Research on Interdisciplinary Training Model under the Framework of Laboratory Co-construction
—Take Language Technology as an Example

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--***ABSTRACT***--
To enhance the interaction and fusion of the arts and science, the paper proposes the open and sharing idea of "big experiment". The major of applied linguistics lacks the science knowledge in the aspect of scientific empirical research, while the major of informatics lacks the linguistics knowledge such as voice, syntax, semantics, etc. Thus, we can collaboratively establish the language technology lab against the idea of big experiment, to cultivate the interdisciplinary students in this lab vessel, explore the new path to student cultivation, and popularize this mode.
KEYWORDS: *Lab; collaboratively; interdisciplinary; language; science and technology*

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I.   INTRODUCTION

Against the idea of big experiment, the direction of language technology in the major of applied linguistics is integrated with other disciplines with knowledge crossing, to collaboratively establish a lab, through which frame, the premium teaching resources of arts and science in the direction of language technology are integrated. To avoid repeated investment in platform and equipment of language technology aspect or a single discipline starting from own perspective instead of making comprehensive investment and construction, the paper takes the cultivation of interdisciplinary postgraduates in the direction of language technology in the Ji'nan University as an example. The cultivation is mainly dispersed in the College of Information Science and Technology and applied linguistics department of College of Chinese Language and Culture. The College of Information Science and Technology includes such directions as information retrieval and application, machine learning, data mining, speech processing and coding, etc.; the College of Chinese Language and Culture has such directions as corpus base, computational linguistics, speech processing, psycholinguistics, etc. These are all cultivation directions of postgraduates with crossing of arts and science in the language technology. For the lack of operable cultivation frame for direction, following bottleneck problems exist in cultivation currently:

(1) The tutors' background is pure arts or pure science and engineering, so they fail to guide the students effectively and deeply in the knowledge otherwise than own discipline.

(2) The part involving interdisciplinary knowledge in the students' graduation theses are not comprehensible to the tutors, judges, classmates, even the authors themselves do not understand it thoroughly, leading to a perfunctory pass and graduation.

(3) The unscientific or nonstandard training in language technology quality in terms of course system. For example, the applied linguistics department's some electrified education technology courses set for the students are just life skills of the moderns objectively, yet are not closely related to the language technology. The postgraduates in the College of Information Science and Technology bypasses the semantics part or just cannot start this part in research on information retrieval and application, machine learning, data mining[1-3].

The above are just the interdisciplinary cultivation problems insolvable by the pure master pilots of arts and master pilots of science in language technology.

The College of Chinese Language and Culture and the College of Information and Technology are all aggressively applying to become a provincial or country level experimental teaching demonstration center, and a country-level virtual simulation experimental teaching center. To avoid repeated investment or incomprehensive investment and construction, and enhance the interaction and fusion of arts and science, we propose the open and sharing idea of "big experiment", to enhance the technological knowledge in empirical research on language technology and linguistic science for the major of applied linguistics, while further enhancing the linguistics knowledge such as semantics, syntax, speech analysis, etc. for the College of Information Science and Technology can be realized via collaboratively constructing a language technology lab against the idea of big experiment, to cultivate the interdisciplinary postgraduates in this lab vessel[5-7].

Thus, we can collaboratively construct a lab, in which frame, the premium teaching resources of the arts and science will be integrated, to explore the new path to cultivation of this type of interdisciplinary postgraduates and popularize this mode.

II. RESEARCH STATUS

2.1 Foreign research status

The interdisciplinary cultivation mode of postgraduates has been widely established in America, and various interdisciplinary research centers and research institutions were founded in succession. For example, Harvard University, Massachusetts Institute of Technology and Princeton University, etc. all set up respective interdisciplinary research centers. Wherein, the Massachusetts Institute of Technology set 66 interdisciplinary organizations, and a great many mature interdisciplinary organizations have set foot in the doctoral education. This indicates that the interdisciplinary cultivation of postgraduates has not only become the basic idea of postgraduate cultivation in America, but also has been widely implemented[8-11].

2.2 Domestic research status

The State Compendium of Intermediate Educational Reform and Development (2010-2020) points out that the innovation on the talents cultivation mode should adapt to the needs of national and social development, and should "innovate the education and teaching methods and explore manifold cultivation modes". The postgraduate education is closely related to the technological talents resources especially the high-level interdisciplinary talents, and we should deepen high-level talents cultivation and the sharing mechanism of premium resources of different disciplines, make interdisciplinary, trans-unit and team-based combined cultivation, expedite knowledge innovation and technology innovation.

