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PROBLEMS AND COUNTERMEASURES OF CULTIVATING DATA LITERACY IN UNDERGRADUATE ECONOMICS MAJORS UNDER THE BACKGROUND OF "NEW LIBERAL ARTS"

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Abstract: The digital economy is related to the overall situation of national development, and the healthy development of the digital economy cannot be separated from the improvement of digital literacy and skills of all the people in the whole society, and the digital economy has become the new driving force of China's economic growth, which also puts forward a higher demand for the data literacy of college students. Nowadays, the traditional talent training programme for economics majors ignores the cultivation of technical skills such as data mining, data cleaning and database, resulting in insufficient data analysis ability of economics majors, which restricts the improvement of students' data literacy level. This paper takes economics majors as the research object, and discusses the problems and countermeasures of data literacy cultivation for economics majors under the background of "new liberal arts" from the three aspects of course group construction, course resource construction and teaching concept.

Keywords: Data Literacy; Data Analysis Skills; New Liberal Arts

1. Introduction

The construction of the "new liberal arts" emphasises the need for higher education to adapt to the needs of social development and to cultivate composite talents who can meet the requirements of the new era. The rapid development of modern information technology continues to change the decision-making, production and management modes of enterprises. The development of digital economy has driven a large number of enterprises to regard data resources as a new type of production factor, and to construct and cultivate data literacy as the core competitiveness of talents. More and more enterprises have begun to pay attention to the improvement of data literacy of talents. In particular, the rapid development and popularity of the Internet, mobile communications, e-commerce and other new technologies, the continuous generation of massive data has driven the gradual transition of enterprises to big data thinking. Economic management and economic research talents with a high level of data literacy, familiarity with data thinking and mastery of data technology are increasingly in demand in the talent market. For economics students, in addition to mastering the professional knowledge of traditional economics

majors, the ability to sensitively discover new opportunities with a high level of data literacy, and to grasp fleeting business opportunities by digging out the new knowledge behind the chaotic appearances with the help of data analysis technology will become an important competitiveness of economics majors. Under the social reality of great employment pressure, it is of great significance to improve students' data literacy level to adapt to the new requirements of the society for economics majors. As economics majors who will be at the forefront of the economy in the future, they need to be able to adapt to such drastic changes, and it is imperative to improve students' data literacy.

2. Literature review

Data literacy can be simply summarized as possessing data sensitivity, being able to obtain, utilize, and present data, and possessing the ability to analyze and judge data. Data literacy can be summarized as two abilities. One is data thinking ability, which refers to the sensitivity of data analysts to the potential value contained in data. This sensitivity can be driven by empirical thinking or data mining thinking to drive researchers to create value through data. The second aspect of data literacy is data technology skills. Data technology capability refers to the ability of researchers to use tools such as professional software and programming to extract, clean, explore, visualize, and model data. These two abilities of data literacy do not exist in isolation, but rather as a dialectical unity, interconnected and mutually reinforcing. In addition to relying on economics, econometrics, and data mining theories, data thinking ability also relies on repeated training at the technical level. Data technology ability provides implementation means and basic materials for data thinking ability training. However, in addition to the knowledge of the technology itself, the ability of data technology to function correctly and effectively still depends on a rational and clear understanding of the real economic world. In the digital age, this understanding precisely requires the support of digital thinking skills. It can be said that digital analysis ability is an organic fusion of economic professional knowledge, data thinking ability, and data technology ability, and none of them are indispensable. The improvement of data literacy requires the simultaneous advancement of three abilities, none of which is indispensable. Therefore, it is necessary to create a scientific curriculum group and embed it into the existing economics curriculum system in a suitable way to achieve comprehensive improvement of professional knowledge and data literacy. Only in this way can data literacy ultimately be transformed into productivity, accepted and appreciated by employers.

