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Research Article

The Major Challenges Faced in the Education 3.0 Era and Evidence-Based Solutions

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Abstract

This paper analyzes the history of educational development using the organizational approach, teaching methods, educational purposes, and target audiences as a coordinate system. It distills the three stages of educational development and their main characteristics. Based on the teaching resource allocation model, talent supply and demand analysis, and extensive field investigations, the paper identifies the three major challenges that contemporary education must address: promoting individualized talent development, bridging the significant gap between educational content and practical work, and providing not only professional education but also holistic education. In response to these challenges, the paper proposes an Education 3.0 solution based on teaching reform and experimentation: implementing the combined credit system at the resource allocation level, allowing students to choose courses according to their own interests; applying the five principles of instructional design, the PDCA iterative improvement pedagogy, and peer instruction at the classroom teaching level; establishing the comprehensive education and teaching organizational system that includes the "research-teaching-study nexus," grade-based residential colleges, and student learning societies at the organizational structure aspect; creating a project-based learning curriculum system; and implementing internationalization education at home that benefits all students to enhance international competitiveness. Evidence suggests that this solution is universally significant for addressing the aforementioned challenges and for enhancing the competitiveness of students and higher education institutions.

Keywords

History of Education Development, Challenges, Education 3.0 Solutions, Combined Credit System, Pedagogy, Organizational System, Curriculum System

1. A Broad Historical Perspective on Education

Stepping back from local details will help to see the essence of the issue more clearly. From the perspective of the entire human development history, and using the organizational form, teaching methods, educational purposes, and target audience as a unified coordinate system to view the development history of education, we can broadly divide the development of education into three main stages:

Stage 1.0: Its organizational model is primarily based on

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individual instruction [1]. The teaching method revolves around philosopher-teachers, such as Socrates or Confucius, who tailored their instruction to the individual student's abilities [2]. The educational purpose mainly focuses on inspiring the mind and imparting knowledge, primarily serving the elite class. The works that have been handed down through the ages are mainly those of heuristic education and teacher-student discussions, such as the *Analects* and *Wang Yangming's Record of Transmission and Learning*.

Stage 2.0: This stage corresponds to the large-scale training methods adapted to industrial development. Its organizational model evolves into classroom teaching [1], with educational methods and purposes concentrated on knowledge impartation. The teaching method remains teacher-centered, and the audience is still primarily the elite class. However, due to the expansion of the audience and the lack of effective knowledge-sharing technology, teachers focus more on unilateral knowledge impartation to improve teaching efficiency, essentially discarding the practice of tailoring instruction to individual abilities.

Stage 3.0: Higher education has become accessible to the masses. Students come from diverse family and upbringing backgrounds, and varying learning speeds and abilities have become commonplace. In this situation, the classroom teaching system, which is "entirely prepared for passive listening," [3] is obviously no longer applicable. On the other hand, due to the rise of internet technology, digital educational resources have become easily accessible. This provides revolutionary elements and new combinations for teaching and knowledge sharing. Education is currently in an environment known as "VUCA," which stands for Volatility, Uncertainty, Complexity, and Ambiguity. In such an environment, "The value of explicit information is rapidly dropping to zero." "The key lies in how to apply knowledge to new environments or new problems." [4] "Being eager to learn" becomes more important than "learning well" [5], and the purpose of education needs to evolve to stimulate students' intrinsic motivation and promote their comprehensive development.

The above can be summarized in the following table:

Table 1. *Evolution of Education.*

	Education 1.0 (Pre-Industrialization)	**Education 2.0 (Stage of Industrialization)**	**Education 3.0 (Internet Era) "VUCA" Era**
Organizational Form	Individual Instruction	Classroom Teaching	The traditional "class-based teaching system" is outdated.
Teaching Methods	Teacher-centered, heuristic education	Teacher-centered, primarily didactic	The transition from the "Old Three Centers" to the "New Three Centers" in education [a]
Educational Purposes	Inspiring the mind and imparting knowledge	Imparting knowledge	Simply imparting knowledge is no longer sufficient; it is necessary to ignite one's intrinsic motivation
Target Audience	The Elite Class	The Elite Class	The Masses

a: The former is characterized by a "textbook-centered, teacher-centered and classroom-centered" approach, while the latter is "student development-centered, student learning-centered, and learning outcomes-centered." [6]

There are various reference frameworks and methodologies for dividing the developmental stages of education [7] (p. IV). The one presented here by the author is merely one of them.

2. Three Major Challenges Facing Education at the Current Stage

As shown in Table 1, after entering the 3.0 stage, education has undergone radical changes in its organizational structure, teaching methods, educational purposes, and target audience. The challenges facing education today are omni-directional. To grasp the principal contradiction or the main aspect of the contradiction, the author, based on the teaching resource allocation model [8], Qian Xuesen's question [9], and the analysis of talent supply and demand and the efficiency loss in talent cultivation during the popularization of higher education [10], has identified the first major challenge that education must address today: how to promote the personalized development of talents while ensuring large-scale workforce training.

Through a survey of the ability of teachers at a private undergraduate university (hereinafter referred to as "G University") and a private vocational college to solve practical industrial problems [11], an analysis of the issues in the development of universities in Zhuhai City [12] (p. 262), and Stanford University's role in fostering the birth of Silicon Valley and high-tech industries, the second major challenge facing education has been identified: how to bridge the significant gap between educational content and workplace realities.

