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Construction of Intellectual Property Literacy Education Mode in University Libraries

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Abstract: The importance and urgency of IPLE (intellectual property literacy education) are increasingly prominent. This paper aims to build an IPLE mode to provide support for the talent cultivation in university libraries facing opportunities and challenges in the service transformation period. The IPLE mode and content of the Regional Patent Information Centers (PIZ Regional Centers) in German universities and university libraries are studied through network research, literature research, and comparative analysis. Based on the practical experience, educational characteristics and advantages, this paper constructs an IPLE mode of university library that includes six modules. Building the IPLE mode of university libraries can provide reference for university libraries in the work of IPLE, and gradually form an IPLE system that meets the needs of users' training, conforms to the university's talent training objectives, and improves the development plan of the university libraries.

Keywords: Germany; PIZ; intellectual property literacy education; education mode

1 Introduction

As the globalization and the intellectualization of economies, intellectual property (IP) is becoming increasingly important in today's knowledge-driven society (Lall 2003). IP information plays a significant role in promoting technological change and innovation and is an important tool for global competition (Zhang and Bao 2022). In different industries, various technological innovation subjects need to build their own IP portfolio mode to improve and keep their competitiveness (Drivas et al. 2015; Nelson and Monsen 2014).

The essence of global economic and cultural competition is the competition for knowledge and talent. As the main field for talent cultivation, colleges and universities are the

hub for transforming knowledge into actual productivity. Research universities and libraries should also focus on building a talent cultivation mode with innovative consciousness and technological protection ability, improving patent literacy and promoting scientific and technological progress (Tan, Cao, and He 2018). Universities and colleges play an increasingly important role in the development of national science and technology and, under the situation of exploring the development and innovation of higher education, intellectual property literacy education (IPLE) is an important breakthrough. However, as outlined by Gimenez, Bonacelli, and Carneiro (2012), intellectual property is a topic that is not yet widespread present in the curriculum of undergraduate courses in developing countries. The IPLE in colleges and universities is thus a necessary basic education and a crucial way for college students to acquire the IP-related theories and skills required for innovation and entrepreneurship.

There is no unified and widely accepted concept of IP literacy. Some researchers have studied IP knowledge as a part of information literacy in university library and information science (Trencheva 2019) and emphasize the ability to search, find, sort out, analyze, and evaluate IP information through various information and communication technologies. Other researchers view IP literacy as including IP awareness and its application ability (Wu, Chang, and Li 2011).

In comparison with the related concept "information literacy," some scholars define IP literacy as people's ability to understand IP and use IP to solve problems. According to this perspective, IP literacy is considered to include basic IP education, patent literacy education, copyright literacy education, and education on basic laws and regulations (Li 2022; Li and Chen 2008). Overall, while there is no universally accepted definition of IP literacy, there is agreement that it involves understanding and applying concepts related to intellectual property.

A study focusing on IPLE for undergraduates points out that IP literacy involves the ability to use IP information and technology to solve relevant problems in their study and work, including IP awareness, ability, and morality (Zhang 2012). IP literacy for graduate students should also include professional knowledge and quality in science and technology, intelligence, law, and management (Li et al. 2015). Based on the existing research on the connotation of IP literacy, Chang et al. (2021)

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summarized that the IPLE for university libraries is to provide IPLE related activities including teaching, promotion, and social practice, aimed at improving the ability of educational subjects to create, use, protect, and manage intellectual property.

As the training and export base for talents, university and university libraries are well-placed to undertake IPLE due to their rich data resources and ability to integrate multi-source information on IP, which can integrate multi-source information of IP (C. X. Liu 2022). With high-quality teaching and scientific research conditions, university libraries can fully mobilize and integrate all kinds of IP teachers, experts, and scholars. Overall, the IPLE system is a combination of IP practice and education activities carried out by university libraries based on human resources, information resources, and space advantages, aiming at college students' understanding of IP standards, norms, policies, regulations, and application.

The role of university libraries in carrying out IPLE is mainly reflected in the following three aspects:

- (1) To enhance the IP awareness of college teachers and students.

University libraries can play a significant role in enhancing IP awareness and personnel training by engaging in IPLE initiatives. This includes building and improving the IP knowledge system to enhance the ability to distinguish common IP information and defend against intellectual property infringement, as well as enhancing the IP awareness of college students and encouraging them to actively participate in innovation and entrepreneurship activities (Zhu and Zhang 2022). Additionally, teachers and students can avoid potential legal risks and better protect their rights and interests through IPLE (C. Liu 2022).

- (2) To cooperate with the colleges and universities to develop IP personnel training.