Schield (2004) [1] first discussed data literacy, believing that it is an important component of information literacy and statistical literacy. The so-called data literacy refers to the ability to obtain, evaluate, process, summarize, and present data. With the rapid development of information technology, there has been a rapid increase in literature on data literacy since 2008. Sundion O (2008), Lloyd A, and Williamson K (2008), Oakleaf M (2008) [2-4] have systematically discussed the methods, characteristics, and evaluation methods of data literacy, becoming classic literature in this research field and having a profound impact on subsequent research on data literacy. The focus of subsequent researchers is mainly divided into two aspects, with the first aspect being how to improve data literacy capabilities. In the early stages, Lloyd A (2009), Julien H and Barker S (2009), Gross M and Latham D (2010) [5-7] and others successively conducted research on how to improve students' data literacy abilities. Another area of concern for researchers is how to evaluate data literacy. The literature of Pinto M and Sales D (2009), Walsh A (2009), Pinto M (2009, 2012) [8-11] has had a significant impact on this aspect of research. With the deepening of research and the expansion of the application scope of big data, more and more scholars are paying attention to the cultivation of data literacy in specific industries or fields and other specific scenarios.

For example, Schildkamp K et al. (2013) [12] studied educational decision-making issues based on data education, while Zhang Jingbo (2013) [13] studied data literacy issues in the era of big data. He Haidi (2015) [14] conducted a study on data literacy education in Chinese university libraries based on big data. Engida H. Gebre (2018) [15] provided his own insights on the cultivation of data literacy among middle school students. The research on data literacy issues in China has mainly focused on the years after 2012, with more literature on data literacy issues related to library, information, and archive management. In addition, there has also been more research on data literacy issues in disciplines such as education, journalism and communication, computer science and technology, and physics. This paper will explore the solution to the problem on the basis of systematically sorting out the problems in the cultivation of data literacy in economics majors.

3. Problems with Data Literacy Development in Economics

3.1. Inadequate development of data thinking skills

It has been found in teaching that students' ability to think about data has not kept pace with the increase in the demand for this ability in society, compared with their ability to think logically. On the one hand, when encountering data, especially large datasets, students are limited by the lack of data science knowledge, and are often easily disturbed by the volatility of the data and unable to quickly grasp the main contradiction of the problem, and then unable to carry out in-depth analysis. This problem not only reduces the efficiency of analysis, but more importantly, students are unable to obtain important information through data, which affects their professional judgement when facing data information. On the other hand, limited by the technical ability of the data, students can hardly grasp the characteristics of the data quickly when analysing the problems, and tend to use qualitative rather than quantitative methods to carry out analyses, and few students are able to reasonably use the data induction and statistical inference methods as the entry point of the research.

3.2. Insufficient data technology capacity development

Data technical competence is the ability to rely on tools to achieve the research objectives set by data thinking. This realization process contains multiple links such as data collection, access management, cleaning, analysis, modelling, model checking or testing, etc., and any weak link may affect the whole analysis process. At present, the insufficient cultivation of data technology ability in economics majors is mainly manifested in the following aspects:

3.2.1. Data collection, storage, cleaning and other links are completed manually, with low efficiency and precision, and cannot adapt to the massive data scenario.

At present, most students rely on web page copying or manual downloading of professional databases to collect data. It is not only inefficient, but also confusing and difficult to organize the downloaded data. The access management and cleaning of data mainly rely on Excel. Especially in the face of multiple Excel table data cross, the use of Excel to manually gather data is slow and prone to errors.

3.2.2. Single form of data visualization, unable to accurately express the relationship between complex variables

In terms of complex and voluminous data, the information density of the chart is much greater than the number. Complex data expressed through graphical means, not only can comprehensive and accurate information transfer, and even help researchers find valuable laws or features. At present, most economics students use Excel to achieve data visualization, mainly using bar charts, pie charts or curve charts to describe the changes in data. The expression form is single, especially the multi-dimensional and developmental data set is poor.

3.2.3. Insufficient data modelling ability, unable to effectively explore the value of data

The main theoretical source of modelling for economics students at the undergraduate level is the Econometrics course, but the course has limited value for application. The content taught in Econometrics at the undergraduate level is mainly based on classical econometric models, but modern econometrics has gradually become the mainstream of academic research, which makes it easy for students to be unable to correctly use modern econometric models for empirical analyses.

In addition to the lack of econometric model modelling ability, students' data mining modelling ability is missing. As data mining ability relies heavily on algorithms and programming skills, its theoretical and applied knowledge is more defined in the field of information or computer science, and teachers and students majoring in economics as a "liberal arts" do not have enough understanding of this field and lack of attention. This has led to the limited data mining knowledge reserve of economics teachers and the lack of motivation for students to learn data mining knowledge.

