

# The Latest Advances and Enlightenment of Research in Internal and External Course Resources for High School Biology Based on Key Competency in China

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**Abstract:** After the release of Core competencies and Values for Chinese Students' Development, the term “core competencies and values” has made a big difference rapidly in the field of education. In this paper, by using China National Knowledge Infrastructure (CNKI), which is widely recognized by the domestic intellectual community, as the retrieval database, and its document analysis tool, a statistical analysis was made on 143 papers included, and it was found that the topic of “internal and external course resources for high school biology based on key competency” is closely linked to the policies, and that besides the basic education practitioners, the scientific research team in colleges and universities is developing rapidly. Moreover, most of the researches cover the construction and cultivation of core competencies and values, as well as curriculum implementation of students for biological sciences. However, there is a lack of research in the development of resources for biology course outside the school and related cases in terms of core competencies and values.

## 1. Introduction

Since the 1990s, the topic of “key competency” has become a research focus in the field of education. In our country, some basic education and college teachers try to learn relevant education and teaching experience from abroad, and have made continuous research results. In this paper, by using CNKI as the retrieval database and its document analysis tools, a statistical analysis was made on 143 papers included, to make a thorough inquiry in the previous studies and development tendency of “internal and external course resources for high school biology based on core competencies and values”, so that peers and relevant personnel can systematically and intuitively understand the development status and hot topics of related domestic research, and provide reference for the research on the external course resources for high school biology related to similar schools.

## 2. Data collection

In order to ensure the reliability of research data, CNKI Chinese database widely recognized by domestic scholars was selected as the data source, which includes “Basic Science, Engineering Science and Technology I, Engineering Science and Technology II, Agricultural Science and Technology, Medicine and Health Science And Technology, Philosophy and Humanities, Social Science I, Social Science II, Information Technology, Economy and Management Science” and so on. Based on TS (core competencies and values), document type (full text, title, key words, abstract), the time span is from 2000 to November 2019. A total of 15,140 documents were retrieved, and then 143 related documents were retrieved through secondary retrieval of TS: (senior high school biology course), file type: (full text) on November 29, 2019.

In addition, with TS (external course sources), document type (full text), 3,972 documents were retrieved, and then in the results, with TS (external course of High School Biology), document type (full text) were retrieved twice, and 0 documents were retrieved on November 29, 2019.

### 3. Methodology

In this paper, based on the theory of mapping knowledge domain in the field of scientific quantitative chemistry, the statistical analysis function of CNKI was used to vividly display the knowledge basis, hot topics, cutting-edge areas and overall knowledge framework of research in external course resources for high school biology based on core competencies and values, as well as the development trend and hot spots reflected in a certain period of time.

### 4. Feature analysis

#### 4.1 Analysis on the number of publications

The importance and attention of the field is reflected by the number and variation of documents published each year. Generally speaking, there were few scholars focusing on the research of “key competency for high school biology course” from 2000 to 2015, and a lack of relevant documents. However, it is on the rise for the number of documents on the research in high school biology course based on core competencies and values from 2016 to 2019.