Through an international comparison of students' in-class and out-of-class learning time [11] and the requirements of the "VUCA" era, the third major challenge facing education today has been ascertained: not only to provide professional education but also to conduct holistic education, innovation and entrepreneurship education, and cultivate students' independent and rational thinking.

3. Evidence-Based Education 3.0 Solution Framework

To address the aforementioned challenges, a comprehensive reform of how education is organized and how students learn is imperative. To this end, the author has developed an Evidence-Based Education 3.0 solution.

3.1. Combined Credit System (CCS)

According to a 2014 college admission survey, 84.4% of freshmen do not know what they truly want to study [13]. This indicates that they or their parents have merely selected their majors based on a rather superficial understanding. But, "the main factors affecting college students' attitudes towards learning are their identification with and interest in their majors" [14]. In most universities in China currently, the majority of compulsory courses and professional development paths for students are predetermined. Students lack the autonomy to select courses and the opportunity to make choices again after experiencing relevant professional courses. This not only deprives students of the precious opportunity to learn how to make choices, try and error, and take responsibility for their own decisions during their school education, but also results in low learning motivation among students. This further leads to "a persistent lack of outstanding talent emerging." [9]

The essence of this issue is how we can utilize limited educational resources to most effectively cultivate talent. To address this, the author applies the principle from economics that new combinations of factors promote innovation [15] and has developed an education solution that balances individual growth with mass cultivation [10]: the combined credit system course framework that integrates the advantages of the European Credit Transfer System and the American elective system [13]. For undergraduate students, during their four-year study process, they can have "four opportunities to choose and more than five development paths" [16]. The key is to grant teachers and students autonomy in choosing their areas of study within certain parameters. The aim is to enhance the outcomes of talent cultivation by using the most economical and effective new combinations of resources. As the expert panel organized by the Beijing Municipal Education Commission concluded: "This project has provided students with more opportunities to choose and understand themselves, avoiding problems such as the lack of a systematic knowledge structure and insufficient high-level elective courses caused by the complete credit system. It not only offers a platform for students to choose their development direction based on their interests but also enables them to acquire professional competence and transferable abilities during the learning process."[1]

The purpose of implementing the CCS is to stimulate students' intrinsic motivation and facilitate the transition from “Forcing Me to Learn” to "I want to learn" [17]. Therefore, it is imperative to dismantle the fixed-class teaching organizational model that has continued from the industrialization stage to the present, where students spend four years or three years in the same class. Especially in the first year, it is crucial for freshmen as it marks a transitional period for their learning and living patterns. Purposefully designing the first-year experience will aid students effectively in adapting to college life and provide them with the essential skills, knowledge, and competencies necessary for the success throughout their academic journey. For instance, a colleague of the author adjusted most of the courses in the two semesters of the freshman year to two periods of nine weeks each, allowing students to choose their future course combinations at the beginning of enrollment, in the middle of the first semester, at the end of the first semester, in the middle of the second semester, and at the end of each academic year. This approach helps freshmen understand and recognize themselves through five opportunities to choose within their first academic year, learning to make choices and take responsibility for them. The author's comparative survey on-site indicates that freshmen who have undergone the aforementioned adjustments in their first-year teaching model invest much more time in out-of-class study than other freshmen.

According to the global engineering education leader Olin College of Engineering and the author's practice, a student's four-year learning process in college can be divided into the first one to two years as the foundation stage, the third year as the specialization stage, and the fourth year as the realization stage [16, 18]. Based on Stanford University's "2025 Plan," the student learning process is correspondingly divided into the "Calibration Phase," "Activation Phase," and "Inspiration Phase" [19]. Students can autonomously choose their learning paths according to their development plans and the university's credit requirements at each stage of learning.

After abolishing the traditional class-based teaching system characterized by subject-specific instruction, teaching in fixed class periods, and alternating classes among different subjects [1], and allowing students to attend classes based on their course selections, their daily learning and practical activities are primarily managed by "Research-Teaching-Study Nexus" (RTSN, further discussed below) at different stages. Additionally, students require a sense of belonging within a learning community outside of class to fulfill the principle of

1 Quoted from the expert panel's appraisal opinion for the conclusion of the key project (2014-zd09) funded by the Beijing Municipal Education Commission.

"life as education." Therefore, it is necessary to complement this with grade-based student residential colleges (hereinafter referred to as "grade colleges") that accompany students throughout their academic journey from enrollment to graduation, and student learning clubs that facilitate peer instruction, together forming a comprehensive educational and instructional organization system. This is illustrated in Figures 2-4.