University libraries can also cooperate with colleges and universities to cultivate interdisciplinary IP talents who meet the needs of national IP strategy development. The interdisciplinary and complex nature of IP can expand the breadth of thinking of teachers and students; the theoretical and practical teaching can enhance their knowledge structure and understanding of all aspects of IP to optimize operation, management, service, and other aspects (Zhu and Zhang 2022).

- (3) To meet the needs to expand and deepen the work of university libraries.

Expanding and deepening IPLE work in university libraries is necessary to meet the growing demand for innovation and entrepreneurship and discipline construction in universities. With their experience in information literacy education, university libraries can

provide a solid resource base and teacher base for carrying out IPLE. Overall, IPLE initiatives in university libraries can have a significant impact on enhancing IP awareness and personnel training.

Because of the growing correlation between IP and competitiveness, university libraries should actively adapt to national strategic needs, take their users' needs as benchmarks, optimize the IPLE and training mode of the university, and provide more powerful support for national IP talent training, university library development, and university scientific research management.

IP education in European and American countries starts relatively early, as they own rich experience in IP education, and university libraries can draw on this experience to promote and improve their IPLE programs. Certainly, the IP systems are different in different places in the world, so the IP education in European and American countries cannot be applied to any country. However, it is considered feasible to selectively adopt or make appropriate adjustments based on the IP laws and policies of each country.

Therefore, this paper studies the IPLE mode and content of Regional Patent Information Centers (PIZ) in German universities or university libraries through network research, literature research, and comparative analysis. Based on their practical experience, this study focuses on researching specific practical methods for carrying out IPLE and training in university libraries, with the aim of providing reference for university libraries in the work of IPLE. The goal is to gradually form an IPLE system that meets the training needs of users, conforms to the talent training objectives of schools, and improves the development planning of the center.

2 Literature Review

2.1 IPLE in European and American Universities

The patent system in European and American countries was established earlier than other countries, and the development of IPLE services is relatively mature. Patent education in colleges and universities is strengthened through policy guidance, system building, and faculty training.

The Patent Information Centers (PATLIB) in Europe provides various IP information services, such as IP information consulting, patent analysis, and various IP training (Yan 2019). The European Patent Office (EPO) has established the European Patent Academy, which cooperates closely with countries and international organizations and institutions to develop education and training plans related to IP rights in Europe. In addition to patent-related standardized courses,

the European Patent Academy develops education and training programs and provides specialized or personalized courses tailored to specific customer needs (Wu 2017; Zhang and Zhou 2019).

In 2016, the IP Awareness Network (IPAN) commissioned the National University of Singapore to investigate the campus knowledge and policy practice of IP in British higher education institutions (Zhang and Bao 2022). According to the investigation, 69 % of students and 32 % of faculty were unaware of the IP curriculum in their university, while 76 % of faculty supported the inclusion of IP curriculum in the education system. In 2017, the European Intellectual Property Office (EUIPO) launched the IP education project and established an expert network composed of the Ministry of Education and the National Intellectual Property Office of EU member countries to develop a common approach to IP education. The network has been constantly strengthening the connection with IP training in higher education (Zhang and Bao 2022).

Elsewhere, the United Kingdom has facilitated the patent education in colleges and universities through policy guidance and established a special network education base (Tan, Cao, and He 2018). Elsewhere, Arias-Coello et al. (2020) studied copyright literacy in Spanish libraries and focused on their knowledge, opinions, and experiences in IP legislation and training. Outside of Europe, Schmidt (2015) analyzed and compared the results of a survey distributed within the United States with the course content of the current ALA certified LIS program collected from online courses in the United States, in order to better provide IPLE for graduates to meet the upcoming IP demands in the job. Rodriguez, Greer, and Shipman (2014) also discussed the importance of incorporating copyright education as a part of the overall information literacy curriculum, and offered online courses specifically designed for the development of creative content and creative abilities related to copyright. Hawkridge et al. (2010) discussed whether the curriculum of British universities is influenced by the ownership of IP rights in Open Education Resources (OERs) and explored the issue of IP in the creation of open education resources in higher education in the UK.

In the United States, all colleges and universities have opened patent courses, with research universities mainly offering patent education as elective courses (Tan, Cao, and He 2018). The Patent and Trademark Resource Centers (PTRC) in the United States are designated by the United States Patent and Trademark Office (USPTO) to provide services and assistance to local inventors, enterprises, and other publics and disseminate patent and trademark information. A PTRC must provide public accessibility to products and services, offer patent and trademark training, and provide reference assistance and outreach to the public (Lei and

Tian 2020). Huang, Xiao, and Li (2021) investigated and analyzed the IPLE in 30 national IP demonstration universities and 10 university libraries in Switzerland, Sweden and the United States.

