Study on Undergraduate Research in Chinese Higher Education Based on Content and Co-word Analysis

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Abstract. Undergraduate research has become an attracting topic in higher education in past few decades. To give a comprehensive picture of this field in Chinese higher education, the content analysis and co-word analysis were employed to analyze the relevant literature indexed by the Chinese Social Science Citation Index. The distribution characteristics of paper quantity, published journals, research institutions and research type were revealed. The co-word analysis was used to analyze the research topics. Combining the results of abstract and keywords, this paper explore the research themes. Given the results of analysis, this paper also suggests directions for further work.

Introduction

The development of economy and innovation of education is mutual promotion. Since education reform centered on education innovation in 1970s in Europe and the United States, education innovation which focused on thinking innovation and ability innovation played a significant role in promoting economic development. At present, faced with the goal of building an innovation oriented country which needs to cultivate a large number of innovation talents, university education can also provide a unique environment, and the physical and mental characteristics of college students determine that the undergraduate stage is the critical stage of talent growth. However, for a long time, undergraduate education places too much emphasis on imparting knowledge, neglecting the cultivation of ability, and more on the basis of teachers, neglecting students' initiative and thus often stifling the creativity of students. So we should focus on undergraduate education again, and further focus on undergraduate research. Research activities are considered as one of the most influential teaching practices. Undergraduate research is a very important part in the teaching practice of higher education. Undergraduate research has been developed rapidly in European and American countries by making undergraduates participate in scientific research activities to cultivate their practical ability and comprehensive quality. Since the 1990s, Tsinghua University has been introduced undergraduate research to China, then the Ministry of Education in China also launched a formal program of undergraduate research projects, which makes more and more universities to carry out a wide range of research activities for undergraduates. So it is therefore necessary to analyze the changes in this field.

Research Design

Research Method

Content analysis is a systematic and quantitative method, which can give a comprehensive description of the status of information from literature. The key processes of content analysis include determining the analysis unit and analyzing the categories. In this paper, year, journals, institutions and research types were used to analyze the distribution of papers. In addition, research content was also analyzed.
Co-word analysis draws upon the assumption that a paper’s keywords can give an adequate description of content. VOSviewer is a software tool for constructing and visualizing bibliometric maps. Unlike most computer programs that are used for bibliometric mapping, VOSviewer is especially useful for displaying large bibliometric maps in an easy-to-interpret way, and pay more attention to drawing and clustering. So we hope to use it to make a clearer and richer keyword co-occurrence analysis of undergraduate research.

Data Collection

The data were collected through a set of procedures. First, Chinese Social Science Citation Index (CSSCI) database was selected as the data source. Second, according to the purpose of this study, the search criteria were formulated by including “undergraduate research”. The data were extracted in June 2018, with the search in the topic field covering the period from 1999 to 2018. Finally, a total of 237 articles were retrieved and selected as the analysis sample.

Research Analysis

Number of Papers

After analyzing the literature collection of undergraduate research from the CSSCI database, the publication growth from 1999 to 2018 was shown in Fig. 1. The increase rate is slow before 2005. There has been a steady increase since 2005 and the quantity reached to a high tide in 2014.

Journals

From 1999 to 2018, 74 journals contributed 237 articles. We ranked journals on their total contribution to the list of articles. The top 10 journals with the largest number of publications were identified. The result is presented in Fig.2. All of them are educational journals, China University Teaching is the journal with the highest number of papers.

Institutions

During the 20 year period of the study, the 237 first authors were affiliated with 118 institutions. The top 8 universities are ranked in Fig. 3, which are mostly top universities in China. Beijing Normal University is the institution with the highest number of papers. It is suggested that top universities usually pay more attention to the advanced education mode.

Research Method

As concerning research type and methodology, we distinguished among theoretical, case and empirical study contributions. The results are presented in Fig.4. There are more theoretical
researches from 1999 to 2018, which suggests this method is main form. At the same time, empirical and case researches began to increase in 2003.

![Graph demonstrating leading institutions contributors over time.](image)

**Figure 3.** Leading institutions contributors.

![Graph showing frequencies of research types over time.](image)

**Figure 4.** Frequencies of research types.

### Keywords

Generally, searching keywords for research papers is a convenient way to retrieve data for studying a research field. Using the VOSviewer1.68, this paper also conducted the statistical analysis of keywords, demonstrating the most popular research topics. Fig. 5 gives the density of the all keywords. Fig. 6 shows the keyword co-occurrence networks.

![Density visualization of keywords.](image)

**Figure 5.** Density visualization of keywords.

As can be seen from the Fig.5, cultivation (including talent cultivation, innovation ability, cultivation model, scientific research ability, innovation, innovative talents, cultivation of innovative talents, undergraduate tutorial system) is most main topic, which is the core of undergraduate research.

The Fig. 6 visualized the relationships among the high-frequency keywords (over 10). The study categorized those keywords that appeared multiple times into five themes. The first cluster focused on talent cultivation, innovation consciousness, cultivation model, practice capability, teaching reform, scientific research, scientific tutorial system, scientific quality. The second cluster focused on the
cultivation of the medical students, such as tutorial system, teaching model, undergraduate tutorial system, scientific innovation, scientific thinking and capability training. The third cluster focused on the nursing students, including suggestions, influencing factors, current situation, practice and capability. The fourth cluster focused on the innovation, including innovative talents, innovative capability, scientific training and scientific program. The fifth cluster focused on cultivation form, research universities, and cultivation of scientific ability.

Figure 6. Keyword co-occurrence network.

Research Themes

According to the abstracts and keywords of articles, this paper categorized the research themes of each published article into the following 3 categories. The first category mainly analyzes the theoretical contribution, including development situation and practices. Some authors analyzed the characteristics of undergraduates’ research process in China, advantages and disadvantages of undergraduate research\(^1\)\(^-\)\(^2\). Some authors gave some effective strategies, practices and method to improve scientific research ability\(^3\)\(^-\)\(^4\). The second category mainly introduces the practice of colleges and universities, such as the success of the Undergraduate Research Opportunity Programme (UROP) in American research universities\(^5\), main models of undergraduate research in American research universities\(^6\), the undergraduate research ability cultivation in NC State University\(^7\), the history of American undergraduate research\(^8\), the analysis of the value appeal in undergraduate research of American research universities\(^9\), the specific implementing measures of undergraduate research program in American universities\(^10\), Reveal the learning experience of research pattern in China and compares it with the pattern in American research universities\(^11\). The third category uses empirical method to explore the impact of research training on undergraduate, such as improving the cultivation of innovation talents, individual development and innovative quality greatly\(^12\)\(^-\)\(^14\).

Conclusion

Based on bibliometrics and content analysis, this study produced a reasonable result. This study can analyze the characteristics and trends of the previous studies, and describe systematically development situation, which can give reference for other researches.

The results of co-word analysis show that the research focuses mainly on the importance of undergraduate research on talent cultivation, including quality, capability, model and so on.
Our study has got some valuable conclusion, but it is not free from limitation. In the future, we can enlarge the sources of publication and use other quantitative approaches to learn more about the intellectual structure of research of seminar teaching in Chinese higher education.

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References


