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Integrating Modern Technological Achievements into Primary and Secondary School Curricula: Values, Challenges, Practices, and Suggestions

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Abstract

Integrating modern scientific achievements into primary and secondary school curricula is a crucial prerequisite for enhancing science education. Its value lies in responding to contemporary development concerns, implementing key measures of curriculum reform, and providing essential support for educational functions. At present, there are realistic challenges that need to be confronted, including the need to clarify conceptual understanding, optimize content structure, update teaching methods, and clarify primary responsibilities. Based on this, Chongqing has constructed three progressive courses involving innovation, coordination, green, openness, and sharing—five dimensions for integrating course, guided by the spirit of scientists and for many years, it has been committed to advancing the tiered cultivation of talents with the comprehensive, individual, and lifelong development of students as the educational goal. It proposes approaches such as developing standards to set norms and quality indicators for course integration, enhancing teacher capabilities with a focus on course development skills, building platforms to create a real-virtual integrated course resource pool, broadening paths to facilitate scientists and research institutions' participation, and improving systems to establish a comprehensive collaborative guarantee and incentive mechanism to expand and enhance the integration of modern scientific achievements into primary and secondary school curricula.

Keywords

Modern scientific achievements; Primary and secondary school curricula; Science education; Eaglet Program.

1. Introduction

Modern scientific achievements, as the crystallization of human technological development, are an important part of primary and secondary school curricula. Modernizing educational content is a crucial part of educational modernization. The guiding principle of the new round of basic education curriculum reform is to enhance the ideological, scientific, contemporary, systematic, and directive nature of the curriculum. Therefore, integrating modern scientific and technological achievements into primary and secondary school curricula is an intrinsic requirement for the modernization of education. It is an inevitable choice to adapt to the rapid development of modern science and technology and the swift emergence of new achievements. It is also a necessary action to deepen curriculum and teaching reform and to strengthen mechanism innovation. In-depth analysis of the contemporary value of integrating modern scientific and technological achievements into primary and secondary school curricula, assessment of the realistic challenges, extraction of practical pathways, and planning of implementation suggestions are important prerequisites for fulfilling the fundamental task of moral education and for enhancing science education.

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2. The Contemporary Value of Integrating Modern Scientific and Technological Achievements into Primary and Secondary School Curricula

2.1. Respond to contemporary development concerns

President Xi Jinping pointed out that "innovation in science and technology and the popularization of science are the two wings of innovative development. We should place the popularization of science on an equal footing with scientific and technological innovation." The main subjects of scientific and technological innovation are scientific and technological workers, centered around scientists and engineers, whose innovation achievements are the most crucial content for science popularization. The main target audience for science popularization are the general public, primary and secondary school students included. The methods and quality of science popularization directly determine the scientific literacy of citizens. Therefore, integrating modern scientific and technological achievements into primary and secondary school curricula is an important bridge linking scientific and technological innovation with science popularization. It helps to alleviate the contradiction between the rapid development of science and technology and the lag in updating the content of basic education curricula. Moreover, it forms an integrated educational force of science and education, contributing to the high-quality development of education.

The report of the 20th National Congress of the Communist Party of China historically coordinated and deployed education, science and technology, and talent as an integrated whole. The report of the 20th National Congress of the Party historically integrates education, science and technology, and talent—trinity into a unified deployment. The Ministry of Education's 2024 work priorities emphasize grasping the strategic path for implementation, understanding the intrinsic regularity of advancing education, science, and talent together, and strengthening the connections between integrating science and education, industry-education collaboration, and talent cultivation. Education cultivates talent, talent generates scientific research achievements, and these achievements promote high-quality development in education. The three elements are interlinked and mutually reinforcing. Therefore, during the implementation of primary and secondary school curricula, organically integrating modern scientific achievements is both an effective path to implementing the spirit of building an education powerhouse and a concrete action to fulfill the fundamental task of educating for moral development.

2.2. Mplement key measures of curriculum reform

The main component of primary and secondary school curricula in China is the national curriculum. ***The General Senior High School Curriculum Scheme*** **(2017 edition, revised in 2020)** proposes that new courses should "reflect contemporary demands, updating teaching content and discourse systems based on new changes in economic and social development and new achievements in scientific and technological progress." It is evident that integrating modern scientific achievements into primary and secondary school curricula aligns with the core ideas of the new round of curriculum reform. This is not an optional task but a crucial one that must be done immediately and executed well.