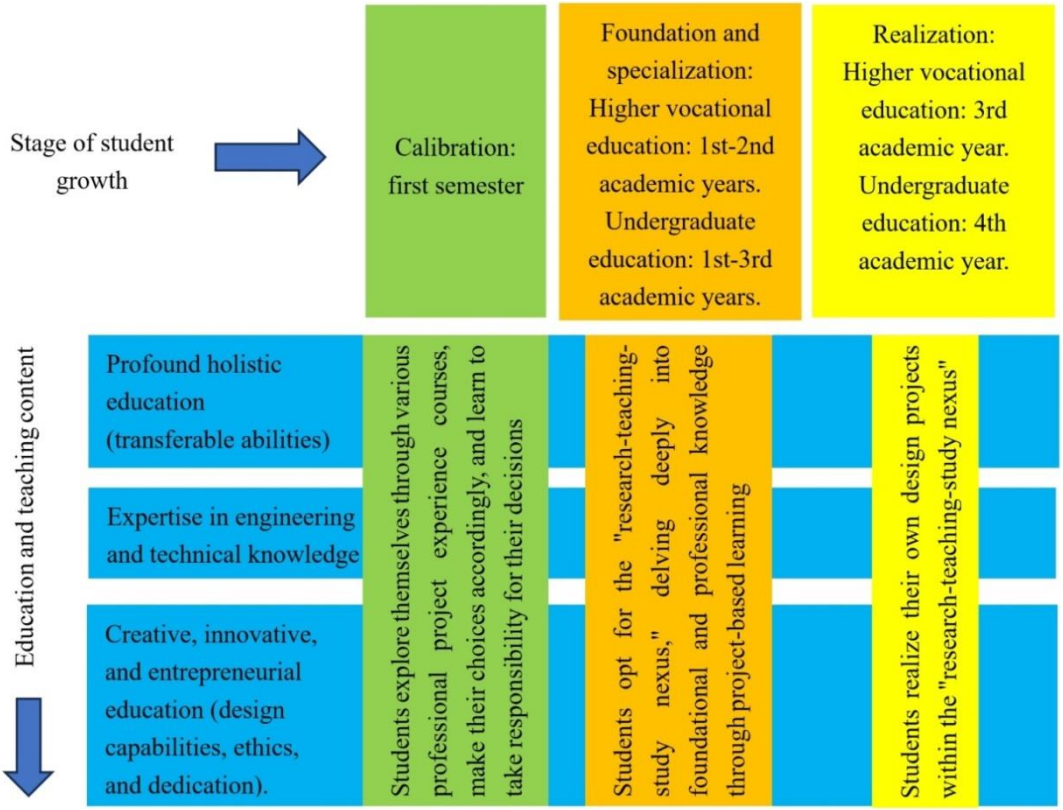

Figure 1. *Student Growth Matrix.*

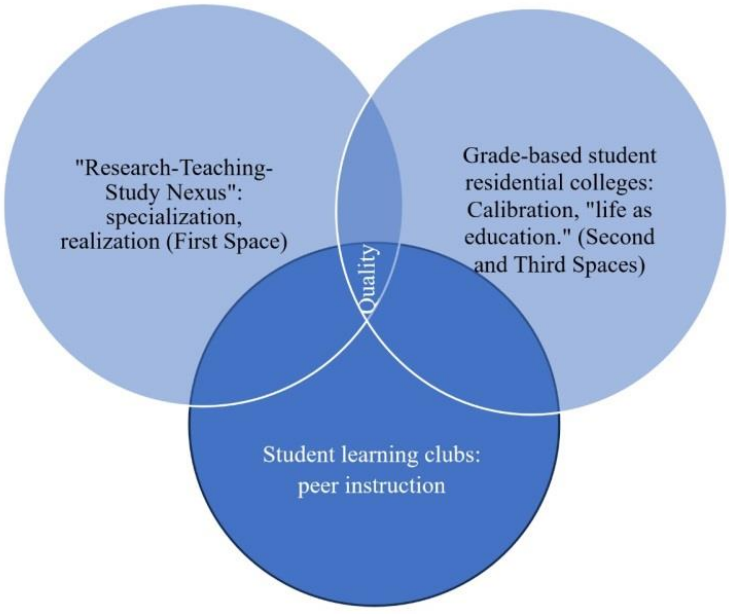

Figure 2. *Comprehensive Education and Teaching Organizational System: "Research-Teaching-Study Nexus" + Grade Colleges + Student Learning Clubs.*

