The Exploration and Practice of Talent Cultivation in Big Data Specialty in Universities under the Mode of Science and Education Integration

Take Qinghai University as an Example

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Abstract. The integration of science and education is an important way to achieve the collaborative development of scientific research and teaching innovation and cultivate innovative professionals. The cultivation of big data professionals is an inevitable demand for the scientific, sustained, and high-speed development of industry in the current information era. In order to implement the national strategy of rejuvenating the country through science and education, the strategy of strengthening the country through talent development, and the strategy of innovation driven development based on the overall deployment of science and technology, education, and talent, this article takes the cultivation of talents in the big data direction of computer science and technology majors at Qinghai University as an example, proposes a collaborative cultivation model for talents in big data majors that integrates science and education, and explores the integration of scientific research and education and teaching Promote innovative talent cultivation models and major measures for collaborative development of industry, university, and research, and summarize talent cultivation ideas and teaching experience in the major of big data, with a view to providing valuable reference for relevant professional talent cultivation research or teaching practice.

Keywords: Higher education · Integration of science and education · Big data · Talent cultivation

1 Introduction

With the rapid development of information technology, the big data industry has rapidly developed into a hot topic of common concern among academia, industry, and the government [1]. The report of the 19th National Congress proposed "Implementing the National Big Data Strategy and Accelerating the Construction of a Digital China"; The report of the 20th National Congress of the Communist Party of China proposed "accelerating the development of the digital economy, promoting the deep integration of the digital economy and the real economy", and explicitly proposed "implementing the strategy of

P. Qi and Z. Chen (Eds.): ICBDIE 2023, AISR 178, pp. 848–858, 2024.
https://doi.org/10.2991/978-94-6463-238-5_109

rejuvenating the country through science and education, and strengthening the support of talents in modernization construction" [2]. The combination of new generation information technology and various industries to form a digital productivity and digital economy is an important direction for the development of modern economic systems. New generation digital technologies such as big data and artificial intelligence are the most active and widely used scientific and technological fields in contemporary innovation [3, 4], which can bring profound impact on industrial development and social governance. The current national digital economy development strategy provides opportunities for the demand for big data professionals, there are also training challenges.

Qinghai is an important strategic channel and strategic fulcrum in the construction of the national "the Belt and Road". In 2015, the State Council issued the Outline of Action Plan for Promoting Big Data Development and the Big Data Industry Development Plan (2016–2020), making top-level design and strategic deployment for the development direction and framework of big data industry. In the same year, the Qinghai Provincial Government issued a document, "Notice on Printing and Distributing Implementation Opinions on Promoting the Development of Cloud Computing and Fostering the Big Data Industry", which clearly states that universities in the province are encouraged to establish big data professional courses, cultivate a new generation of big data researchers and industrial application talents, promote the integration of production, education, research and application in the field of big data, and lay a solid foundation for the development of the big data industry in Qinghai Province.

As the only university in Qinghai Province that owns the national "211 Project" key construction university and is jointly built by ministries and provinces, Qinghai University, in conjunction with the first big data company in Qinghai Province, planned to establish the Qinghai Big Data Industry Research Institute in 2015, which was officially inaugurated in 2017. In the same year, relying on Qinghai University to build the "Qinghai Big Data Research and Application Platform", aims to carry out talent cultivation, project research A series of related work such as practical training application and achievement transformation.

Relying on the "Big Data Research and Application Platform" and based on the application needs of innovative talents in the big data industry, it is urgent to explore and practice a more effective talent cultivation model to carry out curriculum construction and discussion, professional skills training, and cultivate relevant professional talents for emerging technologies in the big data industry. How to implement the national strategic development direction and actively respond to the demand for talent cultivation in the big data industry.

2 Current Problems in Talent Cultivation of Big Data Majors

Since the "13th Five Year Plan" development plan, the status of big data has risen to a national strategy, serving as a core support capability for digital transformation and assisting the development of the digital economy. However, the "talent shortage" problem of big data is increasingly prominent. In response to the shortage of big data professionals, universities have become the main camp for cultivating big data professionals. Currently, in the field of talent cultivation for big data majors, some common issues restrict the

quality of relevant talent cultivation and output. These common problems are mainly reflected in the relatively weak construction of academic majors related to big data, the inadequate teacher talent system, the high threshold for big data majors, the lack of effective connection between practical and theoretical links, and the inability to find the data needed for teaching [5, 6].

