

How to improve the scientific literacy of modern college students: based on the survey and analysis of current situation

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Abstract

Scientific literacy is one of the essential core qualities for modern citizens, which is of great significance for the comprehensive development of college students and social progress. This article analyzes the current situation of scientific literacy among modern college students and finds that there are certain deficiencies in their scientific knowledge, methods, attitudes, and spirit, especially in their insufficient mastery of interdisciplinary knowledge, weak ability to apply scientific methods, and lack of critical thinking. In response to these issues, this article proposes strategies to enhance the scientific literacy of college students from four levels: social environment, educational concepts, family support, and endogenous motivation, including creating a scientific atmosphere, optimizing science education, building a good family tradition, and strengthening self-education. The research results aim to provide reference for the reform of science education in universities and assist in the comprehensive improvement of college students' scientific literacy.

Keywords

Scientific literacy, modern college students, improvement strategy.

1. Introduction

Scientific literacy refers to an individual's understanding of scientific knowledge, mastery of scientific methods, formation of scientific attitudes, and cultivation of scientific spirit. It is an important ability for modern citizens to participate in social affairs and solve practical problems. With the rapid development of technology and the acceleration of globalization, the importance of scientific literacy is becoming increasingly prominent. As the backbone of the future society, the scientific literacy level of college students not only relates to their personal career development, but also directly affects the country's scientific and technological innovation capabilities and social progress.

However, the current state of scientific literacy among Chinese university students is not optimistic. Although universities have invested a lot of resources in science education, there are still significant differences in students' scientific literacy levels, especially in the integration of interdisciplinary knowledge, the application of scientific methods, and the cultivation of critical thinking. In addition, some students' interest in science is limited to practical value, neglecting the innovative and truth-seeking spirit in the process of scientific exploration. These issues not only constrain the comprehensive development of college students, but also have a potential impact on the country's future technological competitiveness.

This study aims to systematically analyze the current situation of scientific literacy among modern college students through questionnaire surveys and interviews, explore the existing problems and causes, and propose practical and feasible strategies for improvement. The research results will provide theoretical basis and practical guidance for the reform of science

education in universities, and help cultivate new era college students with high-level scientific literacy.

2. Current situation investigation

2.1. The channels for mastering scientific knowledge need to be expanded

A survey shows that college students generally have a good grasp of basic scientific knowledge, especially in natural science fields such as physics, chemistry, and biology. Most students are able to correctly answer basic concepts and principles. However, the understanding of cutting-edge technological knowledge and interdisciplinary knowledge is relatively insufficient. For example, less than half of the students are able to accurately explain the basic concepts of cutting-edge technologies such as artificial intelligence and quantum computing. Students majoring in humanities and arts are relatively weak in natural science knowledge, and some students even have misunderstandings about some basic scientific concepts. At present, the innovative development of digital technology and Internet technology provides a more diversified information resource database and practice platform for the formation and improvement of college students' scientific literacy. However, there is a significant gap in the utilization rate of various channels for obtaining technological information, making it difficult to fully utilize the existing popular science channels and resources in society. The Internet and mobile Internet have become the primary channel for college students to obtain scientific and technological information, far more than other channels. The uneven utilization of technology information acquisition channels reflects the problem of the need to expand the channels for cultivating scientific literacy among college students in the new era[1].

2.2. Insufficient ability to apply scientific methods

The performance of college students in the application of scientific methods varies greatly. Science and engineering students generally have strong logical thinking and experimental design abilities, and can effectively apply scientific methods to solve practical problems. However, students majoring in humanities and arts are relatively lacking in the application of scientific methods, and some students lack basic scientific thinking training, making it difficult for them to analyze and solve problems through scientific methods. In addition, the survey also found that some students tend to rely on intuition and experience when facing complex problems, rather than conducting systematic analysis through scientific methods. Mainly reflected in the following aspects: unclear problem formulation, lack of clear research objectives and hypotheses, and difficulty in focusing on core issues; Weak data analysis ability, inability to correctly apply statistical methods or ignore outliers in the data, resulting in biased conclusions; Logical reasoning is not rigorous, may overlook counterexamples or overly rely on a single piece of evidence, lacking in-depth analysis of causal relationships; The literature review is insufficient and fails to fully understand the existing research results, resulting in repeated studies or neglect of key theoretical support[2].