The main subjects, scope, and methods for integrating modern scientific achievements into primary and secondary school curricula have been clearly outlined in the ***Opinions on Strengthening Scientific Education in Primary and Secondary Schools in the New Era*** issued by the Ministry of Education and 18 other departments, such as "encouraging scientists (scientific and technological workers) to research and participate in scientific education in primary and secondary schools." Scientists (scientific and technical workers) integrate their ideas, achievements into primary and secondary school curricula through appropriate methods,

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not only updating the teaching content in form but also enhancing the scientific and ideological quality of the courses in substance, which contributes to improving science education.

2.3. Provide essential support for educational functions

Scientific and technological achievements refer to results obtained through observation, experimentation, research and development, or dialectical thinking activities on a specific scientific and technological research topic, which have certain academic or practical significance. Therefore, from a content perspective, scientific research achievements are advanced, mature, and applicable knowledge that has been proven effective through practice, and they are an indispensable part of students' knowledge systems. From the perspective of process and methodology, scientific achievements result from scientists employing rigorous scientific methods to explore and verify through "identifying problems - analyzing problems - solving problems." This approach aligns with human cognitive patterns and vividly demonstrates innovative thinking in practice, capable of being transformed into educational processes that conform to educational principles. From an emotional, attitudinal, and value perspective, many of our country's modern scientific achievements reflect scientists' pioneering spirit of striving for excellence and being trailblazers, their pragmatic spirit of pursuing truth and rigorous scholarship, their collaborative spirit of pooling intelligence and working together, their spirit of dedication characterized by modesty and focused research, and their patriotic spirit of serving the nation and its people. These achievements serve as important vehicles for nurturing the spirit of scientists. Integrating modern scientific achievements into primary and secondary school curricula, and promoting the comprehensive enhancement of students' scientific knowledge, thinking, methods, and spirit through the guidance of scientists, helps cultivate "idealistic, capable, and responsible" builders and successors of socialism.

3. Challenges of Integrating Modern Technological Achievements Into Primary and Secondary School Curricula

3.1. Why we integrate: The understanding of concepts needs clarification

A comprehensive and accurate understanding of concepts is the key prerequisite for effectively integrating modern technological achievements into primary and secondary school curricula. Elementary and secondary school teachers are the direct practitioners of their respective curricula. How they understand the integration of modern technological achievements into these courses directly affects the degree of goal attainment and the effectiveness of the integration. After years of on-site observation, investigation, and interviews, it has been found that many teachers have some misconceptions at the level of ideological understanding, which are mainly reflected in three aspects: Firstly, primary and secondary school is the stage where students build their foundational knowledge. The learning content mainly consists of ancient and moder scientific achievements, while modern scientific achievements are the results of human technological development reaching a higher stage since the early 20th century. They are more complex and exceed the students' cognitive abilities. Therefore, there is no need to integrate them. Secondly, modern scientific achievements have been already included in primary and secondary school curricula, so there is no need to specifically emphasize integrating them. Even if they are integrated, it does not add any special new significance. It merely serves as a supplementary role. Lastly, integrating modern technological achievements into primary and secondary school curricula could increase teachers' instructional design workload and students' academic burden, reduce the efficiency of knowledge transmission, and affect teaching outcomes.

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3.2. What to integrate: The content structure needs optimization

The field of modern scientific and technological achievements is vast and abundant. When selecting them, one must consider both domestic and international perspectives, universal impact and local characteristics, as well as personalized design and standardized requirements. There are still some issues regarding the integration of current modern technological achievements into the content structure of primary and secondary school curricula.

Firstly, there are more scientific and technological achievements abroad, while there are fewer domestically. The important events and scientists involved in the presentation of natural science knowledge systems are predominantly Western, with relatively little mention of contributions from Chinese scientists. When it comes to "cloning", many people are familiar with the British cloned sheep born in 1996, but they are unaware of the Chinese cloned fish born in 1963, which was first proposed by the "pioneer of cloning" Tong Dizhou. However, this groundbreaking research seems to have faded from memory.