In addition to facing more or less of the common issues mentioned above, Qinghai University's talent cultivation process in the major of big data also faces some specific problems due to the shortage of various resources and talents in the remote areas of the west, mainly reflected in:

I. Qinghai native students account for more than 60% of the students, and the overall foundation of students is relatively weak. There are significant differences in the level of students' existing knowledge structure.
II. Influenced by traditional teaching models, ways of receiving knowledge, and learning habits, acquiring knowledge is more inclined to a passive learning model, lacking the ability and motivation to actively receive and transform knowledge, and lacking a comprehensive understanding of "why to learn, what to learn, and how to learn".
III. The development of the local big data industry has started late, and students have insufficient understanding of the talent needs and industry positions of big data professionals. Most students cite "hot" as the reason for choosing courses but lack understanding of big data positions and industry applications, which has a limited impact on the curriculum development goals.
IV. The rapid development of big data, rapid technological updates and iterations, and more explicit and detailed trends and application scenarios in the "big data+" application field have resulted in a lack of practical and comprehensive application scenarios for practical needs in teaching, as well as a lack of goals for students to work towards, which to some extent has brought some difficulties to the cultivation of large data professionals.

Therefore, in the face of the current situation of cultivating big data professionals with high thresholds, weak foundation, and lack of practice, how to explore effective curriculum teaching and practice models in the context of difficult curriculum knowledge systems, rapid iteration of professional technology updates, etc., in combination with the level of knowledge structure and learning characteristics of Qinghai University students, fully meet the training objectives of big data professionals in the western Qinghai region, and utilize the resources of the established big data software and hardware platform, Improving the quality of course teaching and educating people, and providing talents for big data research and industrialization applications in various fields such as meteorology, water conservancy, agriculture, animal husbandry, salt lake chemical industry in Qinghai Province, will have very important teaching and practical significance.

3 Overall Thinking of Talent Cultivation

The combination of scientific research and education and teaching has become one of the important ways for colleges and universities at home and abroad to cultivate high-level and high-quality talents [7, 8]. In order to implement the national strategy of rejuvenating

the country through science and education, the strategy of strengthening the country through talent development, and the innovation driven development strategy based on the overall deployment of science and technology, education, and talent, the integration of science and education has been implemented throughout the entire process of talent cultivation in the major direction of big data, thereby contributing to the high-quality development of talent cultivation in China.

Small scale professional talent cultivation is effective and worth trying, such as the Turing class at Peking University and the ACM top talent class at Shanghai Jiao tong University. Based on the overall situation of the computer major of Qinghai University and the demand for application talents in the major of big data, this study relies on the core curriculum of "Data Analysis and Processing Technology (Big Data)" and adopts innovative talent cultivation models such as online MOOC resources, innovative teaching design, science and education integration, and research to promote education. The overall thinking is shown in Fig. 1.

The specific practical thinking is to guide and optimize the curriculum training outline, enrich curriculum teaching resources, design and implement curriculum teaching, equip teachers, and cultivate student selection, with the goal of cultivating talents in the major of big data. In the second semester of students' third year of university, with the background of "integration of science and education, collaborative education", and the goal orientation of scientific research, select students with good knowledge level to establish a small class targeted training class for big data professionals. The selection conditions refer to students' knowledge level, subject competitions, course direction interests, scientific research intentions, and big data related job selection intentions. In terms of training methods, on the one hand, optimize teaching design, and on the other hand, adopt a scientific research project task driven approach to encourage students to participate in scientific research practice exploration, and cultivate students' comprehensive scientific research literacy, innovation ability, and professional practical ability. At the same time, in terms of teacher allocation, high-quality teacher teams, teaching resources, and scientific research platforms related to big data should be equipped. Emphasis should be placed on promoting teachers with experience in hosting scientific research projects and needs related to big data collection, transmission, storage, analysis, and security as instructors for comprehensive practical tasks of student courses, to cultivate students' comprehensive knowledge and practical abilities.

In addition, in talent cultivation, emphasis is placed on bench-marking the engineering education requirements of the Ministry of Education. In accordance with the national first-class undergraduate professional construction standards, in addition to cultivating students' professional abilities in big data, the curriculum fully explores and integrates ideological and political elements in fields related to big data professional technology, cultivating students' awareness of responsibility, innovation, and responsibility, and achieving moral and talent education [9, 10].