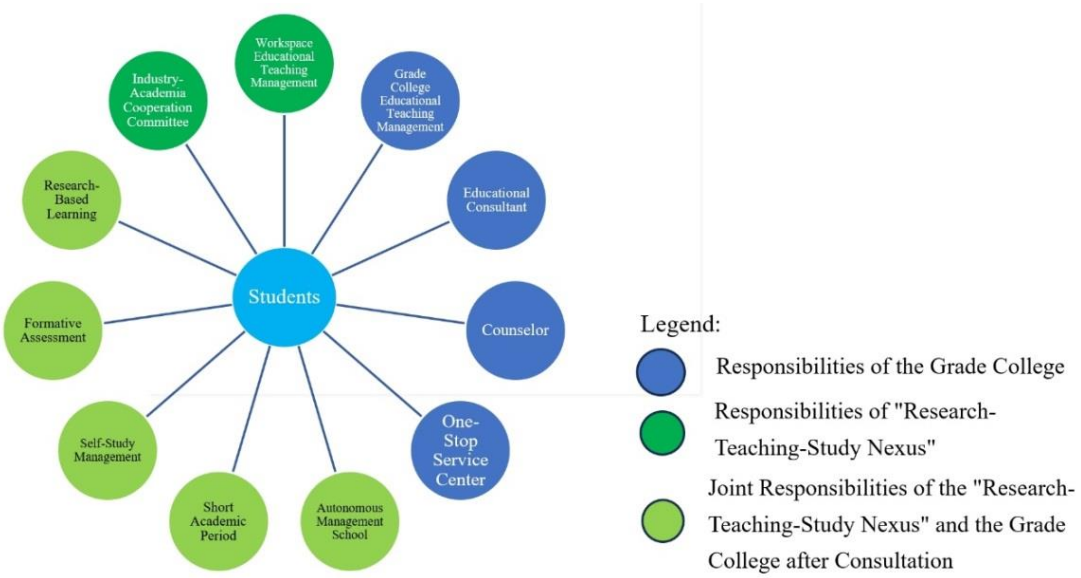

Figure 3. *Student-Centered Service Structure for the XX Major.*

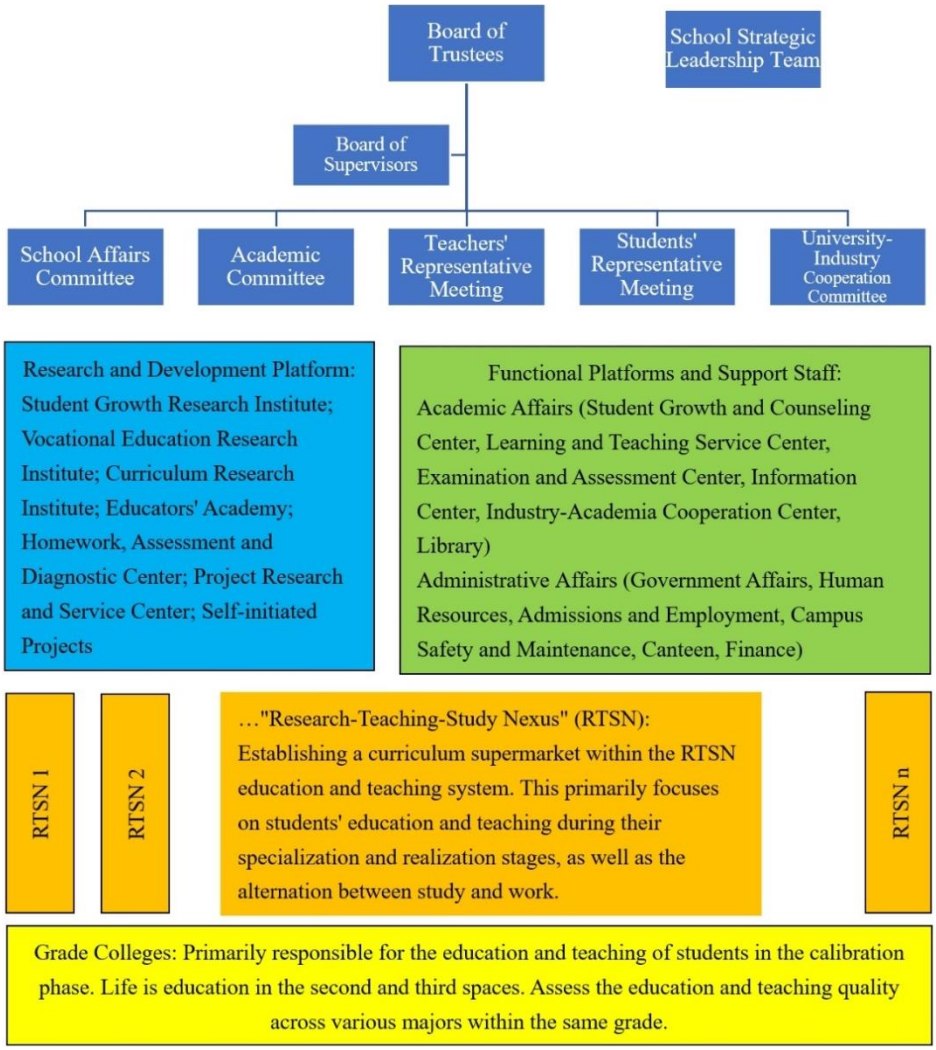

Figure 4. *Organizational Structure of the Future School: A Matrix Education Model Combining the "Research-Teaching-Study Nexus" and Grade colleges.*

The author has adopted the CCS to preliminarily reconstruct the courses at G University, which has significantly promoted course integration, healthy competition between courses and majors, and collaboration on interdisciplinary courses, achieving a synergistic effect where the whole is greater than the sum of its parts. Before the CCS reform, G University had an average of 69.95 courses per major, with students spending most of their time in classrooms and lacking a rational design for self-study time, resulting in weak problem-solving abilities and misplaced energy. As criticized by Li Zexiang, there was an over-specialization of majors, a formalization of foundations, a virtualization of practice, and a fragmentation of knowledge [4]. After the CCS reform, a large number of fragmented courses were merged or eliminated, reducing the average number of courses per major to 49.36, a significant decrease of 29.44%. However, compared to the traditional American engineering curriculum (40 courses) [4], there is still a 18.96% reduction space; compared to Olin College (28-35 courses) [18], there is at least a 29.1% reduction space.

Based on Olin College's experience, through curriculum restructuring, it is possible to integrate detailed and fragmented courses into multidisciplinary integrated courses that span from design to production. Integrating arts, humanities with science and engineering is the best way to reduce the number of courses [4].