In recent years, the American idea and practice of interdisciplinary cultivation for postgraduates have received much attention from the researchers and managers in Chinese domain of higher education. In an effort to meet the demands of the social development for the high-level interdisciplinary talents, many colleges in China gradually began to explore the interdisciplinary cultivation of postgraduates. For example, Beijing University founded the "Biomedical interdisciplinary research center" with crossing of biomedicine, physical science, applied science and social science, and cultivated interdisciplinary postgraduates in the major of biomedical engineering in 2001. The Plasma Physics Institute of Chinese Academy of Sciences made certain achievements in interdisciplinary cultivation of postgraduates with crossing of physics, biology and chemistry. However, as a whole, the interdisciplinary cultivation of postgraduates in China still prioritizes the form over the content and has more theoretical content than practice. The current research on how to build an interdisciplinary postgraduate cultivation mode is far from adequate, and the interdisciplinary cultivation of postgraduates still lacks a scheme easy for practical operation.

III. DESIGN OF INTERDISCIPLINARY LANGUAGE TECHNOLOGY POSTGRADUATE CULTIVATION IN THE FRAME OF COLLABORATIVELY CONSTRUCTED LAB

The paper constructs the idea of big experiment based on an analysis on the history and status of language technology cultivation, to explore the mode of language technology interdisciplinary postgraduate cultivation in the frame of collaboratively constructed lab.
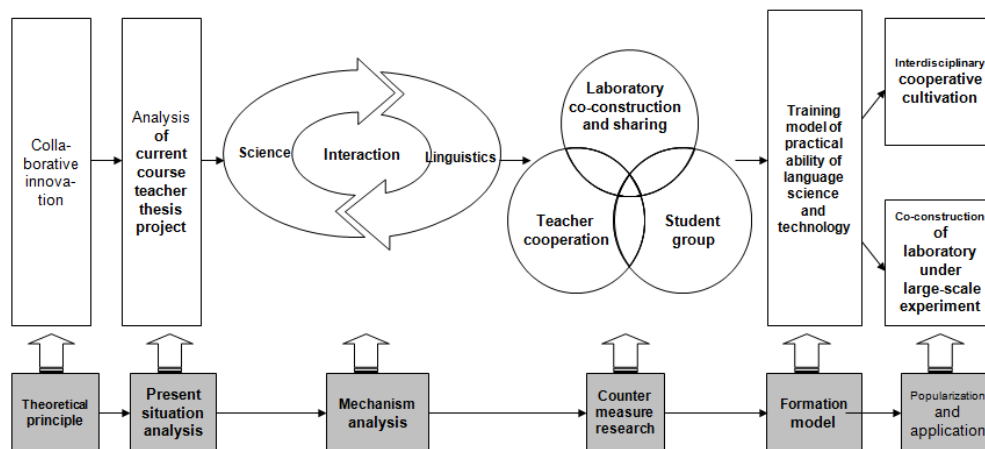

Fig.1 The flow chart for construction

(1) The idea of big experiment

The idea places a high premium on hands-on operability in experiment and fusion of humanistic education and scientific experiment, to realize combination of perceptual knowledge and rational knowledge, combination of language theory and scientific experiment, linguistry and technology. With transition from the arts class to the technology lab, it aims to cultivate the modern language professionals with solid basic skills, strong professional practice ability, good innovation awareness and high innovation ability.

(2) The theory of collaborative innovation

"Collaborative innovation" means effective convergence of innovation resources and elements to fully unleash the vigor of such innovation elements as "talents, capital, information and technology" between the innovation subjects by breaking their inter-barrier. Our research does not involve the meaning of "industry-university-research cooperation" in the collaborative innovation, but mainly utilizes the "collaborative" means which break the barrier among the subjects.

IV. ANALYSIS ON THE MECHANISM OF COLLABORATIVE CONSTRUCTION AND RESEARCH ON THE COUNTERMEASURES

4.1 Combing of the historical and current status

Firstly, we make a comparative analysis on the historical and current status of language technology postgraduate cultivation in the applied linguistics department and the College of Information and Technology. The comparative analysis is mainly about the following aspects:

(1) The investigation of the historical situation and current status for the direction of language technology research set by the applied linguistics department in the College of Chinese Language and Culture and the College of Information and Technology.

The directions set by the College of Information and Technology include: machine learning, data mining, information retrieval and application, speech processing and coding, etc. The projects carried out include: Data mining lab of Job168.com, support for data mining and marketing decision for Taobao Mall; intelligent books recommendation for universal library; collection and push-notification of business news; collection of public sentiment and analysis and prewarning; realtime collection of technological public sentiment; classification of massive news in newspaper; retrieval-based research on medical diagnosis technology; analysis on ingredients and efficacy of TCM prescription; BBS with monitoring function; observation and tracking of Weibo hotspots; mining of social network data; psychoanalysis based on Weibo, etc.

The directions set by the College of Chinese Language and Culture include: Evaluation on computer-aided design language, automatic indexing for documentary information, computational linguistics, computational linguistics assisted Chinese teaching, construction and processing of corpus base, etc. The projects carried out include: research on classification problem of network corpus base, automatic classification of network resource text, construction of Guangdong semantic grid platform of linguistic resources, etc.

