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DISSERTATION

MANAGEMENT OF INNOVATIVE DEVELOPMENT THE SYSTEM OF CHINA CITIZENSHIP HIGHER EDUCATION

Speciality 073 - Management

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ANNOTATION

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Higher education in China has always had priority among the areas of state support. Since the opening-up reform, the Chinese government has invested a lot of resources in higher education and introduced a series of policy measures, such as Project 211, Project 985, and the Overseas Talent Development Implementation Program, to improve the quality of education in higher education institutions, strengthen the foundation scientific research and promote international cooperation. These measures have produced remarkable results, as the level of higher education in China has greatly increased, and many Chinese universities have gained international prominence.

The innovations and development of China's higher education management system mainly include the following aspects: building a modern higher education system - the Chinese government has gradually created a modern higher education system with unique Chinese characteristics by improving the regulatory and legal framework, strengthening the vertical management, developing the globalization of education through the introduction international standards and other measures; promoting the popularization of higher education among the population - through the system of training subsidies and expanding opportunities for access to higher education; improving the quality of education - through the implementation of international standards of integrity and improvement of innovative abilities of students; strengthening international cooperation and academic exchanges: China actively carries out exchanges and cooperation in the field of higher education with other countries, absorbs advanced international experience and ideas, and promotes the integration of Chinese higher education into the world educational and scientific society.

The conducted methodological analysis of the investigated problem in the context of the implementation of innovative technologies in the modern educational space of China made it possible to find out that the level of the contribution of higher education to economic growth in the provinces of the Silk Road Economic Belt over the past 16 years (determined using the Dennison growth factor analysis method) is insignificant (k=0.013), significantly lower than the national average (k=0.037). The main reasons are insufficient investment in higher education, the lack of high-level universities in this part of the country, and a serious brain drain. The results show that it is possible to increase the level of the contribution of higher education to economic growth in the Silk Road Economic Belt thanks to the growth of investments in higher education, the optimization of the distribution of higher education resources, the improvement of social conditions in the places of residence of students, the improvement of the quality of training and the motivation of education seekers, and the strengthening of the formation system personnel potential of higher education, improve the mechanism of attraction and retention of employees and create a favorable environment for their development.

The basis of industrial transformation and modernization is the breaking of the original growth model, which largely depends on technological innovation, especially on the improvement of independent innovation capabilities. The study of higher education reform in Ukraine helped to enrich the knowledge system, expand the scope of research on higher education in China, and draw the attention of scholars to the reform and development of education in developing countries.

This work analyzes the main characteristics of higher education models in China and Ukraine, compares the scientific, technological and innovative activities of higher education institutions in China and Ukraine, and also puts forward the path of innovative development that combines modern science. In China, education expenditure reached more than 4% of GDP from 2012 to 2023, but the dispersion of GDP per student in China shows a decreasing trend year by year. Higher education must meet the trends of the world economy, change the concept of education, carry out ideological and political education, strive to cultivate innovative talents, promote

the integration of industry, university, and research, vigorously improve the quality of teachers, and accelerate the reform of higher education in all aspects.

Currently, the Chinese Government's strategic program "Digitalization of Education" is being promoted in depth as a key to the implementation of the work of the Ministry of Education, and it has achieved significant results in the construction of new infrastructure, learning innovation and management system reform.

However, on the one hand, due to the wide geography of the country, the direction of educational reform faces the difficulties of unbalanced regional development with different characteristics, so it is very important to fully study the experience of digital education reform in the world in order to find a fulcrum of policy and improve the technological path.

On the other hand, with the continuous advancement of global integration, the issue of education can no longer become a problem that can be solved by the region on its own, and the optimization of education issues is also a cultural base to influence the values of the future world of the citizens of the People's Republic of China, promote the coordinated management of global society, and support the world peace and security, stability and development and other important international issues.

In 2023, the goal of the Chinese government was to further increase the international competitiveness and level of university education. At the same time, competition will increase and universities will have to be more transparent and open to attract more of the best teachers and the most motivated students.

The relevance of the chosen research topic is determined by the methodological and conceptual principles of open civic education of the People's Republic of China and is determined by the strategic directions of state policy in the field of education, which have become priorities, namely: the formation of a safe educational environment, environmentalization of education; development of scientific and innovative activities in education, improvement of the quality of education on an innovative basis; informatization of education; ensuring national

monitoring of the education system; increasing the social status of teaching staff; creation of a modern material and technical base of the higher education system.

Thus, the phenomenon, current state, possibilities and problems of using augmented and virtual reality tools in the educational process were studied by Wu H.K., Hsin-Kai Wu, Silvia Wen-Yu Lee, Hsin-Yi Changc, Jyh-Chong Liang.

S.Yuen, G.Yaoyuneyong, E. Johnson conducted scientific reviews on the development of virtual and augmented reality. An aspect of student learning using AR is explored in the works of Lee K.