The outcome of reducing and compressing courses is the liberation of students' time from the classroom. Taking G University as an example, in the first semester of the 2014-2015 academic year before the CCS reform, the total average weekly class hours across the university were 28.13. After the reform, in the first semester of the 2016-2017 academic year, the total average weekly class hours decreased to 24.39, a reduction of 3.74 hours. The sophomore class saw an even greater reduction of 6.49 hours. The previously common situation in Chinese universities of a lax first year, a heavy workload in the second year, and a sophomore slump has been alleviated to some degree. However, this still only approximates the average weekly study hours of 22-24 for domestic top-tier undergraduate institutions. Compared to foreign universities, which have only 15-20 classroom hours per week [11], there is still significant room for further reduction.

The result of granting students autonomy in choosing their learning areas is an unprecedented surge in their learning enthusiasm, a positive adaptation by teachers as students gain more choice, and generally positive feedback from parents. This can be glimpsed from the change in library attendance rates. A school library, originally the most sacred place, saw infrequent visits from many students before the CCS reform. Numerous students did not borrow even a single book throughout their four years of university. After the CCS reform, "the number of freshmen borrowing books increased by 52% compared to the previous year, the number of books borrowed increased by 65.8%, and the number of visits rose to 30,865, marking a 73.6% increase." [20]

Looking at the changes in the absenteeism rates for CET-4 and CET-6 exams before and after the implementation of the CCS reform, Figure 5 shows that in the three years prior to the reform, due to students' low learning enthusiasm, the absenteeism rate for CET-4 fluctuated between 11% and 22% (with an average of 15.84%), and the absenteeism rate for CET-6 fluctuated between 18% and 33% (with an average of 25.3%). In the first semester of the 2016-2017 academic year after the CCS reform, due to the increase in students' learning enthusiasm and education on honest test-taking, with the number of examinees remaining roughly the same, the absenteeism rates for CET-4 and CET-6 decreased to 9.82% and 5.68%, respectively.

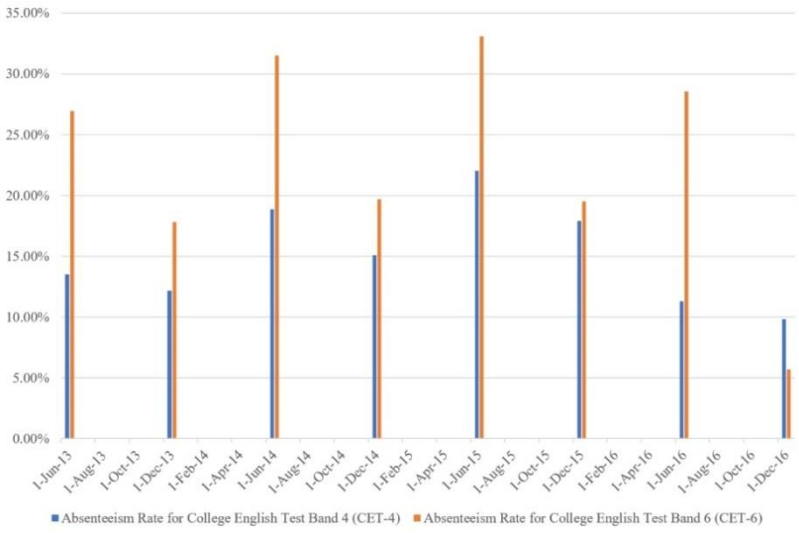

Figure 5. *Changes in the Absenteeism Rates for CET-4 and CET-6 Exams for Undergraduate Students at G University During the 2013-2016 Academic Years.*

3.2. The PDCA Iterative Improvement Pedagogy

At the macro level, while allowing students to autonomously choose their learning paths and compressing fragmented courses, it is imperative to improve the teaching of each course and class at the micro level. Otherwise, the condensed class hours might be utilized by less self-disciplined students for recreational activities such as gaming. To address this, the author has refined and developed five principles of instructional design based on teaching experiments [11]. These principles include: transforming teachers into facilitators who transitioned from a traditional one-way transmission model to a dynamic "research-teaching-study nexus" that fosters active learning; increasing the proportion of formative assessment in evaluations; organizing instruction around Problem-Based Learning; designing the whole learning process both in and out of class; and promoting output-based learning to enhance input-based learning. Furthermore, based on the new combinations of pre-class, in-class, and post-class learning activities, new combinations of behavioral elements, and new personnel combinations, the PDCA Iterative Improvement Pedagogy has been developed [21].

Surveys on student development demonstrate that after experiencing the aforementioned cooperative learning processes both in and out of class, students not only acquire professional knowledge but also experience comprehensive growth in their transferable abilities and non-intellectual factors. This holds universal significance for reforming the traditional class-based teaching system, effectively utilizing online learning resources, enhancing students' engagement in out-of-class learning, improving the learning efficiency of the teaching and learning community, balancing students' individual growth and social function training, integrating professional education with holistic education, and implementing a quality closed-loop in daily teaching processes [21].