Secondly, there are many scientific achievements with universal impact, but there are insufficient local scientific achievements. Modern scientific achievements presented in textbooks often have wide influence, but there is less inclusion of scientists and their accomplishments from the regions where primary and secondary schools are located. For instance, in the "Landforms" section of high school natural geography, the textbook introduces geographer Davis's theory of erosion cycles but does not mention Professor Yuan Daoxian from the Chinese Academy of Sciences and the College of Geography at Southwest University's "Karst Dynamics" theory. Many geography teachers are even unaware of this theory, making it impossible to inform students about it.

Lastly, there is a significant amount of personalized integration into the curriculum, but there is no clear standardization requirement. Currently, there is high enthusiasm among various regions and most primary and secondary schools for developing local and school-based curricula. However, due to the lack of unified standards, each region and school operates independently, leading to significant disparities in curriculum quality. Many educational institutions such as universities, research organizations, science popularization venues, enterprises, science and technology museums, museums, and study bases have abundant scientific achievement resources. However, due to the lack of unified standards, the courses provided often do not align well with the needs of primary and secondary school curricula, resulting in suboptimal educational outcomes.

3.3. How to integrate: Teaching methods need to be updated

The effectiveness of integrating modern technological achievements into primary and secondary school curricula depends on the breadth and depth of curriculum resource development, the curriculum design capabilities of primary and secondary school teachers, and the integration pathways for scientists and research institutions. Currently, the main issues are reflected in the following three aspects.

Firstly, modern technological achievements are often static and tend to be used in fragmented ways. The newly revised national science courses for primary and secondary schools have consciously integrated modern scientific achievements. For example, the fifth edition of the compulsory high school physics textbook includes elements of China's new scientific achievements: (The People's Education Press edition mentions these achievements 17 times, the Shanghai Science and Technology edition 39 times, the Guangdong Education edition 40 times, the Shandong Science and Technology edition 24 times, the Education Press edition 25 times.). Such as the "Tiangong II" space lab, the "Beidou Satellite Navigation System", and the "C919 aircraft" are all mentioned. These scientific achievements are statically distributed across chapter pages, reading columns, and examples and exercises. Many teachers, constrained by teaching inertia and time pressures, make little use of them or do not utilize

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them at all. They also rarely actively explore how to systematically and dynamically integrate them into their teaching, resulting in insufficient depth and breadth of integration.

Secondly, many primary and secondary school teachers have weak capabilities in integrating modern technological achievements into their curriculum development. In daily observations, it has been found that many teachers lack the ability to uncover modern technological achievements and leverage their educational value. They also face shortcomings in conducting interdisciplinary teaching, inquiry-based teaching, and higher-order thinking instruction. The update of teaching concepts is slow, often centered around the teacher, with insufficient attention given to individual student differences. In some schools, scientific learning methods are limited to static learning approaches such as listening, watching, thinking, memorizing, and reciting. In teaching, there is a disregard for experimental instruction and subject practice, with a prominent issue of "more talking, less doing". Students have fewer opportunities and experiences to independently construct and apply knowledge to solve real-world problems. There are also fewer innovative experiments, field studies, and surveys.

Lastly, scientists and research institutions face limited integration pathways, and there is a need for the development of unified standards. Scientists primarily engage through popular science lectures, but they pay insufficient attention to students' individual needs. Their reach is mainly concentrated in well-developed educational areas, with limited impact on underdeveloped regions. Collaborations between large and medium-sized enterprises, schools, and museums are relatively common, but the forms of cooperation are quite limited and the content is rather sparse. Most activities involve site visits and superficial experiences, which are insufficient to effectively spark teenagers' curiosity, imagination, and desire for exploration. Due to the lack of unified standards or guidelines, some scientists (researchers) are unsure about how to effectively implement and the depth of related educational activities.

3.4. Who will integrate: the primary responsibility needs to be clarified

Currently, the main entities involved in exploring the integration of modern scientific achievements into primary and secondary school curricula include scientists (science and technology workers), primary and secondary school teachers, educational researchers, and textbook authors. The relevant supervisory departments primarily consist of provincial education commissions (education bureaus), provincial science and technology bureaus, and provincial associations for science and technology. Professional research institutions mainly include provincial educational research and scientific research departments, as well as related universities. The participating organizations typically involve research institutes and science popularization venues. In the specific implementation process, there are still some prominent issues. Firstly, the responsibilities of the relevant parties are unclear, and the depth of resource coordination and integration is insufficient, making it difficult to leverage the collective power of shared resources and collaborative education. Many teachers believe that integrating modern technological innovation into primary and secondary school curricula is primarily the responsibility of administrative departments and textbook authors. Secondly, the institutionalized integration mechanism is still not well developed. Coordination among various departments' policies is insufficient, making implementation challenging. Researchers lack sustained motivation to participate in science education, and integrating science popularization into schools also faces difficulties. Enterprises and social organizations encounter issues such as a lack of incentive policies and standardized integration channels when engaging in science education. Support for the professional development of science teachers, including staffing and funding, is inadequate. Research indicates that nearly one-quarter of elementary school science teachers do not have the opportunity to attend relevant training each year.