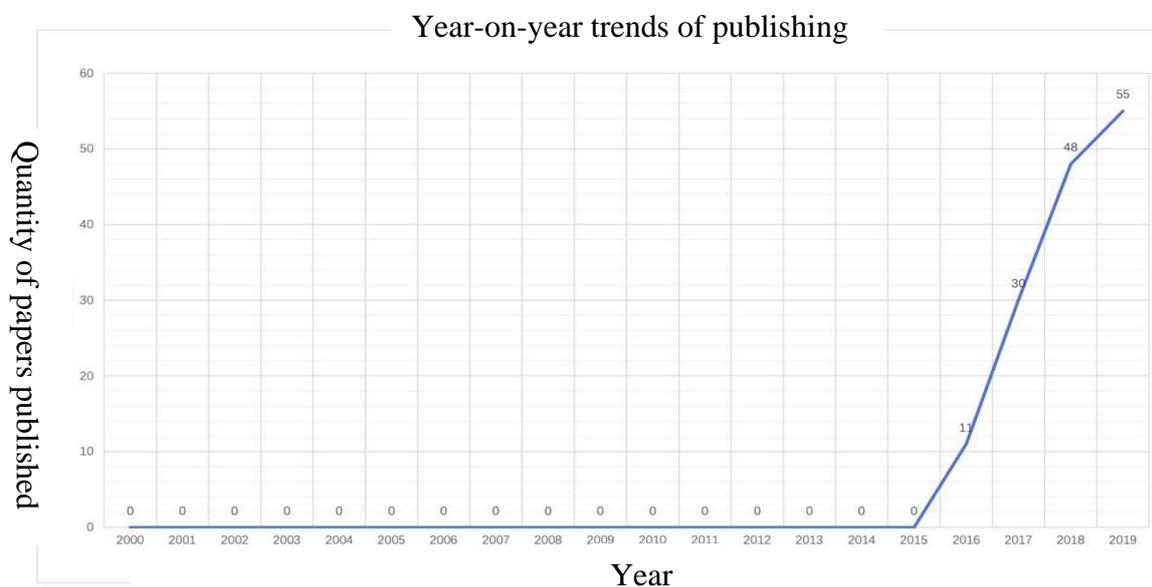


Figure 1 Total number of published papers per year (2000-2019)

From the perspective of relevant policies issued in China, it was pointed out in the *Decision of the CPC Central Committee and the State Council on Deepening Education Reform and Promoting Quality Education in an all-round Way* in June 1999 that the development of students' core competencies and values is an important measure to implement the fundamental task of strengthening moral education and cultivating people. From 1997 to 2007, the Ministry of Education of the People's Republic of China and BP p.l.c (BP for short) jointly launched the “Green Education in Primary and Middle Schools in China” in order to promote the education practice of core competencies and values in the 21st century on a global scale, aiming to integrate environmental education and sustainable development education into the curriculum of primary and middle schools in China. By 2007, nearly 500,000 primary and middle schools in China were involved in curriculum practice. Since 2010, Chinese scholars began to study core competencies and values. In 2012, the 18th National Congress of the Communist Party of China (CPC) put forward “cultivating people through morality” as the fundamental task of education, and established it as the fundamental task of education for the first time. In May 2013, Professor Lin Chongde of Beijing Normal University led the launch of the “Research on the overall framework of core competencies and values of students in the stage of basic education and higher education in China”, which is a major project of the Ministry of Education, indicating

that the research on core competencies and values in China has been officially started. In March 2014, the Ministry of Education officially issued the *Opinions of the Ministry of Education on Comprehensively Deepening the Curriculum Reform and Implementing the Fundamental Task of Building Morality and Cultivating Talents*, which proposed for the first time in the national document that “research and develop the system for the students' core competencies and values and academic quality standards”. It was also required to study and formulate the standards for the development of students' core competencies and values and academic quality, and put the core competencies and values into the subject teaching, so as to promote the comprehensive and personalized development of students. As the concept of “core competencies and values” is known by more and more people, the discussion about the connotation is also increasing. At the beginning of 2016, entrusted by the Ministry of Education, the Chinese Education Society issued the *Core competencies and Values for Chinese Students' Development (Draft for Comments)*, proposing that the core competencies and values are comprehensively reflected in nine major accomplishments, specifically social responsibility, national identity and international understanding; humanistic connotations, scientific spirit and aesthetic taste; physical and mental health, learning and practical innovation. In September of the same year, the term “core competencies and values” quickly made a big difference in the field of education in a short time. From 2016 to 2019, there were 11, 30, 48 and 55 papers published, accounting for 93% of the total sample document. There are more and more papers published on the research of “biology curriculum in high school under core competencies and values”, and the attention is getting higher and higher. Among them, the amount of papers published in 2017 has doubled compared with that in 2016 (Fig. 1), indicating that such researches have a strong policy tendency.

#### **4.2 Analytic hierarchy process (ahp) of article publishing**

From the perspective of relevant research level, 101 papers on basic education and secondary vocational education have been published, accounting the most for 76.52% of the total sample documents, followed by 27 papers on fundamental research (Social Sciences) (Fig. 2), accounting for 20.45% of the total.

#### **4.3 Analysis of issuing organization**

Most of the papers are published by institutions of higher learning, indicating that the research in “biology curriculum in high school under core competencies and values” has strong policy tendency and the scientific research team in colleges and universities is developing rapidly except for the practitioners of basic education.(Fig. 3)