3.3. The Research-Teaching-Study Nexus (RTSN)

To address the second challenge, the significant disconnect between educational content and workplace realities, it is imperative to integrate teaching content with the resolution of real-world issues. Therefore, there is a need to reform the traditional classroom teaching system [1] and establish the RTSN. In the interconnected relationship of the RTSN, "research activity is seen both as a compelling form of teaching and as a necessary method of learning," and "as a basis for teaching and learning." [22]. This nexus "is an organizational structure that can combine teaching and research on a large scale. This seems to be the core of the success of American universities as research-centered organizations"[23].

Before the advent of the internet, the RTSN organizational form was primarily seen in graduate education. With the internet, knowledge that was previously conveyed through face-to-face instruction, such as conventional explicit knowledge (e.g., various textbooks) and tacit knowledge (e.g., craftsmanship and experience), is now readily accessible, providing students with the conditions for research-based learning. Consequently, the organizational form of the RTSN has begun to emerge gradually in undergraduate [8] and vocational education [12] (pp. 159-164).

In practice, the organizational form of this nexus can be manifest as seminars or workshops in the lower grades or foundational stage, and as workspaces (e.g., studios) or laboratories in the higher grades or specialization and realization stages. Students can make their own choices by selecting courses in different stages through a flexible course-taking system.

Currently, in most universities in China, despite numerous attempts at reforming teaching methods, the educational organizational model for undergraduate and vocational students still primarily adopts a fixed class system, either a four-year or three-year consistent system from enrollment to graduation. The advantages of this organizational model are evident, particularly in its low organizational costs. However, its disadvantages are also prominent, as it forces students who are still exploring their identities, with diverse characteristics and strengths, into a rigid mold, fostering them according to a unified format. The author has previously argued that the "developmental demands of the information era necessitate a paradigm shift in education" [11].

The RTSN that the aforementioned students participate in during the lower grades or calibration phase — seminars — their teaching organization form, although also manifested as a class form, is fundamentally different from the traditional class-based teaching system with a fixed number of students arranged by grade for several years, at least in two aspects: firstly, students can make choices based on their interests and adjust their choices according to their actual situation during the learning process. Therefore, the number of students in such seminars is not fixed. Secondly, the learning approach in seminars emphasizes inquiry-based learning and focuses on the cultivation of abilities. In contrast, the traditional class-based teaching system predominantly adopts subject-based teaching, placing greater emphasis on the understanding and mastery of subject knowledge [1]. Although the mastery of knowledge is important, "knowledge only becomes actual and effective power when it is used to answer and solve problems" [24].

At this stage, the RTSN is still in its infancy in undergraduate and vocational students' education in Chinese universities. However, some comparative teaching experiments and explorations [8, 10, 12] have already shown promising results.

Since RTSN teaching primarily adopts seminar-style and project-based learning methods, it places higher demands on teachers' teaching abilities, students' learning abilities, and

cooperation skills. The investment in studios or laboratories in RTSN is higher compared to traditional classroom teaching, and it takes time for studios or laboratories to secure stable support from social resources outside the school to become more service-oriented "Organized Research Units" [25]. The development of RTSN courses requires iterative improvements, and the enhancement of students' practical work abilities through RTSN teaching methods needs time to prove. Given that external evaluations of universities still adopt traditional methods, and parents and society still have doubts about this new educational organizational model, transitioning from the traditional class-based teaching system to the RTSN teaching organizational form requires a gradual approach.

The first step involves transforming the teaching organization of senior-year specialized courses into studio or laboratory teaching. The second step involves transforming the teaching organization of lower-year specialized foundation courses and general education courses into seminars and workshops. With the condition of fulfillment of necessary credit requirements, students can choose classes based on their own interests.

In the future, with the development of RTSN, universities will be able to connect with industries or entrepreneurial incubation platforms through studios/laboratories. Through RTSN, the universities can provide a continuous supply of talent and support for innovative projects to society. This will undoubtedly contribute to fostering a positive interactive relationship between schools and industries.

3.4. Project-Based Learning Curriculum System

The aforementioned RTSN primarily focuses on the innovation of teaching organizational model. To address the third challenge (Please refer to Section 2 of this paper), it is necessary to reform the teaching content based on the actual needs of various majors. This involves "using project tasks as the carrier and the work process as the main thread," reconstructing the project-based learning curriculum system that connects educational content with the reality of the workplace, based on the work processes of professional positions and the cognitive laws of action fields, and conducting project-based learning within the RTSN organizational framework [12] (pp. 159-164).

Starting from project-based learning, it is possible to integrate traditional basic courses, specialized courses, practical training courses, and ideological education courses. This has been demonstrated in the two compulsory courses for freshmen and sophomores at Olin College of Engineering: Quantitative Engineering Analysis (QEA) I and QEA II. These two courses are equivalent to four traditional courses [4].

By adopting project-based learning, specialized engineering and technical knowledge can be combined with profound holistic education (focused on the development of transferable abilities) and creative, innovative, and entrepreneurial education (focusing on design ability, ethics, and dedication) (see Figure 1). This approach enables the realization of the Olin Triangle curriculum system [26], achieving upstream and downstream curriculum chain coordination in the process of solving problems and cultivating students' professional competence, cooperation skills, sense of responsibility, and complete personality [12] (pp. 159-164).

