Certification of Engineering Education: Constructing Support and Service System for Undergraduate Major in Colleges and Universities Library

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Abstract: [Purpose/significance] Oriented to the professional certification of engineering education, this paper constructed the supporting service system of university library, gave full play to the advantages of library resources and serves, and promoted the discipline construction and the cultivation of international engineering talents. [Method/process] By analyzing the contents of supporting services that can be deeply embedded in the university library on the seven-general-criteria of professional certification, the paper logically divided the 12 requirements of graduation ability. Based on the three-dimension and two-level model (3D2L Model), the paper constructed the undergraduate education and teaching support service system of university library from six aspects, three dimensions and two levels, for the example of DLUT. [Result/conclusion] The 3D2L Model is the structure model of discipline construction and talent cultivation in colleges and universities. The university library support service system is organized and instantiated according to the 3D2L Model, and some policy suggestions are put forward for specific implementation.

Keywords: library support service system; professional certification; reader services; professional teaching of undergraduate course

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