2.3. Lack of scientific attitude and scientific spirit

Most college students hold a positive attitude towards science and believe that it plays an important role in promoting social development. However, some students have a relatively one-sided understanding of science, believing that science is only synonymous with technology and ignoring the importance of scientific spirit and ethics. Specifically, it includes the following aspects: Firstly, some students lack critical thinking and are prone to blindly accepting authoritative viewpoints or online information, lacking independent thinking and questioning spirit. Secondly, there is a clear tendency towards utilitarianism, with an excessive focus on the short-term benefits of scientific research results and a disregard for the essence and long-term value of scientific exploration. Thirdly, the awareness of scientific ethics is weak, and some

students engage in academic misconduct such as data falsification and plagiarism in experiments or research, which violates the principle of scientific integrity. Fourthly, the lack of solid grasp of scientific methods, inadequate experimental design and data analysis abilities, leads to a less rigorous research process. Fifth, lacking a persistent spirit of exploration, easily giving up when faced with difficulties, and having difficulty delving deeper into scientific problems. Sixth, the ability to integrate interdisciplinary knowledge is insufficient, limited to a single disciplinary perspective, making it difficult to tackle complex scientific problems. Finally, some students have insufficient understanding of the social responsibility of science and overlook the impact of scientific achievements on society, the environment, and ethics. These issues not only affect the academic development of college students, but may also constrain their future contributions in the field of science[3].

3. Main factors affecting scientific literacy

3.1. Insufficient emphasis on science education in universities

As one of the main places for college students to study and live, universities bear the main responsibility of cultivating their scientific literacy. The formation and improvement of scientific literacy among college students in the new era is a complex systematic project, and the multidimensionality of scientific literacy determines that universities must have a sound scientific education system to carry out the cultivation of scientific literacy among college students. However, some universities lack sufficient awareness of the importance of cultivating scientific literacy among college students, and the level of attention needs to be improved, resulting in significant room for improvement in the scientific education system of universities. Firstly, in terms of science education content. Due to the fact that the main course arrangements for college students are determined by their majors, this results in a relatively lower level of mastery of scientific knowledge, methods, etc. among students majoring in humanities and social sciences compared to those majoring in science and engineering. In addition, due to limitations such as course arrangements and credit settings, the knowledge learned by college students in textbooks and classrooms is relatively limited, and the acquisition of technological knowledge and information is also relatively limited, which is not conducive to college students' growth of knowledge and broadening of horizons. Secondly, in terms of the form of science education. Some universities have failed to truly implement the policy requirements for cultivating scientific literacy among college students, resulting in these universities being perfunctory in carrying out related cultivation work, making the cultivation of scientific literacy among college students a mere formality and seriously affecting the effectiveness of the work. Thirdly, in terms of the provision of scientific education facilities. The activity platform and hardware equipment are important conditions for college students to cultivate and train their scientific literacy. Some universities lack special funds for cultivating scientific literacy among college students, resulting in relatively low investment or limited budget for related special funds, making it difficult to build and afford high cost scientific education platforms and hardware equipment. Fourthly, in terms of campus atmosphere. The cultural atmosphere on campus represents a collective value orientation, which can subtly influence and guide the group. A good campus atmosphere directly affects the attitude and pursuit of scientific literacy among college students. Due to insufficient understanding of the importance and necessity of cultivating scientific literacy among college students in some universities, the implementation of related work is not deep and comprehensive enough, making it difficult to create an atmosphere of love for science and innovation on campus, which is not conducive to enhancing college students' recognition and practice of scientific literacy[4].

3.2. The family atmosphere that advocates science needs to be developed

Family is the basic cell of society and the first school in an individual's growth process, which will subtly influence the formation of personal behavior habits, values, and so on. No matter how the times change or how society evolves, the fine traditions of emphasizing family, tutoring, and family ethics must always be continued. Good family education and family ethics play an important role in the formation of scientific literacy among college students, and their influence even runs through the entire process of their growth and development. However, influenced by traditional family education concepts, many parents inevitably have the idea of "emphasizing grades over literacy". In the education process, parents pay more attention to their children's grades and neglect the formation and improvement of their children's literacy. For example, in real life, some parents even try to improve their children's academic performance through superstitious behaviors. This also reflects that some family members in some families still have superstitious thoughts and lack scientific concepts. This kind of superstitious behavior of parents can easily have a negative demonstration effect on the formation of children's ideological concepts. In addition, many parents still have the misconception that "educating their children is the sole responsibility of the school", and fail to truly recognize the important role of family education and family culture in promoting the comprehensive development of college students. This traditional family education concept is deeply rooted and hinders the formation and improvement of scientific literacy among college students, which is not conducive to their comprehensive development. On the contrary, if every family in society can attach importance to family science education and consciously create a family atmosphere of respecting and loving science for their children's growth, it will help achieve the goal of "educating a child, influencing a family, and driving the whole society"[5].