4. Analysis of the causes of the problem

The existing data literacy-related course system of economics majors lacks systematic thinking, the class group setting is unreasonable, the short board of students' data analysis ability is obvious, which seriously limits the application scenarios of students' data analysis, and it is difficult to improve the level of data literacy, and the learned knowledge can not be transformed into productivity. The reasons for the above problems can be summarised as follows.

4.1. Lack of interdisciplinary knowledge in data literacy-related courses and lagging behind in the development of "new liberal arts"

Professional theory competencies, data thinking competencies, and data technology competencies together drive levels of data literacy. Professional theoretical competence can be acquired through the core curriculum of the economics programme, while the latter two often require interdisciplinary knowledge. Currently, the relevant courses offered by economics majors are added gradually based on the development needs of the discipline, especially the academic needs. Due to the limitations of professional cognition, academic development needs and faculty conditions, the newly added related courses are often derived from the traditional statistics and econometrics, and the teaching concept fails to change from discipline-oriented to demand-oriented. Insufficient attention has been paid to the crossfertilization of economics and information technology, and the construction of "new liberal arts" is relatively lagging behind.

4.2. Curriculum focuses on empirical analyses and underplays data mining

The application of data analysis can be divided into two categories based on its analysis logic, a type of analysis based on logical deduction, through the data analysis means to achieve the results of the deduction of the evidence, called empirical analysis, its basic analysis logic for the first deduction, after induction. The other type of analysis is based on induction as the main means to find regularity in the data to discover new knowledge, and its basic analysis logic is induction first, then deduction, which is called data mining. Compared with empirical analysis, the analysis logic of data mining based on the deductive results of data phenomena is more difficult to be recognised in the academic community due to the lack of mechanism analysis, which leads to colleges and universities belittling the cultivation of students' data mining ability under the orientation of disciplines and academic needs.

4.3. Insufficient cross-fertilisation of information technology and significant shortcomings in data technology capabilities

The shortcomings of the data technology ability of economics students are mainly manifested in the pre-processing of data analysis, which mainly includes data collection, cleaning, management and other aspects. These three aspects of the ability to program and database knowledge support, because database knowledge and programming technology traditionally has no direct link with economics, but with information or computer science majors and other science and technology majors are closely related, so the economics professional curriculum often contains less relevant content. As the starting point of data analysis, the lack of the above three aspects of ability seriously limits the application of students' data analysis ability. Due to the lack of data capture, data storage and management, and data cleaning, the experiments in the relevant courses are mainly validation experiments, and there is little exploratory learning process. The core of data literacy lies in problem-oriented data collection, exploration and analysis. This status quo not only leads to students' problem exploration ability not being exercised, but also makes their data analysis ability incomplete, which restricts the improvement of the level of data literacy. It is necessary to improve students' data collection, cleaning and management skills with appropriate database theory and programming knowledge in economics majors.

5. Recommendations for addressing data literacy development in economics

The cultivation of data literacy in economics undergraduate majors should abandon the discipline demand orientation, respect the actual demand for talents in society, and pay attention to the cultivation of students' application ability, especially the ability to find value in data - i.e., data mining ability. The enhancement of data literacy should start from the exercise of data thinking ability and technical ability, through the improvement of the existing course group construction, to make up for the short board of the data analysis ability chain, to ensure the comprehensive development of students' data literacy level; through the enrichment of the curriculum resources, to strengthen the teaching effect; through the "student-centred" teaching practice, to enhance the practical ability of the students in data analysis.

Enhance students' practical ability in data analysis through "student-centred" teaching practice.

5.1. Improving data literacy course clusters to fill the technology gap

The construction of data literacy course clusters should aim at comprehensively improving the level of data literacy of students, and constructing a complete chain of data analysis capabilities as a teaching task. By means of reducing the overlapping of course contents and smoothing the content interface between courses, the course cluster should be reasonably configured with classroom resources, and finally form a sound system, complete content and clear hierarchy of the course cluster.

A case of a data literacy course cluster designed based on the actual situation of the economics major curriculum. The case takes Statistics and Econometrics as the core of the required courses that are most closely related to the cultivation of data literacy in economics major, and builds a course cluster that can realise the teaching task of cultivating the whole chain of data analysis ability by taking Introduction to Big Data, Python Language and Python Data Analysis as the periphery.