A report by the Center for Intellectual Property Understanding (CIPU) released in April 2021 pointed out that none of the top 20 American business schools in 2020 required or had core IP courses (Zhang and Bao 2022). CIPU believes that the problems revealed in the report are not only within the United States but also for all developing and developed countries that recognize the significant role of IP rights in their business success. Gubby (2015) claims that patent information research should not be restricted to law school graduates but should also be appropriately extended to business school students, and also proposes an education method to cultivate abilities in IP assessment and protection.

In summary, IPLE in European and American universities has received widespread attention, been extensively developed, and become one of the core contents of information literacy and innovation capacity. Many universities have set up intellectual property courses or modules aimed at cultivating students' intellectual property awareness and related skills; the IPLE courses emphasize the combination of theory and practice, using various forms of education and service to enhance students' intellectual property awareness and innovation capacity.

2.2 IPLE in Chinese Universities and University Libraries

Research on IPLE in Chinese colleges and universities has focused on two main aspects: IPLE services provided for all students by university libraries or University Intellectual Property Information Service Centers, and IPLE provided by specific schools for professional students.

In the first aspect, researchers have provided an overview of the current IP service situation and overall framework of Chinese university libraries, including education and training (Liu and Li 2020; Liu and Yu 2021; Zhang et al. 2020). Taking Chongqing University Library as an example, Chang et al. (2021) constructed a multi-level IPLE mode. Elsewhere, Wang et al. (2020) built an IP information service training course system with five modules for four groups of Chinese university library directors, subject librarians, scientific researchers, and students. Another example is Er and Ma, who proposed to attach importance to the implementation strategy of IP literacy curriculum education including curriculum content and curriculum reform (Er and Ma 2020). Furthermore, Wu et al. (2019) analyzed the problems in patent literacy education in Chinese universities, and proposed a patent

information literacy education method that meets different users' needs, taking the patent information service practice of a university library in China as an example. Finally, Xu, Zhang, and Bian (2019) found that the IPLE in Chinese university libraries mainly includes lectures and public elective courses, and pointed out that most universities have the problem of a lack of systematic training form and content.

In the second aspect, Deng and Zhou (2020), and Zhou (2018) put forward suggestions on the training mode and path of IP talents in domestic universities. Li (2018) also proposed a multi-level and multi-dimensional patent education training mode, while Jia and Liang (2016) analyzed the IP quality training mode in innovation and entrepreneurship education for college students.

In summary, researches on IPLE in Chinese colleges and universities are aimed at providing effective intellectual property education and training to support innovation and entrepreneurship within the country. The importance of intellectual property literacy education in Chinese universities and university libraries is gradually increasing, but there are still some gaps compared to European and American countries.

The IPLE in Chinese universities is still in its early stages and has not yet formed a systematic and standardized training system. Chinese universities and university libraries are gradually strengthening the promotion and implementation of IPLE, but further improvement of systems, expansion of channels, enhancement of service capabilities, and increased publicity and popularization are needed.

3 IPLE Mode of PIZ in German Universities

As an important member of the European Union, Germany has an excellent and mature IP system. Its innovation capacity

and construction of the IP creation and protection system have become an example for many countries in the world to learn from. In terms of IPLE in German universities and university libraries, network research, literature research, and comparative analysis show that the Patent Information Center (PIZ) in Germany plays a crucial role in providing IPLE services.

3.1 Introduction to PIZ in German Universities

The PIZ are recognized cooperation partners of the German Patent and Trade Mark Office (DPMA) and members of the European PATLIB network. The PIZnet was established in 1992 to develop patent information centers in German states and promote the dissemination of information related to IP to the public, without profit-oriented goals. There are 19 PIZ regional centers in Germany, of which 12 are located in universities or university libraries, serving not only university teachers and students but also small and medium-sized enterprises (SMEs), patent agents, and the public around the region (Lei et al. 2021).

The service projects offered by PIZ Regional Centers are based on a cooperation agreement with the DPMA, which lays down the services to be provided by the patent information centers within the framework of cooperation. As the PATLIB centers designated by EPO, the PIZ regional centers also cooperate with EPO under the coordination of DPMA and receive guidance and support from EPO; the PIZ Regional Centers also have the flexibility to add service projects according to the needs of regional users and their own advantages. The distribution of PIZ regional centers in German universities or university libraries is shown in Table 1 below.

Table 1: The distribution of PIZ regional centers in German universities or university libraries.