3.3. The self-education awareness of college students needs to be improved

Higher education aims to cultivate well-rounded college students, and the comprehensive development of college students cannot be separated from the play of their own subjectivity. The formation and improvement of scientific literacy among college students is a gradual process, which cannot be separated from the support and promotion of external forces, nor from the proactive actions of college students themselves. However, according to the survey results, most college students are able to recognize the important role of scientific literacy in personal development and social progress, but their awareness of actively enhancing scientific literacy in practical actions still needs to be improved. The main reasons for this are as follows. On the one hand, according to the school's teaching plan, college students have limited spare time and relatively limited time and energy to participate in science popularization activities both on and off campus. College students often need to participate in other activities arranged by the university on the basis of completing course requirements, resulting in a corresponding reduction in time spent on science popularization activities. On the other hand, some students still have utilitarian thinking. For example, some college students participate in on campus science popularization activities not to acquire useful knowledge, methods, etc., but to fulfill the school's mandatory requirements or obtain credits for extracurricular practical activities. From this phenomenon, it can also be seen that the voluntary and proactive participation of some college students in science popularization activities needs to be strengthened. On the contrary, if college students can truly recognize the importance of self cultivation of scientific literacy, it will help to greatly enhance their proactive awareness of self cultivation of scientific literacy, guide them to consciously transform their cognition of scientific literacy into practical actions, and fully exert their subjectivity in science education[6].

4. Strategies for enhancing the scientific literacy of college students

4.1. Gather social resources and create a scientific atmosphere

The supplementation and improvement of various social resources can provide important support and guarantee for the cultivation of scientific literacy among college students in the new era. According to the results of the questionnaire survey, the main channels for college students to obtain scientific and technological information are the Internet and mobile Internet, textbooks and classrooms, television and radio, etc. This requires colleges and universities to make full use of the main channels to carry out the scientific literacy cultivation of college students, and at the same time, vigorously develop other channels within the scope of society, gather various resources, and expand new ways for the scientific literacy cultivation of college students. The cultivation of scientific literacy among college students in the new era cannot be separated from the support of society. Firstly, the existence of feudal superstitions, pseudo scientific "scams" and other phenomena in society is not conducive to college students establishing a scientific worldview and methodology. Relevant government departments should increase governance efforts, eliminate many erroneous ideological trends in society, and create a social atmosphere that loves science and advocates innovation as much as possible. This will provide external environmental guarantees for the cultivation of scientific literacy among college students, enabling them to achieve comprehensive development under the influence of a good social atmosphere and become high-quality talents useful for social development. Secondly, the development of science and technology calls for the emergence of more high-quality popular science works. As an important carrier for college students to receive scientific knowledge and methods, establish scientific spirit and scientific thinking, popular science works are effective tools for guiding college students to approach science and comprehend science. At the social level, we should actively use emerging science and technology, give full play to the role of the Internet and mobile Internet, television and radio, encourage the research, development and innovation of popular science works, increase the promotion of excellent popular science works, and promote high-quality popular science works into textbooks, classrooms and schools. Finally, the cultivation of scientific literacy among college students in the new era should fully utilize the abundant social practice resources. On the one hand, we need to promote the improvement and innovative construction of science popularization venues, increase publicity efforts for science popularization venues, enhance the attractiveness of science popularization venues to college students, and fully leverage the functions of science popularization venues in promoting scientific spirit and ideas, and popularizing scientific knowledge and methods. For example, science popularization venues such as science museums and museums provide learning opportunities for college students, including physical objects, inspections, visits, and teaching activities. They guide college students to acquire scientific knowledge and methods through personal experience, which helps to supplement their alternative learning experiences. On the other hand, we should actively promote the organic integration of science popularization venues with school education, actively seek educational resources related to university courses in science popularization venues, coordinate with university course content, design and develop learning plans at different levels by grade and subject, and provide effective supplements for universities to carry out the cultivation of scientific literacy among college students.

4.2. Transforming educational concepts and optimizing scientific education

General Secretary Xi Jinping pointed out that "China has the largest higher education system in the world, a broad stage for the development of various undertakings, and is fully capable of continuously cultivating and nurturing a large number of outstanding talents and masters." Universities bear the important responsibility of cultivating the scientific literacy of college

students in the new era and are one of the important subjects in carrying out science education for college students. In response to the development of the times and the requirements of reality, universities need to transform traditional educational concepts, starting from the content, form, facilities and equipment of science education, and campus science education atmosphere, and further improve and perfect the science education system.