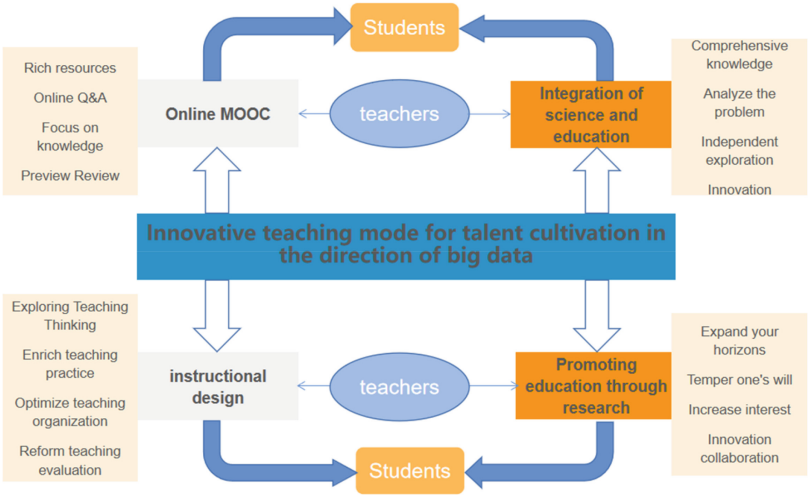

Fig. 1. The overall research and practical thinking on talent cultivation

4 The Exploration and Reform Measures for Talent Cultivation Mode

In terms of teaching practice, assessment and evaluation, teaching faculty team, and analysis of the degree of achievement of training objectives, through measures such as strengthening the construction of curriculum resources, teacher cultivation, innovative teaching models, and school-enterprise cooperation, high-quality scientific research projects and platform resources are integrated into curriculum professional teaching, promoting teaching through research, and integrating science and education, exploring and practicing the talent cultivation model for big data majors in the western Qinghai region. The specific reform measures for talent cultivation mode are as follows:

I. Revision of the syllabus for talent cultivation.

Revise the teaching syllabus for talent cultivation and build a talent cultivation mechanism that integrates science and education. According to the characteristics of the demand for big data professionals in various fields such as meteorology, water conservancy, livestock industry and other fields in Qinghai Province, the teaching syllabus for talent cultivation in the big data field has been revised and formed by bench-marking the engineering education certification of the Ministry of Education and the national first-class undergraduate professional construction standards. In the process of revising the syllabus, the talent cultivation concept of "science education integration and collaborative education" was incorporated, focusing on the practical teaching process of students, and relying on scientific research projects to cultivate students' innovative spirit and practical ability.

In the syllabus, the basic requirements for cultivating application talents in the big data profession are determined: possessing good basic knowledge in the big data profession, possessing certain problem analysis and scientific research capabilities, and

being able to use the professional knowledge of big data collection, storage, calculation, query analysis, and visualization to solve complex engineering problems based on different industry application scenarios. At the same time, a curriculum architecture centered on key technologies of big data, distributed file storage system HDFS, computing framework map-reduce, data warehouse Hive, and data visualization platform Tableau Public has been determined, and experimental and practical training content has been set according to the curriculum training objectives and relevant curriculum relevance. In the practical training phase of the course continuation, a project-driven task-based training model is used, ranging from big data source acquisition, data prepossessing, data storage, calculation, analysis, and visualization. A series of links enable students to understand the process of project development, scientific research, and application practice through a small project, which helps promote the attempt of science and education integration in practical theoretical and experimental teaching, Improve the cultivation of students' professional abilities.

II. Construction of teaching resources.

During several rounds of continuous teaching, the course gradually integrates and refines its teaching content. With the help of high-quality big data platform course resources and online MOOC resources built within the department, it pays attention to consolidating the professional basic knowledge of course segmentation. Build a case library of teaching resources and continuously accumulate teaching cases, including cases, graduation projects, innovation and entrepreneurship projects related to the development and practice of big data technology and applications by students who have completed course learning. Adjust the content of experimental and practical operations appropriately based on the characteristics of students' learning situations, while enhancing the ability of students to comprehensively apply knowledge.