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4. Practical Pathways for Integrating Modern Technological Achievements Into Primary and Secondary School Curricula

In 2011, the Chongqing Municipal Education Commission established the Youth Innovation Academy in line with reform trends, deeply implementing the youth innovation talent cultivation program, and building a bridge for cooperation between universities and primary and secondary schools in cultivating innovative talents. In 2023, the Chongqing Institute of Education and Science established an Institute for Innovative Education, continuing to advance scientific education and the cultivation of outstanding innovative talents. Over the past thirteen years, through continuous exploration, practical pathways have been established for integrating modern scientific achievements into primary and secondary school curricula.

4.1. Guided by the promotion of the spirit of scientists, form five dimensions of integration into the curriculum

Science knows no borders, but scientists have their homeland. Scientific achievements cannot be achieved without spiritual support. The spirit of scientists is a precious spiritual asset accumulated by scientific workers through long-term scientific practice. Therefore, when integrating modern scientific and technological achievements into the curriculum, using the promotion of the spirit of scientists as a guiding principle can ensure that the course remains on the right track.

According to the presentation and characteristics of modern scientific and technological achievements, when integrating them into primary and secondary school curricula, they can be categorized into five dimensions: achievement holders, achievement-holding organizations, core content of the achievements, the process of achieving the results, and future development of the achievements. Achievement holders refer to the pioneers, trailblazers, or key contributors of modern scientific and technological achievements. These individuals can be transformed into mentor resources for the curriculum. Currently, Chongqing has selected over 2,500 scientists and science and technology workers to join its mentor database, including academicians of the Chinese Academy of Sciences and Chinese Academy of Engineering, as well as Changjiang Scholars, among others. Achievement-holding organizations refer to universities, research institutes, experimental bases, and enterprises that produce these achievements. These entities can be transformed into research and practice bases for the curriculum. Currently, Chongqing has selected 2 national-level natural resources popular science bases, 13 research institutions, and 49 municipal popular science bases as practice bases for the curriculum. The core content of achievements refers to the conclusive knowledge such as technological principles, theorems, laws, and inferences that have been proven advanced, mature, and applicable within a certain scope. The process of achieving results refers to the scientific exploration process of "identifying problems - analyzing problems - solving problems." Future development of achievements refers to the ongoing research on relevant science and technology to address new problems or the shortcomings of existing research. At present, Chongqing has launched 1,169 special research projects for primary and secondary school students. The core content, formation process, and future development of achievements provide important content and possible ways for integrating modern scientific and technological achievements into primary and secondary school curricula.

4.2. Guided by the principles of innovation, coordination, sustainability, openness, and sharing, develop three types of progressive courses

The principles of "innovation, coordination, green development, openness, and shared benefits" represent the new development concepts of the era. Implementing these principles in primary and secondary school curriculum development can contribute to addressing relevant issues. By fostering innovation, we can address the lack of motivation in curriculum development.

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Coordination helps resolve imbalances in development across different regions and schools. Embracing green development tackles the disharmony between humans and nature in the educational process. Openness improves the connection between internal and external development, while shared benefits ensure the implementation of quality and balanced education.