Firstly, enhance the richness and timeliness of science education content in universities. University science education should ultimately be implemented in the classroom. As the most direct way for college students to receive science education, the classroom is an important channel for cultivating their scientific literacy. Due to the relatively greater emphasis on professional education in Chinese universities, humanities and social science students mainly study humanities and social science content, with less involvement in natural sciences. Compared to science and engineering students, humanities and social science students have weaker mastery of relevant scientific methods, knowledge, etc. Therefore, in terms of classroom settings, the proportion of science related courses for liberal arts college students can be appropriately increased to highlight the status of science education. For example, some elective courses related to the history of science, sociology of science, philosophy of science, etc. can be added to provide students with specialized course resources and enrich the content of science education in universities. In terms of classroom content design, in order to enhance the richness and diversity of science education content, teachers should achieve innovative use of teaching resources while fully grasping the teaching objectives, and highlight the fun, practicality, timeliness, and diversity of science education content in teaching design.

Secondly, strengthen the diversity and innovation of scientific education forms in universities. The main battlefield for cultivating scientific literacy among college students in the new era is in universities. We should fully tap into the rich resources of universities, continuously enrich and innovate the forms of scientific education in universities, and achieve innovative utilization and transformation of university resources. For example, the forms of cultivating scientific literacy among college students can be enriched through conducting scientific experimental exploration activities, organizing scientific knowledge competitions, invention and creation competitions, technology exhibitions, and other means. By carrying out these specific activities, it helps to stimulate college students' interest in understanding and participating in science, mobilize their initiative and enthusiasm to participate in science popularization activities, and guide them to consciously establish scientific thinking and spirit in practice, improve their mastery and application of scientific methods and knowledge in practical exercise, and thus achieve the overall improvement of their scientific abilities.

Thirdly, improve the facilities and equipment for science education in universities. If universities invest relatively little in hardware facilities related to science education and cannot meet the practical needs of cultivating scientific literacy among college students, it will to some extent limit the smooth development of scientific literacy cultivation for college students in the new era. Therefore, universities should strive to improve their scientific education facilities and equipment as much as possible, providing relatively complete hardware facilities for the cultivation of scientific literacy among college students. For example, universities can establish specialized experimental platforms, science education classrooms, and on campus science and technology museums, actively utilizing emerging technologies and equipment to provide technical support for the cultivation of scientific literacy among college students in the new era. At the same time, universities should strengthen the management and utilization of these facilities and platforms, and maximize their utilization value as much as possible.

Finally, create a campus atmosphere that values science. As the main place for college students to receive scientific literacy cultivation, it is very important to create and optimize the campus scientific and cultural atmosphere. To create a good campus atmosphere, universities need to rely on campus culture construction, mass media, and public opinion propaganda. Specifically,

the scientific literacy atmosphere of universities can be created through various activities such as campus promotion of typical models, inviting experts in science related fields to give lectures and interact with each other, setting up a combination of online and offline technology columns, etc., so that college students can be influenced and exercised in an atmosphere of respecting science, advocating science, and loving science.

4.3. Pay attention to family education and build a good family tradition

Valuing family education is a fine tradition of the Chinese nation and a fundamental aspect of talent cultivation. Family, upbringing, and family traditions profoundly influence the formation and development of a person's character, cultivation, and other spiritual qualities. General Secretary Xi Jinping profoundly pointed out: "No matter how the times change, no matter how the economy and society develop, for a society, the livelihood of the family cannot be replaced, the social function of the family cannot be replaced, and the civilized role of the family cannot be replaced." This requires that the cultivation of scientific literacy among college students in the new era should pay attention to the positive guiding role of family education.

Firstly, we should fully leverage the exemplary role of parents as role models. According to the survey results, parents' words and actions directly affect the formation of college students' scientific literacy, and parents who occasionally and frequently participate in superstitious activities will have varying degrees of negative impact on the formation of college students' scientific literacy. From this, it can be seen that parents' words and actions will subtly influence the development of college students' thinking patterns, values, and behavioral habits, and affect their healthy growth and comprehensive development. To achieve this, the key to playing the exemplary role of parents is to make them aware of the important influence of their words and deeds on the growth of college students and the progress of social civilization, and to make them consciously restrain their own behavior, actively avoid superstitious behavior, continuously enhance scientific awareness, set a positive example for college students, and guide them to form a positive attitude of respect, admiration, and love for science in the influence of good family ethics.