Due to the difficulty of the curriculum knowledge system and the rapid iteration of professional technology updates, special attention is paid to the updating and accumulation of teaching resources, such as datasets and cases, in the construction of curriculum resources. The teaching content will continuously update and refine key knowledge points. The teaching resources provided to students will additionally supplement high-quality online learning platform content, auxiliary courseware, reference books, etc., to expand the breadth and depth of students' learning knowledge.

III. Reform of teaching methods.

The curriculum explores and adopts various teaching methods, transforming students from passive receivers of knowledge into active participants and explorers, giving full play to their subjective role, creating conditions for their active participation, guiding students to think, explore, and discover, and encouraging students to boldly ask questions.

In the top-level design of course teaching, guide students to "why, what, and how to learn". With the help of school-enterprise cooperation, cutting-edge reports on big data technology will be introduced into the course training process. Through the reports, students will be able to understand relevant cutting-edge technologies, the social demand for big data professionals (especially local enterprises), and industry position awareness, stimulate students' interest in scientific research and career selection, and assist in achieving the cultivation goals of big data-oriented students.

In terms of teaching methods, various teaching methods such as demonstration teaching, discussion teaching, and project case driven teaching are used to deeply integrate theoretical knowledge with practical applications, enable students to demonstrate practical operation content and share in the classroom, and introduce life cases, such as joint prevention and control and precise implementation of big data technology in epidemic prevention and control, recommendation of best-selling products in e-commerce big data, and statistical analysis of temperature combined with climate characteristics in Qinghai, by summarizing, researching, and practicing life cases, students can more easily understand and practice what they have learned.

IV. Innovation in teaching practice.

The effect of talent cultivation ultimately depends on the quality of classroom teaching and the transformation of students' knowledge output. The platform for teaching practice mainly includes the big data research and application platform built within the department and the high-quality open-source platform for online big data. Specific measures for educating people in teaching practice are as follows:

A. Guide students to participate in scientific research projects.

Promote teaching through research, cultivate and guide research on topics related to big data analysis and processing, and the guidance methods are not limited to graduation, scientific research practice, research project sub-tasks, etc. In the comprehensive training phase, teachers who have research projects on big data processing needs are invited to serve as mentors for the comprehensive practical tasks of student courses, using a two-week training period to cultivate students' comprehensive knowledge and practical abilities.

B. Guide and encourage students to participate in discipline competitions.

Promote teaching through competitions, guide, encourage, and organize and guide students to participate in related discipline competitions such as the National University Student Big Data Skills Competition, the China Digital Service Software Innovation Competition, and stimulate students' enthusiasm for learning. At the same time, they can also use the participating training question bank (such as big data analysts) to strengthen the connection between theoretical knowledge and practical operation, and further implement the output conversion of curriculum teaching reform results and talent cultivation.

I. Teaching assessment and evaluation mechanism.

Adopt a process-based assessment method to optimize the teaching assessment and evaluation mechanism. The method of daily assessment (homework, classroom performance, experimental reports, mid-term, MOOC) and final homework is adopted, with emphasis on process-based learning. In terms of effectiveness feedback, we use various forms such as student teaching feedback evaluation forms, questionnaires and star surveys to timely understand students' learning dynamics, listen to classroom teaching suggestions fed back by students, and further implement improvements in subsequent teaching.

II. Teacher team building.

Course teaching requires that teaching teachers have a large and rich knowledge of the cutting-edge aspects of big data. Big data analysis and computing processing not only involve various data analysis and mining algorithms, but also rely more on computing models and architectures for the performance of their computing systems, which requires high teaching teachers' abilities. By seeking more opportunities and external resources, integrating online and offline communication and training methods, and taking advantage of the "THU – QHU" counterpart support advantage, the course team has selected team teachers to participate in professional training, academic exchanges, and advanced studies related to big data processing, computing, analysis, and operation and maintenance, improving the strength of the teacher team and reserving high-level and high-quality teaching talents for the course.