The three types of advanced courses refer to popularization courses, project-based courses, and research-oriented courses, which have a progressive relationship and are designed to build on each other sequentially. Popularization courses focus on science popularization as their primary task. Their goal is to cultivate students' innovative personalities and help them understand advancements and frontiers in science and technology. These courses are primarily implemented through the localized adaptation of national curricula and science popularization activities. Examples include initiatives such as the Chongqing Ecological Environment Relay Research Project, visits by academicians and experts to campuses, and the integration of traditional Chinese medicine culture into schools. Project-based courses focus on scientific training as their primary task. They aim to cultivate students' innovative thinking and help them master the basic paradigms of scientific research by experiencing the formation process of modern scientific achievements through methods such as replication, recreation, and simulation. These courses are primarily implemented through the development of school-based and local curricula. Examples include textbooks such as *Environmental Education*, *Inquiry-Based Learning*, and *Comprehensive Practical Activities*, which have been developed for primary and secondary school students across the city. Among these, *Comprehensive Practical Activities* received the Second Prize for Outstanding National Textbooks at the First National Textbook Construction Awards. Research-oriented courses focus on scientific research as their primary task. They guide students to propose or jointly select a small research topic with their mentors. Through scientific and innovative practices, students continuously explore their innovative potential and form innovative results. Currently, Chongqing has implemented several initiatives led by the government, including the "Seed Program" for primary schools, and the "Chongqing: Chu Ying Program" for both junior and senior high schools. The teacher-student ratio is generally 1:3, and the course duration is typically 1 or 2 years.

As course instructors, achievement holders directly participate in or guide the development of various types of courses for primary and secondary school teachers. They also guide students in conducting innovative research projects and designing innovative teaching activities, thereby exerting a sustained educational influence on students and even primary and secondary school teachers. The construction of educational scenarios is an important vehicle for the step-by-step cultivation of students and usually includes professional personnel, distinctive courses, and instrumentation provided by course bases.

4.3. Guided by the goal of fostering comprehensive, individual, and lifelong development in students, promote hierarchical talent cultivation

Quality primary and secondary school courses should adapt to students' all-round and individual development, and provide a solid foundation for students to adapt to social life, pursue higher education, and prepare for future careers. When integrating modern scientific achievements into primary and secondary school curricula, it is essential to lay the foundation for students' comprehensive, individualized, and lifelong development, and to implement teaching methods tailored to their aptitudes.

In promoting tiered talent cultivation, Chongqing aims to foster students' comprehensive, individualized, and lifelong development through curriculum design, teacher training, and educational environment construction. The general courses are designed for all students to solidify their foundational knowledge across disciplines and basic scientific literacy. Project-based courses primarily target students with strong academic performance and special talents

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in specific subjects, providing them with guidance on methods and skills for personalized learning. For example, High School Affiliated with Southwest University in Liangjiang New Area, Chongqing, offers an elective course called *Astronomy for Future High School Students*, which is supported by a virtual planetarium connected to the National Astronomical Museum and the Chongqing Astronomical Society. Research-oriented courses are designed for students with high overall quality and strong innovative potential. Through a "four-teacher guidance + dual-location training" model, these courses aim to complete research projects with a certain degree of innovation. Research-oriented courses, which rely on universities such as Chongqing University and Southwest University, primarily focus on fields such as mathematics and information science, physics and Earth sciences, and chemistry and life sciences. These courses emphasize research areas including artificial intelligence, big data, mobile communications, the Internet of Things, intelligent manufacturing, new energy, new materials, ocean engineering, and pharmaceutical engineering. Over thirteen years, we have trained a total of 5,032 students through the *Young Eagle Program* and the *Talented Youth Program*, impacting nearly one million students.

5. Suggestions for Integrating Modern Technological Achievements Into Primary and Secondary School Curricula

5.1. Develop standards, establish norms and quality metrics for integrating into the curriculum

A scientifically sound standard system is crucial for ensuring the quality of integrating modern scientific achievements into primary and secondary school curricula. To this end, it is essential to establish a comprehensive standard system based on thorough research, setting basic guidelines for integration. First, establish standards for content integration. While integrating modern scientific achievements into the basic content of primary and secondary school curricula, it is also necessary to establish clear quality standards for content selection, presentation methods, and suitability for different educational stages to enhance the quality of the courses. Secondly, establish integration standards for institutions. Research institutes, technology companies, and higher education institutions participating in the development of primary and secondary school curricula must meet the requirements of the curriculum standards and possess the capability to undertake curriculum development. Thirdly, establish standards for primary and secondary school science teachers. Based on the trends in technological development, establish and complete a standard system for primary and secondary school science teachers. Use these standards as a benchmark for teacher certification, hiring and evaluation, training, and awards.