Secondly, we should fully leverage the scientific guidance role of family education. Family is the first school in life. Cultivating scientific literacy among college students is not only the responsibility of schools and society, but also inseparable from the scientific guidance of family education. Family education plays an important role in guiding college students to form personal ideals, clarify their life development direction, and establish correct values, which coincides with the goal of cultivating scientific literacy among college students in the new era. In the process of cultivating scientific literacy among college students, parents should pay attention to guiding them to consciously practice the socialist core values, actively promote and disseminate the spirit of science and scientists, and take the initiative to shoulder the mission and responsibility entrusted to young people by the country.

Thirdly, we should fully leverage the complementary role of family education in school education. Family education is the foundation of social and school education, and an important influencing factor in the development of students' personalities and habits. The cultivation of scientific literacy among college students in the new era cannot be separated from the mutual cooperation between family education and school education. Through the cooperation of the two, the joint efforts of educating students are gathered to jointly promote the formation and development of scientific literacy among college students. On the one hand, parents should actively cooperate with school science education work, take on the responsibility of family educators, and timely understand the school situation and ideological status of college students. On the other hand, parents should consciously encourage and supervise their students to learn and master scientific knowledge and methods in daily life, guide them to establish scientific spirit and thinking, and form stable study habits, thinking patterns, and values.

4.4. Strengthen self-education and cultivate endogenous motivation

General Secretary Xi Jinping emphasized: "We must respect the laws of talent growth and the laws of scientific research activities, and cultivate a group of strategic talents, technology leaders, and innovative teams with international standards." The cultivation of scientific literacy among college students in the new era should follow the physical and mental characteristics and cognitive laws of college students. The cognitive development of college students is a gradual and spiral upward trend, and the key to the formation and development of their scientific literacy lies in their self-education. Improving self-education awareness is a practical requirement for the formation and development of scientific literacy among college students in the new era, and it is also an important way for college students to seek self-improvement and self-development. Self education is mainly divided into two types: individual self-education and collective self-education. Individual self-education refers to the educational activities in which college students take initiative and consciously educate themselves, with the aim of improving their various qualities and abilities. Improving the self-education awareness of college students in the cultivation of scientific literacy in the new era can help stimulate their subjectivity and enhance the efficiency of scientific literacy cultivation. The key to promoting self-education among college students lies in making them deeply aware of the importance of scientific literacy for personal development and national progress, consciously deepening their sense of identification with scientific literacy, and actively incorporating the training and improvement of scientific literacy into their daily learning and life. This requires college students not only to fully absorb the scientific knowledge and methods learned in the classroom, but also to actively obtain richer and more diverse technological knowledge and methods through channels such as mass media and science popularization venues. In fact, only when college students independently accept and identify with scientific literacy can the cultivation of scientific literacy among college students in the new era achieve more ideal results.

A collective is a combination of common goals, strong leadership core, and correct collective public opinion, and is an external force that cannot be ignored in promoting individual self-education. College students' collective self-education is to independently carry out various forms of scientific education or popular science activities based on group organizations such as classes, student unions, student clubs, and party branches. In this process, college students can use the conformity and contagion effects, cooperation and conflict resolution among organizational members to promote mutual influence among members within the organization, promote the overall improvement of the comprehensive quality of all members within the organization, and thus achieve the goal of collective self-education for college students. Supplementing the cultivation of scientific literacy among college students in the new era through collective self-education can help them strengthen their sense of identification with scientific literacy through the mutual influence of group organization members, deepen their understanding of scientific literacy through collective communication and cooperation, and transform their subjective understanding of scientific literacy into practical actions for self-improvement.

5. Conclusion

The improvement of scientific literacy among college students is a systematic project that requires joint efforts from universities, families, society, and individuals. Under the principle and goal of cultivating scientific literacy among college students in the new era, it is not only necessary to improve the content of cultivating scientific literacy among college students in terms of scientific spirit, thinking, methods, knowledge, and abilities, but also to form a joint force among society, universities, families, and college students. Society needs to further gather social resources and create an atmosphere of love and admiration for science; Universities need

to transform their educational philosophy and focus on the soundness and improvement of the scientific education system; In terms of family, parents need to pay attention to the positive guiding role of family education and build a good family atmosphere; As the first responsible person for self cultivation, college students should strengthen their awareness of self-education and improve their ability in self-education. Through the above measures, the scientific literacy of college students will be comprehensively improved, providing strong support for the country's technological innovation and social development.

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