In China and most countries, the conditions for implementing a dual-system vocational education similar to Germany's (hereinafter referred to as the dual system) are not present [27]. A more practical approach is to integrate the essence of the dual system into the existing teaching system. The dual system's manifestation is the alternating switch between educational and workplace settings, but its essence is the connection between educational content and workplace reality, which aligns with project-based learning. Therefore, starting from project-based learning, it is possible to establish a knowledge system obtained through action by undertaking real tasks, thereby implementing the dual system in connotation and essence [28].

3.5. Internationalization Education at Home

The deepening of globalization demands that the talents we cultivate be able to adapt to an international competitive environment. The most direct manifestation of this is that the quality system of schools should be mutually recognized with that of high-level schools worldwide, allowing for the mutual recognition of students' credits. However, currently, internationalization education in most universities in China still focuses on students' overseas study and foreign language skills teaching. The former only benefits a small number of students, while what is more important than the latter is the alignment of teaching quality standards with international advanced standards.

Even in foreign language teaching, the teaching methods adopted by most Chinese schools are still dominated by explicit learning (memorizing grammar and vocabulary) and input-based learning (listening and reading), with assessments focusing on paper-based tests and neglecting output-based learning (speaking, writing, and translation). This has resulted in a large number of Chinese students having "mute English" and poor communication skills.

To address this, the author has implemented internationalization education in China that benefits all students at G University. An external examiner system compliant with the European Union's education quality system has been implemented across all majors. Foreign language teaching adopts an approach of enhancing input-based learning through output-based learning, and implicit learning (such as creating language-learning dormitories and other micro-environments for speaking, listening, and using the foreign language) drives explicit learning [29, 30]. Students' foreign language abilities have improved rapidly as a result. Three majors have all their

courses taught in English. Five majors have opened international classes. Courses taught entirely in English by local teachers increased from 0% to about 14% of the total number of courses. Data shows that the average score of students' course experience questionary (CEQ) in fully English-taught courses is higher than the average score of CEQ for all courses across the university, and the difference is gradually increasing. This indicates that this teaching paradigm has been recognized by students [11].

According to the author's survey of multiple universities in non-English-speaking countries (such as Finland), when the proportion of fully English-taught courses in a school reaches about 40% of the total courses, students have basically developed a second-language mindset, which can better meet the bidirectional needs of international cooperation. The educational quality and academic standards of the school have also been elevated to the international advanced level during this process [31].

4. Further Development and Application of "Education 3.0 Solutions"

The evidence-based Education 3.0 solutions mentioned above are merely the beginning. Undoubtedly, to enhance the quality of education and bolster the competitiveness of universities in China and worldwide, there is a pressing need to further develop and apply "Education 3.0 solutions." This involves:

4.1. Further Developing Project-Based Learning Curriculum Systems

Each course should undergo reconstruction and regular assessments of its effectiveness. For instance, Olin College conducts annual evaluations of its courses across ten dimensions [4, 18]: (1) hands-on ability; (2) design and creativity; (3) situated learning; (4) critical thinking; (5) integration with practical applications; (6) interdisciplinary integration; (7) communication skills; (8) teamwork abilities; (9) intrinsic motivation; and (10) self-directed learning capabilities.

4.2. Gradually Establishing a New Education and Teaching Organizational System

Replace the traditional three or four-year fixed classroom teaching organizational model with an education and teaching organization system that consists of the "Research-Teaching-Study Nexus" (RTSN), grade colleges, and student learning societies.

The RTSN, in the form of studios or laboratories, is primarily responsible for the education and teaching of students in the specialization and realization stages, as well as the alternation of work and study. It serves as the core of nurturing students by integrating education, teaching, research, and student management into a cohesive unit. This closed-loop teaching organization is based on actual workflow projects, empowering students with process- and scenario-based solutions that aggregate business knowledge points into a comprehensive ability to support students' practical skills.

Grade colleges are primarily responsible for the education and teaching of students in the calibration phase, considering life outside the classroom as education, and assessing the education and teaching quality of various majors within the same grade.

Student learning clubs primarily focus on peer instruction and the accompanying holistic education. In today's internet era where knowledge is readily accessible, the fundamental purpose of schools should be more about serving as "a place for students to find peers" [32].

4.3. Further Refining the Student Ability Growth Scale and Formative Assessment Methods to Stimulate Intrinsic Learning Motivation

Chinese universities generally prioritize summative assessments, often allocating only 30%-40% weight to formative assessments. However, in the author's view, assessment is not merely an evaluation tool but a means of fostering growth. For instance, stimulating tacit knowledge of exceptional types cannot be achieved through exam-oriented education; instead, it requires advance thinking and classroom discussions. Effective intrinsic motivation among students and teachers stems from they could promptly observe their progress. Psychological findings suggest that if action precedes, corresponding thoughts are more likely to emerge [33]. And action occurs in the process. "Decades of research indicate that students' mastery and understanding of knowledge cannot be accurately assessed through a series of 90-minute exams" [7] (p. 133). Standardized tests can only measure specific skills, not work capabilities [34]. Consequently, in the universities where the author previously served, the weight of formative assessments was increased to 70%-80% [35].