Communicative aspects of using virtual and augmented reality tools were investigated by the authors Yun Zhu, Hui Ye, Shukun Tang.

Currently, scientists S. Giasiranis and L. Sofos are raising questions about the quality assessment of educational material with augmented reality.

Martin-Gutierrez J., Guinters E., Perez-Lopez D. note that augmented reality can be used for student collaboration. This becomes especially relevant in the process of performing laboratory and practical work during distance learning in COVID-19, which ensures wide access of higher education seekers to training courses.

With the help of CiteSpace, in order to visualize the map of theoretical studies, an analysis of the level of innovative development of higher education in China was carried out. The results showed that the number of articles published on education research in China increased from 2003 to 2023. Against the background of the revival of the economy of rural regions, education has become a key factor.

In the course of the study, it was determined that any innovative teaching technology (including virtual) involves the art of mastering the process, a certain sequence of operations using the necessary means (materials, tools and an algorithm of actions), i.e. in a procedural sense, the technology must provide an answer to the question : "How to achieve the result of activity (using what and what means)?". At the same time, the concept of technology reflects the focus of scientific or practical research on purposeful improvement of human activity, increasing its effectiveness, instrumentality, and technicality.

Thus, innovative educational technologies characterize the general strategy of the development of education as a whole and the educational environment in particular. The main purpose of educational technologies is to forecast the development of educational systems, their design, planning and determination of factors that meet educational goals.

A virtual learning community created through a variety of online platforms has advantages beyond the reach of conventional learning activities. Teaching activity in a regular classroom is limited by time, place and personnel, and the content of education is clearly regulated. Learning based on the virtual platform breaks the limitations of time and place, makes full use of a variety of online resources and effectively enriches the learning content in the classroom, and provides a flexible and convenient learning space for students to make full use of their learning opportunities.

The scientific novelty of the obtained results lies in the development of a comprehensive system for ensuring the innovative development of Chinese civic education institutions through the continuous use of VR systems and applications in the educational process, for the accumulation of effective functioning and harmonious development of several main subsystems of the organization of higher education (state regulation, knowledge generation, innovative infrastructure, technology transfer), which determine the effectiveness of China's national innovation system of higher education, the main purpose of which is the formation of a competitive, highly qualified specialist with professional and life skills that meet the needs of the modern development of the national economy.

The important tasks of the development of this subsystem should be: first, ensuring the innovative focus of the education system on the basis of large-scale computerization and activation of scientific, technical and innovative activities of higher educational institutions, creation of innovative structures in their system; reforming the education system taking into account the requirements of European standards and preserving cultural and intellectual national traditions. Secondly, increasing the effectiveness of the scientific research and development sector at the

level of universities and colleges in order to strengthen its role in ensuring the innovative development of the national economy. Modern high technologies depend on the level of scientific research, efficiency and effectiveness of their introduction into production. Of course, the quality of scientific and technological developments depends on the qualifications of scientists and engineers, and they, in turn, are the total effect of the civic education system, especially higher education. Thirdly, ensuring the expanded reproduction of knowledge based on the integration of higher education institutions, scientific and research institutes by increasing the level of innovative activity of the public sector of scientific research and development; concentration of resources on priority areas of development of science, technology and innovative activity; stimulating lifelong learning, fostering a culture of innovative thinking.

For a long time, the traditional method of education was based on the authority of teachers, and students formed the habit of excessively relying on teachers, which affects the development of their independent ability to learn. The results showed that the overall score of independent learning ability and the score of each parameter of the experimental group were higher than those of the control group after the intervention, and the differences were statistically significant ($P<0.05$). It has been stated that the application of virtual reality technology in basic teaching for medical college students can improve the self-learning ability of future nurses. At the same time, the teacher allocates 20-30 minutes for students to independently study the content of autonomous learning in virtual software. In this case, the teacher acquires the function of a mentor who prompts, prompts and directs students to study, finds and solves problems, shares experience in a timely manner, and also improves their ability to self-improvement.

The study also aimed to examine the application effects and perspectives of immersive VR learning in basic nursing training. Using the convenience sampling method, 120 students of a four-year full-time nursing course in the third semester of 2021/2022 were selected at one of the universities in China. There were 60 people in two groups, the control group received traditional teaching and experimental

materials, and the experimental group underwent a virtual classroom and group discussion. The scores of the classroom test, theory test, and skill test in the experimental group were significantly higher than those in the control group ($P < 0.05$). It appears that virtual reality immersion learning in teaching basic nursing skills can fully mobilize students' enthusiasm, greatly improve students' practical ability, autonomous learning ability and teaching effect, help students master clinical knowledge, and has good application prospects.

At the same time, with the rapid development of information technology and the mobile Internet, more and more industries and the mobile Internet have begun to integrate, which has forced these industries to break through the bottleneck and find new opportunities for development. The same is true for the education industry, and the integration of the mobile internet and the education industry has contributed to the overall growth of the online education industry.