No.	Location of PIZ	Name of PIZ
1	RWTH Aachen University Library	Patent and Standards Center
2	TU Dortmund University Library	Information Centre Technology and Patents Dortmund
3	University of Magdeburg Library	Patent Information Centre and Standards Infopoint Magdeburg
4	Rostock University Library	Patent Information Centre Rostock
5	Chemnitz University of Technology	Patent Information Centre Chemnitz
6	Technical University of Darmstadt	Patent and Trademark Centre Rhein-Main
7	TU Dresden	Dresden University of Technology Patent Information Centre
8	Ilmenau University of Technology	TU Ilmenau, PATON, State Patent Centre Thuringia
9	University of Jena	Patent Information Centre Jena
10	Kaiserslautern University of Technology	Patent and Information Centre Rhineland-Palatinate Kaiserslautern
11	University of Bremen	Patent and Trademark Centre Bremen
12	Leibniz University Hanover	TIB – Leibniz Information Centre for Science and Technology

3.2 General Situation of IPLE of PIZ in German Universities

The organization and implementation of IPLE activities is an important part of the services of the PIZ in German universities or university libraries. In Germany, patents do not include utility models and designs. The service content in PIZ is not limited to patents, but also includes some other types of IP, such as copyright, designs, semiconductors, supplementary protection certificates, trademarks, and utility models.

The distribution of IP types provided by the above 12 university PIZ regional centers in Germany is shown in Table 2.

Among the 12 PIZ regional centers in universities or university libraries, TU Dresden covers all types of IP services. Most PIZ regional centers provide services related to patents, designs, trademarks, and utility models. Additionally, Ilmenau University of Technology covers supplementary protection certificate services, while the University of Magdeburg Library covers copyright services.

The content of IPLE mainly includes various consulting and training services, such as patent database and patent classification search and consultation, patent application and fee consultation, patent research strategy and patent evaluation consultation, teaching discussion, lecture arrangement, etc. Each PIZ center needs to carry out major courses on the subject of IP protection according to the cooperation agreement, provide basic information and materials on IP protection at trade exhibitions, publicize information on IP protection and related legal fields to the public, and customize lectures and training according to needs.

3.3 IPLE Mode of PIZ in German Universities or University Libraries

The IPLE of PIZ regional centers in German universities or university libraries mainly comes from three aspects. At the international level, EPO will provide education and training related to IP because these PIZ regional centers are also PATLIB centers which are designated by EPO; at the national level, DPMA will regularly train all PIZ association members; and at the regional level, PIZ regional centers will arrange regular training or external expert training according to its own regional characteristics. The IPLE mode of PIZ in German universities or university libraries is shown in Figure 1 below.

Education training experts come from EPO, DPMA, and PIZ, while also including patent lawyers. The topics and content of IPLE courses can be tailored to meet the specific needs of users at different levels of development. Each course or seminar will feature a detailed introduction to the lecturer and the training content.

In terms of the users' level, the education courses at PIZ are generally arranged based on the target audience. For example, online learning resources and materials and programs provided on the EPO website are classified by learning interests (such as Searching for Patents, Applying for a Patent, Law and Practice, and IP in Business) and profile (such as Enterprises, EQE Candidates, Judges, National Patent Offices, Patent Attorneys, Universities, Research Centers, and TTOs). DPMA introduces the topics of lectures and scope of training courses, focusing on specific target groups.

At the PIZ regional center, RWTH Aachen University Library Patent and Standards Center, IPLE courses are

Table 2: Types of IP and contents of IPLE in PIZ.

Name of PIZ	Types of IP						
	Copyright	Designs	Patents	Semiconductors	Supplementary protection certificates	Trade marks	Utility models
RWTH Aachen University Library		√	√			√	√
TU Dortmund University Library		√	√			√	√
University of Magdeburg Library	√	√	√			√	√
Rostock University Library		√	√			√	√
Chemnitz University of Technology		√	√			√	√
Technical University of Darmstadt		√	√			√	√
TU Dresden	√	√	√	√	√	√	√
Ilmenau University of Technology		√	√		√	√	√
University of Jena			√				
Kaiserslautern University of Technology		√	√			√	√
University of Bremen		√	√			√	√
Leibniz University Hanover	√	√	√				√