(2) Investigation of equipment and platform construction for language technology research put in by the lab. For example, the College of Chinese Language and Culture constructed a speech lab and Chinese language information processing lab, etc. and outfitted it with corresponding platform and equipment.

(3) Investigation of courses set for language technology shows that none of the language technology courses set by the College of Information Technology and the College of Chinese Language and Culture is systematic, not to mention interaction and collaborative construction.

(4) Investigation of the tutors' academic background and the project led by them.

(5) Analysis on recruitment of language technology postgraduate.

(6) Analysis and investigation of graduation thesis of language technology research

4.2 Statistic analysis of data

Following analytical approaches are mainly adopted to compare the above aspects for the language technology postgraduate cultivation by the applied linguistics department and the College of Information and Technology:

(1) Theoretical modeling method: Consulted substantive literature, cultivated language technology interdisciplinary postgraduates based on the theoretical basis of big experiment idea and collaborative innovation in the implementation entity vessel of collaboratively constructed lab.

(2) Case analysis: Analyze the historical situation and current status of language technology postgraduate cultivation by the applied linguistics institute in the College of Chinese Language and Culture and the College of Information and Technology.

(3) Survey method: Surveyed the major direction, recruitment, cultivation, tutor, matched courses, projects, etc. for the language technology interdisciplinary direction in the College of Chinese Language and Culture and College of Information and Technology.

(4) Thesis analysis method: Analyze the postgraduates' theses to find out problems.

(5) Students interview method: Design the interview topics and interview with the postgraduates in the direction

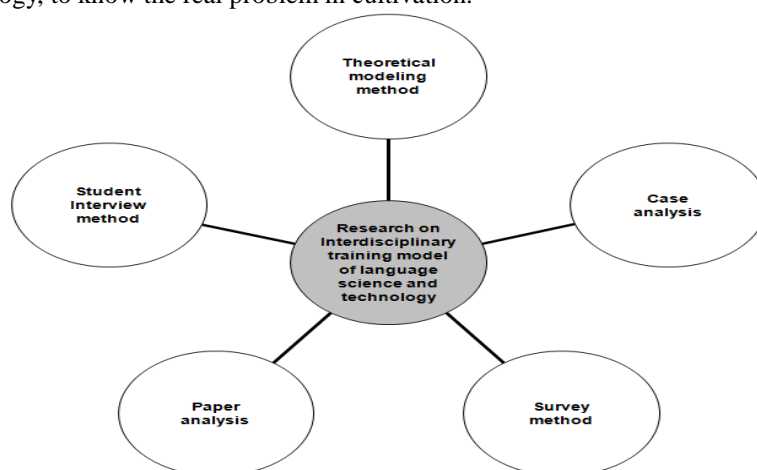of language technology, to know the real problem in cultivation.

Fig.2 Research methods

Following data is obtained via gathering the statistical data of postgraduates' graduation theses in the applied linguistics department and College of Information and Technology from 2010 to 2016:

		Number of tutors in the applied linguistics	Number of theses	Number of tutors in the information technology department	Number of theses
Language technology research	MOOC	3	26	2	13
	APP	2	14	4	34
Information technology research	Artificial intelligence	0	0	8	45
	Information data base	3	17	0	0
	Information integration	0	0	5	28

Table 1 Summary of language technology theses

Following conclusions are drawn according to the above data table: the tutors of applied linguistics department were mainly in the aspect of language technology research, and mainly guided the students to write the theses combining language technology and language teaching. In addition, the tutors of experimental phonetics also guided the students to write the theses of voice information database, and had not yet set foot in the artificial intelligence and information integration. The students of College of Information and Technology presented theses of all aspects except the information data base, particularly more in the research on artificial intelligence and APP. The students of College of Information and Technology were more focused on the utilization of information technology means and basically had no good examples combining linguistics, which further prompt us that to expand the academic view of postgraduates in different majors counts for much for interdisciplinary cultivation of language technology postgraduates, and only edification of different major knowledge can enable them to view and solve the problems in a better and more comprehensive way.

4.3 Mechanism analysis and countermeasures research
(1) Mechanism analysis
The modern general direction of language technology is mutual cooperation and interpenetration of the arts and science, which two must be organically combined to meet the current society's needs for cultivation of high-level language technology talents. A language technology interdisciplinary project generally needs cooperation between two or three arts and science crossing teams to be consummated (For example, the language rehabilitation training project started by professor Cheng Zhuoming, et al. in the Overseas Chinese Hospital of Ji'nan University used cooperation among multiple discipline teams such as applied linguistics, computer, communication, psychology, clinical medicine, etc., and each discipline is indispensable).
The cooperation between arts and science for language technology direction includes three intersections: intersection of project implementation, intersection of lab construction, intersection of students' knowledge structure (course, graduation theses, etc.)
①Intersection of project implementation: From the perspective of project, the projects led by the tutors in the

College of Chinese Language and Culture and the College of Information Technology or graduation projects of students involve a great many problems with crossing of arts and science. The projects of machine learning, data mining, information retrieval and application, speech processing and coding, etc. can be implemented from the perspective of linguistics semantics, etc. by the applied linguistics tutors, while the tutors in the College of Information Technology need to implement them from such perspectives as pattern recognition.