After implementing the aforementioned assessment method, students provided positive feedback stating, "Previously, the assessment criterion was based on final grades, leading students to rote memorization. Those who couldn't memorize gave up and ultimately failed. Now, participation is required in every class, ... transforming the previous daunting final exam into an environment that changes everyone, ... our previous assessment methods were incorrect. The knowledge points we memorized may ultimately be useless."[2]

The author has practiced formative assessment in his own teaching [21] and developed the "Four Rubrics": (1) Professional Competence Rubric: examines methodologies, historical perspectives, and professional knowledge of academic

2 Quoted from the Meeting Record of the Student Symposium on the Conclusion of the Beijing Municipal Education and Teaching Reform Project on November 28, 2016.

studies; (2) Transferable Abilities Rubric: assesses relearning, expression, communication, cooperation, time management, emotional management, critical thinking, problem-solving, and adaptability; (3) Quality Rubric: examines responsibility, integrity, behavior, time management, and information literacy; (4) Creativity Rubric: examines curiosity, authentic practice, concentration, interdisciplinary integration, and absorption of diverse cultures. In the author's view, if students can learn to make choices and take responsibility for them during their university years, learn how to learn, and develop a habit of lifelong exercise, they have already made significant progress.

To prevent formative assessments from becoming mere formalities, the author promoted an N+1 assessment method in the schools where he previously served [35]. Here, N is not less than 3, representing that students must be evaluated on at least N major assignments during the learning process. The 1 represents the final course assessment, which serves as a consistency check for formative assessments. Especially as artificial intelligence approaches widespread adoption, such consistency checks on formative assessment becomes even more necessary.

To prevent the final course assessment from becoming a mere formality, we can require that the proportion of lower-order learning content (memory and understanding [36]) on the exam does not exceed 40%, while the proportion of higher-order learning content (application, analysis, evaluation, and creation) is not less than 60%. Meanwhile, assessments should be conducted through public exhibitions at the end of courses as much as possible, leveraging output-based learning to stimulate input-based learning.

4.4. Reforming the Compensation, Evaluation, and Incentive System for University Teachers

Traditional university teacher evaluations primarily focus on three aspects: teaching, research, and service, which are reflected in classroom instruction, publications, and committee service. Many university teachers' salaries are tied to the number of classroom instruction hours, a legacy of the "class-based teaching system" era. This can easily lead to a focus on in-class instruction at the expense of out-of-class tutoring.

To truly focus teachers on discussion-based and project-based teaching, it is necessary to evaluate not only their in-class instruction but also their out-of-class tutoring for students. Particularly during the specialization and realization stages, the RTSN takes the form of studios or laboratories where teachers guide students on projects and accompany their growth. The workload in these settings is difficult to measure using traditional class hour metrics. Therefore, there is a need to reform the workload assessment, evaluation, and incentive systems for teachers. For instance, Olin College has added four indicators to the original three for teacher evaluation: curriculum innovation, tutoring undergraduate students, research with undergraduate students, and helping other institutions to adopt Olin's curriculum [4].

These reforms aim to shift the focus from merely teaching hours to a more holistic evaluation that values the diverse contributions of educators, including their efforts in curriculum development, student mentorship, and collaborative research, which are crucial for the advancement of educational quality and the competitiveness of universities globally.

5. Conclusion

This paper delves into three developmental stages of education and identifies three key challenges confronting education at its current juncture. To tackle these challenges, the author presents evidence suggesting that implementing the CCS at the macro level, which permits students to attend various classes and select courses according to their own interests, can effectively mobilize students' intrinsic motivation and foster personalized talent development. By implementing PDCA iterative improvement pedagogy, five principles of instructional design, and peer instruction in every classroom, it is possible to integrate professional education with holistic education and implement a quality closed-loop in daily teaching processes. Through the establishment of RTSN and the implementation of project-based learning within the RTSN, the significant disconnect between educational content and workplace realities can be bridged, innovative and entrepreneurial education can be effectively carried out, and students' independent and rational thinking can be cultivated. By adopting internationalization education at home, we can better serve all students and nurture talents with international competitiveness.

These five strategies collectively constitute the Education 3.0 solution tailored to address the aforementioned challenges. Preliminary results from implementing this solution reveal that G university undergraduate students, despite having entrance exam scores below the market average, achieve an average monthly salary upon graduation that surpasses the national average for undergraduate graduates [8]. This serves as a compelling testament to the enhancement of student competitiveness and indicates the universal and significant importance of the Education 3.0 solution in responding to the three primary challenges facing education today and in boosting the competitiveness of both students and universities.

To fully implement the Education 3.0 solution, sustained efforts are required in four areas: developing a curriculum system for project-based learning, establishing a comprehensive education and teaching organization system that integrates the RTSN, grade colleges, and student learning clubs, refining the student ability growth scale and formative assessment methods, and reforming the compensation, evaluation, and incentive systems for teachers. The author sincerely hopes to collaborate with colleagues in the educational sector to jointly advance these efforts.

Abbreviations

PDCA	Plan, Do, Check, Action
VUCA	Volatility, Uncertainty, Complexity, Ambiguity
CCS	Combined Credit System
RTSN	Research-Teaching-Study Nexus
CET-4	College English Test Band 4
CET-6	College English Test Band 6
QEA	Quantitative Engineering Analysis
CEQ	Course Experience Questionary

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Author Contributions

Xiaoliang Ding is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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Research Fields

Xiaoliang Ding: Education Innovation, Politics and Economics of Institutional Change, Comparative Politics and Culture.