III. Moral and talent dual education mechanism.

Establish a moral and talent dual education mechanism, which not only cultivates students' professional abilities, but also enhances their professional literacy. The course provides students with vision expanding services such as industry prospects related to big data majors, scientific research technology, employment guidance and guidance, and establishes students correct and positive professional values and outlook on life through school-enterprise cooperation and conducting disciplinary frontier reports. Another example is to use the ten minutes before class to share with students China's "stuck neck" technical issues in the fields of big data, artificial intelligence, high-performance computing, etc., to stimulate students' awareness of crisis, patriotism, responsibility, responsibility, and innovation, to cultivate more high-quality and skilled talents for the society.

5 The Practice and Effectiveness

Qinghai University's big data professionals rely on the course "Data Analysis and Processing Technology (Big Data Orientation)", which was incorporated into the training program for computer science and technology majors in 2019. The course is a professional compulsory course, offering teaching tasks for students majoring in computer science and technology in the second semester of their third year. So far, four rounds of teaching tasks have been completed. The course is taught for a total of 48 h, including 16 theoretical hours and 32 experimental hours. The background of the course is based on the development background of big data and the demand for big data professionals at the regional and national levels in Qinghai. In the early stage of the course, the professional knowledge architecture of big data analysis and computing processing is fully investigated and understood, integrating the three layers of big data computing system: data storage layer, data processing layer, and data application layer. Relying on the Hadoop open source technology architecture, the configuration process of Hadoop distributed cluster environment is introduced and practiced, HDFS-Shell command operation, mapreduce secondary sorting algorithm and document merging, Hive operation and other basic knowledge are combined with project practice to enable students to understand

and master big data processing and analysis technology with Hadoop key technology as the core, so as to have the basic ability to analyze and process big data.

Through the practice of cultivating big data professionals under the science and education integration mode described above in this article, a certain range of shareable radiation effects have been achieved. The specific summary is as follows:

I. For students, the course introduces high-quality course resources based on the big data platform and carries out online and offline mixed mode teaching. While expanding learning methods and approaches, it cultivates students' autonomous learning ability, promotes the consolidation of students' internal knowledge transformation, and improves teaching quality. The online and offline integrated teaching mode, as well as other high-quality professional course resources on the open-source platform, can be extended to other professional course teaching.
II. For teachers, on the one hand, high-quality learning resources based on the network can facilitate innovative design of teaching links, and student learning data recording can facilitate teachers to track and reflect on the teaching process and progress in a timely manner to improve teaching quality; On the other hand, teachers use actual scientific research topics as practical application needs scenarios for students' comprehensive practical combat. Starting with both scientific research topics and encouraging competitions, they cultivate and exercise students' comprehensive practical combat abilities, which can help cultivate students' practical skills in professional fields. This model can be extended to the teaching of other professional courses.
III. For enterprises, the recruited students have stronger professional literacy and comprehensive abilities in big data, and the trained professionals in big data collection, storage, calculation analysis, and visualization can provide a talent pool for big data research and industrial application in multiple fields such as meteorology, water conservancy, agriculture, animal husbandry and so on in Qinghai Province.
IV. Combining the unique geographical advantages in the development of the big data industry in the local region, as well as the precise positioning and strong support provided by the government to the direction and standards of training new engineering talents based on the big data major by the curriculum practice supporting units, to a certain extent, the function of professional disciplines to serve society and scientific research has been improved, making the training of big data-related talents more able to meet the needs of social progress and development.

6 Conclusions

Based on the core course of "Data Analysis and Processing Technology (Big Data Direction)", this article takes Qinghai University's talent cultivation for big data technology applications as an example, introduces the existing problems, reform ideas, specific measures, and reform results in talent cultivation for the big data specialty, and focuses on the important role of science and education integration in talent cultivation. Talent is the first resource, and innovation is the first driving force, while science and education integration is an important way to cultivate innovative talents. The significance of integration of science and education is not only to provide students with a platform to understand

cutting-edge scientific and technological resources, use high-quality teachers, or software and hardware resources, but also to inspire students to be able to stimulate their motivation for scientific research and innovation and serve the society through professional technology in corresponding required positions, guided by national strategies and social needs. It is hoped that the issues and practical reform measures related to talent cultivation for big data majors mentioned in this article can provide valuable reference for relevant teaching personnel.

Acknowledgement. The research has been supported by the Qinghai University Education and Teaching Research Project (No. JY202209) and the first-class undergraduate professional curriculum construction project (No. YLKC-202102), and it's also received support from the cultivation plan of famous teaching teachers of Qinghai University.

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