International level: EPO	National level: DPMA	Regional level: PIZ	Education institutions
<ul style="list-style-type: none"> • General IP consultation • Education and training courses • Personalized education • Online courses • Online seminars • 	<ul style="list-style-type: none"> • IP consultation • Education and training courses • Seminars • IP trade fairs • 	<ul style="list-style-type: none"> • IP consultation • Lectures and seminars • Online courseware and live broadcast • In-service training • Professional training • 	Education methods
<ul style="list-style-type: none"> • Results exchange • Discussion of hot issues • Patent value evaluation • Patent search and application • Law and practice • Economy and strategy • 	<ul style="list-style-type: none"> • Basic knowledge • IP history • Network database use • Discussion on hot issues • Commercial IP • Development of technical application fields..... 	<ul style="list-style-type: none"> • Patent system and designs • Legal basis and search • Patent family and database use • Patent management • Achievement transformation • Patent infringement assessment • TRIZ theory • 	Education courses

Figure 1: IPLE mode of PIZ in German universities or university libraries.

designed for PhDs, postdocs, permanent scientific research personnel, technical and administrative personnel, and others. Courses or seminars at PIZ regional centers, such as PATON, specify the applicable level (elementary, intermediate, or advanced), applicable objects (bachelor, master, patent engineer, patent manager, patent researcher, double degree, etc.), training objectives, and needs in the training lectures or course introduction. Additionally, Patent Information Centre Rostock provides IPLE courses for students and scientists at universities, as well as employees of SMEs and research institutions and anyone interested in industrial property information.

In terms of education methods, the PIZ use both online and offline provision of training materials. Online resources range from training courseware and videos to courses, while offline resources include consultation, lectures, seminars, and IP exhibitions while, at the regional level, external experts are also brought in for vocational training and major training initiatives. For instance, PATON offers lectures on business law protection and IP management for students with bachelor's and master's degrees, in-service training for patent engineers and double degree personnel, and vocational training for patent researchers. Patent Information Centre Rostock also provides embedded training courses tailored to users' needs.

In terms of education courses and certifications, PIZ regional centers' training courses are highly systematic, ensuring professionalism, continuity, and hierarchy of training. Each center designs courses tailored to the characteristics and needs of their region, and provides corresponding training certificates for different users. For example, participants in education training courses at Aachen University of Technology Library receive an attendance certificate issued by the library, while participants in

education training courses at PATON receive qualification certificates as patent engineers/patent managers or patent researchers.

In terms of education promotion, PIZ regional centers carry out various activities including propaganda, exhibitions, special lectures, consultation, and evaluation services on World Intellectual Property Day, the PIZnet Action Week (held every September), and National Day. These activities broaden the service content, expand the depth of service, and enhance users' awareness of IP.

3.4 Advantages and Characteristics of IPLE of PIZ in German Universities or University Libraries

The survey results show that IPLE courses provided by PIZ regional centers in German universities or university libraries are abundant, systematic, and hierarchical. Users at different types and levels can select appropriate courses based on their needs. At the international and national levels, training and education primarily focus on basic laws and regulations, as well as the search and utilization of relevant databases. PIZ regional centers are responsible for providing detailed content.

The IPLE courses offered by German universities or university libraries have several advantages and characteristics:

- (1) They have established partnerships with other IP institutions and associations to provide more diverse and high-quality services. Experts from EPO, DPMA, and off-campus IP service institutions participate extensively, ensuring professionalism and accuracy of educational content.

- (2) They have a comprehensive service system that covers a wide range of IP topics, including patents, trademarks, designs, copyrights, and licensing.
- (3) The vast majority of training lectures and courses offered by PIZ regional centers in German universities or university libraries define the target user type and ensure course effectiveness.
- (4) Education methods include consultation, lectures, courses, activities, and online learning resources, while education promotion mainly involves holding meaningful activities on World Intellectual Property Day, PIZnet Action Week, and National Day.

4 Discussion

Drawing from the IPLE mode and practical experience of PIZ regional centers in German universities or university libraries, the IPLE mode for university libraries has been constructed. This mode includes six modules: education experts, education levels, education methods, education courses, education promotion, and education evaluation, as shown in Figure 2.

4.1 Education Expert Module

IP is a subject that requires interdisciplinary knowledge and strong practical application. As such, high-quality IP teachers in colleges and universities are essential to improving teaching levels and fostering innovation and entrepreneurship. The PIZ regional centers of German universities and

university libraries have EPO and DPMA experts who participate directly in international and national-level training, ensuring the professionalism and timeliness of knowledge. At the regional level, center personnel who understand the region’s development also participate in training. Experts from IP commercial institutions, enterprises, or chambers of commerce are hired for training based on the characteristics of the region and users’ needs.