5.2. Enhance teaching faculty, with a focus on curriculum development capability improvement

Teachers are not only executors of the curriculum but also researchers and developers of it. Primary and secondary school teachers, especially those teaching science-related subjects, should be at the forefront of integrating modern technological achievements into the school curriculum. Therefore, the focus should be on enhancing the ability to integrate modern technological achievements into curriculum development, cultivating a high-quality, professional, and innovative team of science teachers. Encourage top-tier comprehensive universities and research institutions to participate in teacher training, thereby strengthening the supply of high-quality, professional science teachers from the outset. Second, emphasize the integration of scientific research achievements in pre-service teacher training. Modern scientific achievements should be introduced into the curriculum for prospective teachers, guiding them to participate in research on the integration of cutting-edge scientific

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achievements into courses, experiencing the process of scientific innovation, and identifying suitable scientific achievements and their educational value. Thirdly, implement a plan to enhance the scientific literacy and curriculum development capabilities of in-service teachers, advancing tiered training for their teaching transformation abilities, organizing high-quality innovative education classes competitions for teachers, and arranging science course teachers from primary and secondary schools to engage in in-depth learning at universities, research institutes, and high-tech enterprises.

5.3. Build a platform to create a course resource library that integrates real and virtual elements

To address the issue of uneven distribution of course resources, the relevant authorities can lead the establishment of a resource-sharing platform that integrates modern scientific achievements into primary and secondary school curricula. Leveraging national, provincial, municipal, and district-level smart education public service platforms, we will fully coordinate various scientific educational resources both within and outside schools to precisely meet students' needs, providing high-quality digital scientific educational resources and practical exploration spaces. Secondly, mobilize and encourage various enterprises, especially those closely related to cutting-edge technologies, to establish scientific education course resource libraries, provide services for applying and reserving course resources, and actively carry out distinctive science education activities. Third, encourage universities, research institutes, and science popularization venues to guide primary and secondary school science education, and promote effective synergistic linkage between “bringing in” and “reaching out”.

5.4. Expand pathways and ensure smooth access for scientists and research institutions to participate

Scientists and research institutions are the creators of modern scientific achievements. To accelerate the integration of modern scientific achievements into primary and secondary school curricula, it is necessary to broaden the pathways for scientists and research institutions to participate in primary and secondary education. First, establish a science education expert committee that includes scientists. This committee will participate in developing curriculum standards and textbook development, ensuring that modern scientific achievements are integrated more effectively and appropriately into curriculum standards and textbooks. Second, promote collaborative teaching research between research institutions and primary and secondary schools, and conduct various types of curriculum development and teaching practice to integrate modern scientific achievements into the primary and secondary school curriculum system in appropriate ways. Third, advocate for joint construction of innovation laboratories, science popularization stations, and talent training classes. Explore a dual mentorship system between universities and high schools to provide education tailored to students’ aptitude. Fourth, explore appointing scientists, engineers, and other science and technology workers as vice principals for science in primary and secondary schools. Establish science tutors combining full-time and part-time roles, and guide science popularization institutions to participate in primary and secondary school education.

5.5. Refine systems and strengthen multi-party collaborative guarantee and incentive mechanisms

Integrating modern technological achievements into primary and secondary school curricula is a complex systemic project that requires effective and reliable incentive mechanisms. Firstly, promote the establishment of a scientific education collaboration mechanism under the unified leadership of local party committees and governments, involving multiple departments working together, effectively coordinating, and closely cooperating. Continuously improve the collaborative education mechanism among primary, secondary, and higher schools, as well as

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between schools, families, and communities. Secondly, systematically design the top-level framework for scientific education, optimize and improve mechanisms for work deployment, advancement, monitoring, guidance, and promotion. Thirdly, further improve the evaluation and reward system, ensure research institutions and schools fulfill their educational responsibilities, and introduce innovative incentive and error-tolerant mechanisms to encourage active contributions from all parties.

6. Conclusion

In January 2025, the *Outline for the Construction of an Education Powerhouse (2024-2035)* was officially issued, specifically proposing to cultivate scientific literacy among primary and secondary school students through the '*Fertile Soil Program*' and to implement the '*Outstanding Talent Program*' for high school students with innovative potential. This provides strong policy support and specific guidelines for integrating modern technological achievements into primary and secondary school curricula. Chongqing will seize this opportunity to continue leveraging its traditional strengths and thoroughly implement the five recommendations, continuously contributing to enhancing students' scientific literacy and fostering their innovative spirit.

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