5.2. Enriching curriculum resources to enhance teaching and learning

The shortcomings of data literacy teaching in existing economics programmes are mainly highlighted in three areas: programming, data mining and database knowledge. New syllabi, lesson plans, courseware and cases for the relevant courses and basic data sets for training should be required. Since the total number of hours available

for teaching data analysis skills is limited and many new contents need to be added under the original knowledge framework, the construction of online resources should be actively explored in order to improve teaching efficiency. For example, for the more complex content, offline demonstrations are easy to forget, so videos can be recorded for students to watch repeatedly to enhance operational memory. Another example is the more difficult theoretical content, such as the derivation process of econometric estimation or testing, data mining model principles. This kind of content relies solely on offline lectures students may be difficult to understand for a while, on the basis of offline lectures, the theoretical derivation process will be made a good video for students to watch and understand repeatedly.

5.3. Promoting the practice of "student-centred" teaching and learning concepts and innovative approaches to data literacy development

The cultivation of data literacy is essentially the cultivation of students' ability to discover and explore the value of data, which is different from the traditional theoretical courses in economics, and the teaching method that relies solely on the superimposition of knowledge cannot effectively improve this ability, similar to the saying that "even if you know a lot of knowledge about swimming, it will not help you learn how to swim". The improvement of this ability is more dependent on practical experience based on specific scenarios. Based on this, data literacy should be cultivated by creating situations to improve students' cognitive and problem-solving abilities. In the teaching process, teachers should set vivid and specific scenarios, not confined to the teaching of individual knowledge points, problem-solving oriented, based on the needs of the scenarios, guiding students to explore learning, and constantly explore the optimal path and method of discovering the value of data. Taking specific project development as the main line, we systematically teach and train the complete process of project requirement analysis, programming development and result testing. The teaching process is based on heuristic teaching, supplemented by teacher-student interaction, and students are guided to carry out empirical analyses or data mining practices.

6. Conclusion

This paper argues that economics students have deficiencies in both data thinking ability and technical ability. The existing teaching design concept has not been transformed from discipline-oriented to demand-oriented in time. The shortcomings of students' data thinking and technical ability are caused by excessive emphasis on empirical analysis and neglect of students' interdisciplinary knowledge in information technology. Accordingly, this paper argues that this problem should be solved from three aspects: curriculum group optimization, curriculum resource quality improvement and new training method innovation.

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References

Schield M. Information literacy, statistical literacy and data literacy[C]//Iassist Quarterly (IQ). 2004. [2] Sundin O. Negotiations on information-seeking expertise: A study of web-based tutorials for information literacy [J]. Journal of documentation, 2008, 64(1):24-44.

Lloyd A, Williamson K. Towards an understanding of information literacy in context: Implications for research [J]. Journal of Librarianship and information Science, 2008, 40(1): 3-12.

Oakleaf M. Dangers and opportunities: a conceptual map of information literacy assessment approaches [J]. Portal: Libraries and the Academy, 2008, 8(3): 233-253.

Lloyd A. Informing practice: information experiences of ambulance officers in training and on-road practice [J]. Journal of documentation, 2009.

Julien H, Barker S. How high-school students find and evaluate scientific information: A basis for information literacy skills development [J]. Library & Information Science Research, 2009, 31(1): 1217.

Gross M, Latham D. Undergraduate perceptions of information literacy: Defining, attaining, and self-assessing skills [J]. College & Research Libraries, 2009, 70(4): 336-350.

Pinto M, Sales D. Infolitrans: a model for the development of information competence for translators [J]. Journal of documentation, 2008.

Walsh A. Information literacy assessment: where do we start?[J]. Journal of librarianship and information science, 2009, 41(1): 19-28.

Pinto M. Design of the IL-HUMASS survey on information literacy in higher education: A selfassessment approach [J]. Journal of information science, 2010, 36(1): 86-103.

Pinto M. Information literacy perceptions and behaviour among history students [J]. Aslib Journal of Information Management, 2012, 64(3): 304.

Schildkamp K, Lai M K, Earl L M. Data-based Decision Making in Education [J]. Studies in Educational Leadership, 2013, 17:205-224.

Zhang Jingbo. Research Librarian. Data Literacy Education in the Big Data Era [J]. Science, 2013. [14] He Haidi. Research on the Data Literacy Education in Chinese Academic Library under the Big Data Background [J]. Journal of Modern Information, 2015.

Engida H. Gebre. Young Adults' Understanding and Use of Data: Insights for Fostering Secondary School Students' Data Literacy [J]. Canadian Journal of Science Mathematics and Technology Education, 2018, 18(3).