#### **4.4 Analysis of highly cited authors**

The highly cited papers are listed in Table 1, among which the papers of Mr. Tan Yongping, director of biology office, senior editor of People's Education Press, have the biggest concern. He co-authored the standard laboratory textbooks for general high school curriculum of PEP edition, Biology course 3 *Steady State and Environment* and Biology elective course 2 *Biological Science and Society*, as well as the standard laboratory textbooks for compulsory education curriculum of PEP edition. His paper *Key Competency of Biology: Connotation, Denotation and Integrity* was published in the central core journal *Curriculum, Teaching Materials and Teaching Methods*, 2018, issue 8. He believes that there are some tendencies in the discussion on core competency in biology, and its connotation and extension need to be further clarified. The key competency of biology includes values, essential characters and key abilities, which reflect the educational value of biology. In the key competency of the discipline, the concepts of life, scientific thinking, scientific inquiry and social responsibility are related to each other, in which the concept of life is in a prominent position, reflecting the biological characteristics. All of them need to be supported by biological concepts, and integrated with values, characters and competencies. Another paper by Mr. Tan Yongping, Discussion on the reform of biology compulsory content in senior high schools from the perspective of developing

key competency, is also ranked No. 5 among the cited documents. According to the paper, by promoting the students' core competencies and values, the biology in senior high school enables students to form a basic view of life and biology so as to enhance their scientific literacy. The compulsory contents should include: understanding the basic concepts necessary for life, integrating biological ideas, focusing on the general concept of science; overall planning of scientific method education, experiment, exploration and other activities, emphasizing the unity of knowledge and practice, ability improvement; promoting the understanding of the nature of science, and infiltrating the spirit of science. Special attention should be paid to multidimensional integration to promote the all-round development of students.

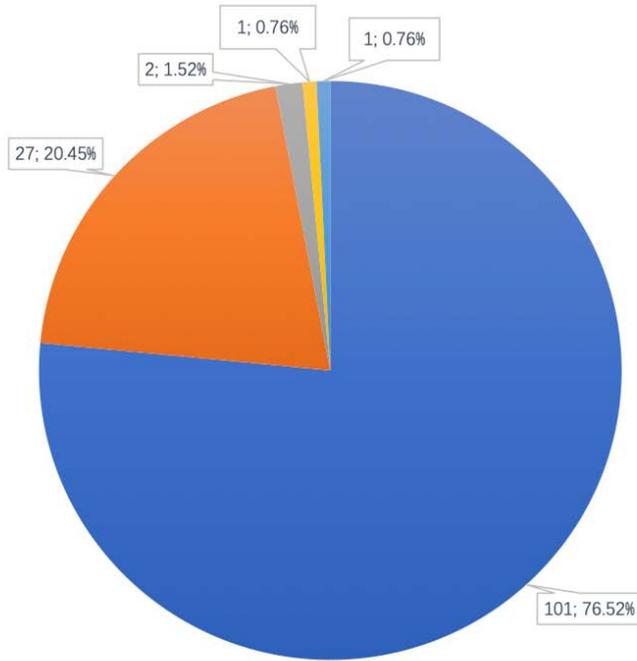
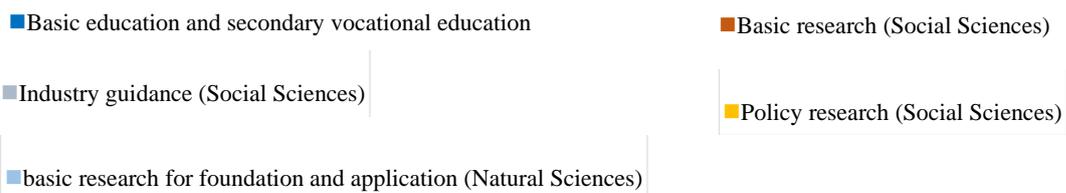