②Intersection of lab construction: In terms of the input in language technology construction for lab, different students have different focuses in construction of platform and equipment in speech signal analysis and processing, machine learning, corpus base, Chinese language information processing, etc., and have intersections. Against the big experiment idea, the collaborative construction and sharing of language technology lab is more scientific.

③In terms of students' knowledge structure (course, graduation thesis, etc.), the postgraduates have a blind zone in the knowledge structure outside respective major when doing the tasks or finishing the language technology courses, so they tend to resort to the students of related majors for help. This aspect has intersection too.

(2) Countermeasures research

Via the above empirical analysis, oriented towards the cultivation of language technology interdisciplinary postgraduates, the paper proposes following countermeasures by integrating the premium teaching resources of different disciplines, and gradually forms a cultivation mode.

①Collaboratively construct and share the lab against the big experiment idea, with the lab as the implementation entity to realize interdisciplinary cultivation of postgraduates.

②Tutors collaborate under the lab, and the dual-tutor system or chief and deputy tutors system should be adopted. With the use of lab vessel and interdisciplinary tutor, the students are enabled to correct a lot of knowledge outside respective majors.

③Multiple multidisciplinary tutors under the lab jointly examine the postgraduates in graduation.

④Collaboration of tutors' projects under the lab to make good for deficiency. For example, such interdisciplinary projects as text mining and retrieval, speech recognition, language rehabilitation training, etc. require cooperation among different major teams such as linguistics, communication and computer.

⑤The students can organize teams for mutual help under the lab (The College of Chinese Language and Culture already has successful experience: the domestic students and foreign students organize teams to help each other in language learning, with a significant effect delivered).

⑥The graduate schools set corresponding students project for interdisciplinary cultivation, and encourage the students with different major backgrounds to jointly apply for them.

⑦The College of Information and Technology and the College of Chinese Language and Culture jointly construct the language technology courses.

(3) Form a cultivation mode and popularize

①Form a frame and mode for cultivation of language technology interdisciplinary postgraduates

②Practice and popularize it, in the hope of making it a supplemental mode for the postgraduate education system

③To realize interdisciplinary cultivation, collaboratively construct a lab against the big experiment idea to share premium resources.

V. MAJOR VIEWPOINTS

5.1 Theoretical significance of research on collaborative cultivation

(1) Comprehension and integrated application of the big experiment idea and the theory of collaborative innovation.

(2) Based on following the idea that postgraduate education should emphasize cultivation of innovation ability, the configuration mode of teaching resources and combination form of teaching conditions are reformed. With the collaboratively constructed lab against the idea of big experiment as the implementation entity vessel, the cultivation mode of language technology interdisciplinary postgraduates is explored, to handle the bottleneck problem in interdisciplinary cultivation to cultivate high-level interdisciplinary talents.

5.2 Practical significance of interdisciplinary cultivation mode

(1) The cultivation mode of language technology interdisciplinary postgraduates can be popularized and copied to other interdisciplines. This mode can serve as a supplemental mode for the postgraduate education system.

(2) The value and use rate of premium teaching resources are largely improved via collaborative construction of lab against the idea of big experiment, to fully realize sharing.

(3) The collaborative construction of lab against the idea of big experiment is a new operable scheme for cultivation of language technology interdisciplinary postgraduates. With high model value, it can be popularized and applied.

(4) The collaboratively constructed lab can accommodate several small experimental platforms, and cultivate postgraduates in several major directions, thereby raising the value and utilization ratio of equipment, platform and premium teaching resources.

VI. SUMMARY

The paper analyzes the current status of domestic and foreign interdisciplinary cultivation of postgraduates and combines the situation of thesis subjects of postgraduates in two different majors of applied linguistics and information technology to have a good grip on the importance of interdisciplinary postgraduate cultivation. We propose exploring the interdisciplinary cultivation mode in the frame of collaboratively constructed lab, which is of important theoretical significance and practical meaning, and can help the theoretical exploration and cultivation practice for cultivation of interdisciplinary talents in the high-level university construction. The interdisciplinary cultivation of postgraduates is a necessary reform on cultivation stimulated by the social needs. How to closely relate different disciplines which are seemingly unrelated yet actually closely related in connotation and have nested extensional industries is a topic worth researching.

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