Teachers of information literacy education in university libraries who have experience in document information acquisition, search skills, and patent-related knowledge could undertake part of the task of IPLE after systematic training in IP theory and practice. Combining information literacy education with IPLE can also achieve good teaching results; certainly, considering the complexity and professionalism of IP rights, some university libraries not having the conditions to develop IPLE, or not being able to carry out in-depth IPLE, adopting a cross-border education mode with multi-agency cooperation is encouraged in order to provide personalized and customized education and training services. The selection of training experts can include the following aspects:

- (1) Experts from the National IP Administration and local IP offices who are familiar with various IP systems, laws, and regulations. They understand the current situation and issues related to IP development in colleges and universities, and have experience in patent management, infringement judgment, patent early warning, etc.
- (2) Teachers or external experts from relevant colleges of the university, such as IP schools, law schools, or management schools as a supplement to the content

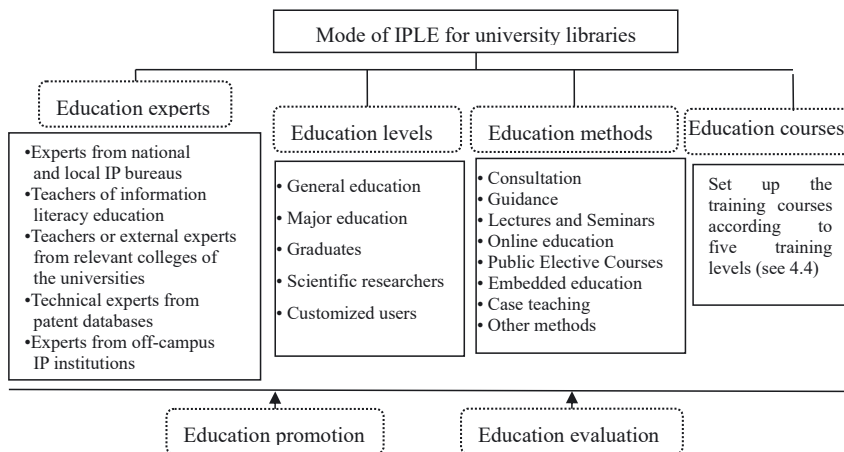


Figure 2: Mode of IPLE for university libraries.

and direction. In addition, University libraries can also develop strategic partnerships with (commercial) IP information service centers in the region. These institutions provide extensive services in IP strategic planning research, information analysis and consultation, scientific and technological strategic research and consultation, regional development planning, industrial competitive intelligence research, data platform development and construction, talent exchange and training, and application and implementation of projects. By collaborating with these centers, universities can build a new and innovative patent information service system.

- (3) Technical experts from patent databases who have professional knowledge and expertise in patent information searching and can provide technical consultation, guidance, support, and training. Additionally, under university policies and funding conditions, purchasing patent analysis software and receiving after-sales services such as search and analysis consulting, regular training for librarians, teachers, and students, and guidance on the writing of topics and analysis reports could be helpful.
- (4) Experts from off-campus IP institutions, such as lawyers in patent agencies, who are proficient in patent-related knowledge and have experience in patent writing, the review process, and communication with the patent review department.

4.2 Education Level Module

The IPLE courses offered by PIZ regional centers in German universities and university libraries specify target groups, applicable objects, applicable levels, and training objectives. To integrate IP education with quality and general education, innovation education, and professional education (Liu and Yin 2017), university libraries can offer IPLE at different user levels based on major settings, discipline development, and user needs:

- (1) General education
Universities libraries should cultivate the compound IP talents with legal, management, and technical knowledge and promote the integration and development of the intersection and application of disciplines and IP knowledge. University libraries can also provide public optional courses on IP general education that require class hours and credits for students. The aim is to improve students' awareness of IP rights, the legal knowledge base, and common issues related to IP utilization through various infringement cases.

- (2) Major education
University libraries can offer a series of major courses on IP for the cultivation of IP majors and talents. The goal is to understand and master IP-related systems, policies, and regulations worldwide, learn IP strategic planning and operation management knowledge, and conduct IP infringement issues and IP evaluation research.
- (3) Graduates
Graduates face challenges related to citation and signature norms when writing dissertations or publishing articles. Strengthening their copyright awareness can help them understand the current situation of university copyright protection and use copyright law to protect themselves and others' legitimate rights and interests.
Moreover, cultivating innovative and entrepreneurial talents is also essential for graduates as they enter the workforce. University libraries can integrate into the university's innovation and entrepreneurship education system to provide comprehensive education and training services for innovation and entrepreneurship.
- (4) Scientific researchers
As the main force of scientific and technological innovation in colleges and universities, scientific researchers should have a strong awareness of IP rights, understand the patent application process and transformation of scientific and technological achievements, analyze IP information, and be aware of IP management and strategic layout. They should also avoid infringement risks when developing technology and writing patent claims.
- (5) Customized users
University libraries can provide embedded education training and customized lectures for teachers and students based on their writing and research needs. Special IP training can be provided for patent information search competitions and innovation and entrepreneurship projects to help users master patent search and analysis skills.