Figure 2 AHP of papers from 2000 to 2019



## Organization

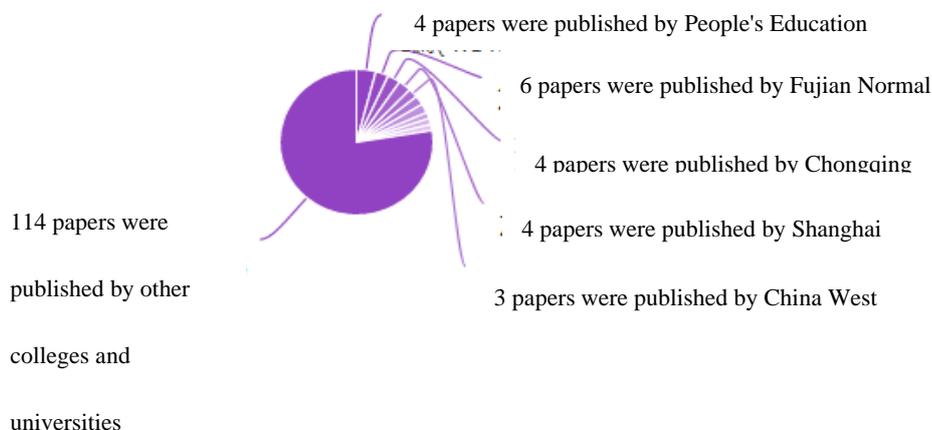


Figure 3 Distribution of issuing

## 5. The current situation of the research on the external course resources of biology in senior high school

CNKI Chinese database was selected as the data source, with TS = (external course resources), file type: (full text), time span: 2000 to November 2019. The retrieval was made on November 29, 2019, and a total of 3,972 documents were retrieved. Then, in the results, TS = (external course resources for biology in senior high school), document type: (full text) was used for secondary retrieval, and 0 documents were retrieved, indicating that there was neither research on the development of external course resources for biology, nor the development examples. It is thus clear that the research on biological core literacy by teachers and researchers in China is still at a relatively early stage; and currently, there are few teachers and scholars in the field of basic education who focus on the development and utilization of external course resources based on students' core competencies and values.

## 6. Conclusions and enlightenment

### 6.1 The research on the core competencies of biology is a hotspot

The core competencies of biology include outlook on life, scientific thinking, scientific exploration and social responsibility[1]. According to the highly cited documents, Mr. Tan Yongping, the director, senior editor of Biology Office of People's Education Press as mentioned above believes that in the course standard, the core competencies of biology are clearly defined, which cover four parts that have a good leading role in explaining the educational value of biology in a all-round way. He also thinks that there are some tendencies in the current topics and views on the core competencies of biology subject, which are worthy of attention. For example, the above-mentioned four aspects are decomposed in a plane, the definition and content are limited to the text which is difficult to break through, the teaching implementation is limited to the subject, and the concept of multiple subjects is ignored. In order to further understand the values, necessary characters and key abilities corresponding to the core competencies, it is necessary to discuss the connotation and extension of these four parts[2].

Table 1 Highly Cited Documents (Top 10)

S/N	Authors	Titles	Journal name	Citation frequency
1	Tan Yongping	Key Competency of Biology: Connotation, Denotation and Integrity	Curriculum, Teaching Materials and Teaching Methods	138
2	Yu Hongcheng	The Teaching and Training Strategies of the Key Competency of Biology in Senior High Schools	Biology Teaching in Middle School	72
3	Xiao Anqing Yan Peihui	The Connotation and Training Strategy of Biological Core Competency in Senior High Schools	Teachers Training of Middle and Primary Schools	67
4	Yang Ming Liu Enshan	Scientific Exploration of Biology Based on Key Competency	Bulletin of Biology	57
5	Tan Yongping	Discussion on the Reform of Biology Compulsory Content in Senior High School from the Perspective of Developing Key Competency	Curriculum, Teaching Materials and Teaching Methods	35
6	Yu Ruwang Hu Menghui	Combing and Enlightenment of the Key Competencies Contained in the Curriculum Standard or Syllabus of Biology in China	Theory and Practice of Education	34
S/N	Authors	Titles	Journal name	Citation frequency
7	Zhao Fang	Research on the Cultivation and Evaluation of the Core competencies in Biology Teaching in Senior High School	Popular Science (Science Education)	31
8	Liu Enshan Liu Sheng	Leading by key competency, paying attention to practice less but better -Thoughts and characteristics of the revision of biology curriculum standard for senior high school	Bulletin of Biology	32
9	Yang Xin Zhang Jun	On the cultivation of the core quality of biology in senior high school	Quality Education in Western China	29
10	Qi Fengzhen Wang Jian Zhai Lin Luo Yan	Evaluation and thinking based on biological core literacy -- Taking Science synthesis (biology part) of 2016 college entrance examination (Tianjin volume) as an example	Study for Exams	28

## 6.2 Scientific inquiry based on the core competencies of biology is the focus of classroom teaching reform of biology in high school

In the *Outline of Curriculum Reform of Elementary Education (Trial)*, it is clearly proposed that students' independence and autonomy should be cultivated in the teaching process, and students should be guided to question, investigate and explore. Liu Enshan, professor and doctoral supervisor of the School of Life Sciences, Beijing Normal University, believes that scientific inquiry is an integral part of the core competencies of biology, and also an important symbol of the natural science attribute of biology curriculum. It also plays an important role in mastering scientific concepts, participating in scientific practice, understanding the nature of science and becoming an independent thinker and learner[3].

## 6.3 Classroom teaching of biology

From the establishment of teaching objectives, the implementation of teaching activities to teaching reflection, the biology classroom teaching has always been carried out around the core competencies, which are reflected in the papers of Yu Hongcheng from Pingwang Middle School, Wujiang District, Suzhou City, Jiangsu Province, Xiao Anqing from Yantian Senior Middle School, Shenzhen City, and Yan Peihui of Shenzhen Institute of Education and Science.

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