4.3 Education Methods Module

In addition to online and offline consultation, lectures and seminars, the IPLE methods for the PIZ regional centers in German universities and university libraries also include holding IP exhibitions, PIZnet action weeks, in-service training, and major training. The education methods that university libraries can choose are shown in Figure 3 below.

In the above-mentioned education methods, the online education method includes various kinds of online courses or lectures, which serve as a supplementary tool for

traditional offline education and training. Fragmented time can be used to choose different learning courses on various platforms.

In addition, IPLE emphasizes the combination of theory and practice, so the education method of case teaching is useful in promoting and stimulating IP knowledge learning. The case teaching method mainly uses classic cases and current events related to IP that have been judged to help students improve their awareness of IP and problem-solving abilities in practice.

4.4 Education Courses Module

The education courses of the PIZ regional centers will be set for different levels of training objects. For example, Aachen University of Technology Library provides courses on patent information and database introduction, patent search methods and strategies, law enforcement and recovery, and patent document formation; Dresden University of Technology offers courses on the theory and practice of property rights, research strategies, and the use of property rights databases; and PATON's courses cover patent introduction and search, national IP systems, using DPMA, EPO, and WIPO databases, writing and reading patents correctly, patent strategies, and evaluating patent infringement risks effectively.

On the basis of learning from the course content setting method of the PIZ regional centers, the education courses of

university libraries are designed according to the five levels of training levels in 4.2, as shown in Table 3 below.

Practical courses play a crucial role in IPLE. Students should be considered as the subject of learning, and heuristic teaching methods should be adopted to improve their thinking ability and cultivate practical application skills. This includes traditional practice courses like major practice and graduation practice, as well as special practical courses such as IP agency and evaluation, information search and analysis, etc. Rather than pure theoretical explanations by teachers in the classroom, universities can invite practical experts such as industry practitioners, judicial judges, administrators, and others to give embedded lectures in major courses at university libraries.

The specific curriculum system must be constructed and selected according to the requirements of school curriculum construction and discipline development. The teaching content should be designed and updated according to the students' professional backgrounds and, additionally, an assessment and incentive mechanism can be established to increase the learning efficiency and participation rate of users. For example, after completing specified training hours (including class hours and practice hours) and passing assessments (which can include written exams, online exams, big reports, etc.), credit certificates or training completion certificates can be issued to enhance enthusiasm and standardize and institutionalize the education and training system.

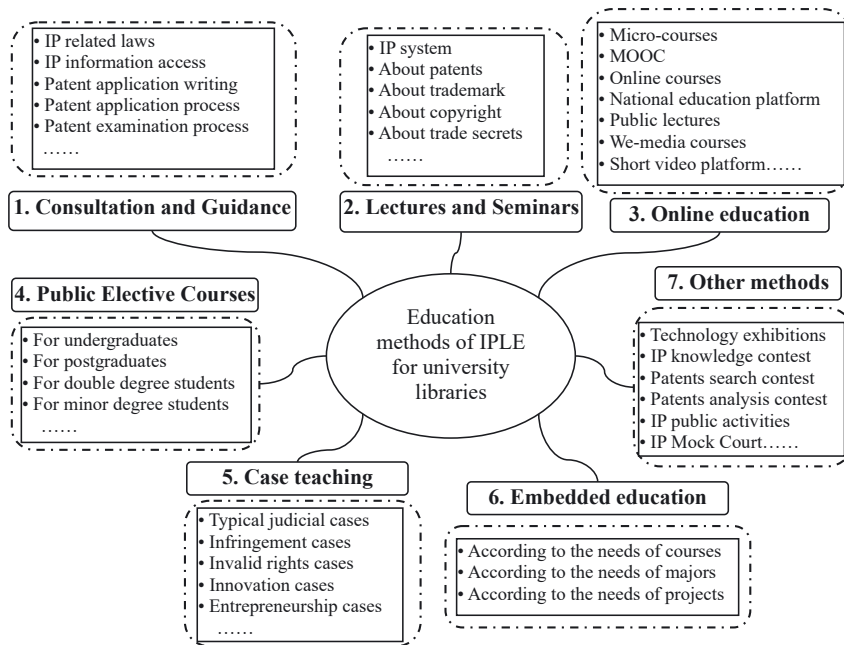


Figure 3: Education methods of IPLE in university libraries.

Table 3: Education courses designed for university libraries.

Education levels	Sub-modules	Contents of courses
1. General education	IP basic knowledge	Basic legal knowledge of various types of IP rights such as patents, copyright, trademark, trade secrets, etc. Search and utilization of patent literature information; IP application and examination process, etc.
	IP infringement judgment	The basis for judging infringement of various types of IP rights, introduction to classic precedents and hot cases.
2. Major education	IP strategic planning	The current situation and trend of IP development all over the world, interpretation and research of the latest IP related policies, industrial IP strategic planning and implementation, and national IP strategy analysis, etc.
	IP infringement assessment	Identification of competitors' infringement, evasion of legal risk of IP, research on IP infringement issues such as service marks, manufacturer names, trademarks, and preventing unfair competition, analysis and evaluation of IP, and patent competitiveness evaluation, etc.
3. Graduates	Dissertation writing	Identification standard of copyright infringement, analysis of the characteristics of copyright infringement conditions, constitutive requirements of copyright infringement, legal conditions and consequences of personal and commercial use of pictures, etc.
	Innovation and entrepreneurship	Cultivation of innovative thinking and innovative consciousness, innovation and entrepreneurship with IP protection strategy, and trademark and brand creation and infringement, etc.
4. Scientific researchers	IP basic knowledge	Basic legal knowledge of various types of IP, development situation of IP law in major countries, scientific and technological innovation with IP, etc.
	IP application and examination	Patent application and examination process, provisions on service inventions and non-service inventions, search of existing technology before application, acquisition of patent documents all over the world, interpretation of examination opinions, etc.
	IP information use	Principles for judging infringement of IP rights, analysis of IP information, IP property management, transformation of scientific and technological achievements, strategic layout of IP, etc.
5. Customized users		Arrange courses according to users' needs

Due to the fact that IP involves a vast complex system, and the IP system in each country has its own characteristics and directions, it is impossible to exhaustively list all the education courses, and these courses listed above may not be applicable to every country. University libraries can accommodate, add, or delete some courses through local customization according to user needs or the socioeconomic environments in their own countries, or customize the training courses to specific local IP and innovation needs.

4.5 Education Promotion Module

The purpose of promotion is to enhance users' understanding of the work scope and content of university libraries, guide demand, and promote the deepening and expansion of IPLE. PIZ regional centers can announce their training courses on websites or notify upcoming lecture training courses and propagate and promote the service content on special days by featuring training content.

University libraries can promote IP awareness among university teachers and students during special days such as Readers' Service Week, World Intellectual Property Day, and other activities. This can be achieved by publishing tweets on official websites and social media, conducting a series of lectures, printing and distributing IP brochures, inviting experts to give academic reports, inviting patent agents to introduce the patent application process and interpretation of examination opinions, and organizing IP knowledge competitions.

4.6 Education Evaluation Module

Establishing an evaluation system for IP information literacy education can promote IPLE, with such an evaluation system including educational approaches, platforms, content, and feedback from teachers and students. Due to the complexity of research, multiple university libraries should cooperate to carry out joint research on IPLE and realize the co-construction and sharing of the evaluation system. The evaluation system helps university libraries formulate objectives, design contents, and cultivate IPLE teams.

Evaluation and feedback investigate problems in each link of IPLE and identify key areas for improvement, avoiding blindness in education and training activities and relying too much on subjective judgment. Evaluation and feedback can help optimize the training mode and identify missing courses and objective problems to make timely adjustments. Feedback may be face-to-face, via email, through an evaluation

system or questionnaires, and results can inform course selection and work improvement.

5 Conclusion and Future Work

IPLE reflects the important functions of university libraries to support the development of disciplines and teaching assistance. As an important transformation of innovative services, IPLE aims to cultivate compound and innovative IP talents and provide strong support for scientific and technological innovation as well as achievement transformation of university researchers. Based on the IPLE mode, content, and practical experience of PIZ regional centers in German universities and university libraries, this paper proposes an IPLE mode for university libraries consisting of six modules: training experts, levels, methods, courses, promotion, and evaluation.

In the future, our work could be extended to further aspects as follows:

- (1) Mining the needs of IPLE in colleges and universities by investigating the current situation of IP literacy in universities and analyzing the needs of IPLE to effectively improve service quality.
- (2) Implementing an incentive mechanism for librarians to increase the expert reserve, including full-time positions, a cooperation education team, reasonable positioning, and additional incentives due to the time and energy needed for IPLE.
- (3) Coordinating IPLE with the university's discipline construction planning to develop scientific, reasonable, and feasible implementation plans that suit the university's discipline construction, major training, and IP services.
- (4) Improving the breadth of IPLE by developing other IP types such as trademarks, copyrights, and trade secrets that impact enterprise development and strategic planning.

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