Keywords: management, innovation, education, higher education institutions, civic education, China, colleges, universities, virtual technologies, online learning, digitalization, teaching methods, development, education quality, COVID-19

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АНОТАЦІЯ

Чжан Веньсі. *Управління інноваційним розвитком системи громадянської вищої освіти Китаю.* Дисертація на здобуття наукового ступеня доктора філософії (PhD) за спеціальністю 073 Менеджмент. Сумський національний аграрний університет, Суми, 2023.

Вища освіта Китаю завжди завжди мала пріоритет серед напрямів підтримки державою. З моменту реформи відкритості китайський уряд інвестував багато ресурсів у вищу освіту та запровадив низку політичних заходів, таких як «Проект 211», «Проект 985» та «Програма впровадження розвитку талантів за кордоном», щоб покращити якість навчання в закладах вищої освіти, зміцнити фундамент наукових досліджень та сприяти міжнародній співпраці. Ці заходи принесли чудові результати, оскільки рівень вищої освіти в Китаї значно підвищився, а багато китайських університетів набули міжнародної популярності.

Інновації та розвиток системи управління вищою освітою Китаю в основному включають наступні аспекти: побудова сучасної системи вищої освіти - уряд Китаю поступово створив сучасну систему вищої освіти з притаманними лише їй китайськими особливостями шляхом вдосконалення нормативно-правової бази, зміцнення вертикалі управління, розвиток глобалізації освіти через запровадження міжнародних стандартів та інших заходів; сприяння популяризації вищої освіти серед населення – через систему субсидій на навчання та розширення можливостей доступу до вищої освіти; підвищення якості освіти – через імплементацію міжнародних стандартів

доброчесності та покращення інноваційних здібностей студентів; зміцнення міжнародного співробітництва та академічних обмінів: Китай активно здійснює обміни та співпрацю у сфері вищої освіти з іншими країнами, вбирає передовий міжнародний досвід та ідеї та сприяє інтеграції китайської вищої освіти до світового освітньо-наукового товариства.

Проведений методологічний аналіз досліджуваної проблеми в контексті реалізації інноваційних технологій у сучасний освітній простір Китаю дозволив з'ясувати, що рівень внеску вищої освіти в економічне зростання в провінціях Економічного поясу Шовкового шляху за останні 16 років (визначено за допомогою методу аналізу факторів росту Деннісона) незначний (k=0,013), значно нижчий середнього по країні (k=0,037). Основними причинами є недостатні інвестиції у вищу освіту, відсутність університетів високого рівня в цій частині країни та серйозний відтік мізків. Результати показують, що збільшити рівень внеску вищої освіти в економічне зростання в Економічному поясі Шовкового шляху можна завдяки зростанням інвестицій у вищу освіту, оптимізацією розподілу ресурсів вищої освіти, поліпшення соціальних умов в місцях проживання студентів, підвищенні якості підготовки та мотивації здобувачів освіти, посиленні системи формування кадрового потенціалу вищої освіти, удосконалити механізм залучення та утримання співробітників та створити сприятливе середовище для їхнього розвитку.

Основою промислової трансформації та модернізації є злам початкової моделі зростання, яка значною мірою залежить від технологічних інновацій, особливо від покращення незалежних інноваційних можливостей. Дослідження реформи вищої освіти в Україні допомогло збагатити систему знань, розширити сферу досліджень вищої освіти в Китаї та привернути увагу науковців до реформування та розвитку освіти в країнах, що розвиваються.

У цій роботі аналізуються основні характеристики моделей вищої освіти в Китаї та Україні, порівнюється наукова, технологічна та інноваційна діяльність вищих навчальних закладів Китаю та України, а також висувається шлях інноваційного розвитку, що поєднує сучасну науку. У Китаї 2012 до 2023

року витрати на освіту досягли понад 4% ВВП, але дисперсія ВВП на одного студента в Китаї з року в рік демонструє тенденцію до зменшення. Вища освіта повинна відповідати тенденціям світової економіки, змінювати концепцію освіти, здійснювати ідеологічну та політичну освіту, прагнути культивувати інноваційні таланти, сприяти інтеграції промисловості, університету, досліджень, енергійно підвищувати якість викладачів і прискорювати реформування вищої освіти в усіх аспектах.

Наразі стратегічну програму Уряду Китаю «Цифрування освіти» поглиблено просувають як ключову в реалізацію роботи Міністерства освіти, і вона досягла значних результатів у будівництві нової інфраструктури, навчанні інновацій та реформі системи управління.

Проте, з одного боку, через широку географію країни напрямок освітньої реформи стикається з труднощами незбалансованого регіонального розвитку з різними характеристиками, тому дуже важливо повністю вивчити досвід реформування цифрової освіти у світі для пошуку точки опори політики та вдосконалення технологічного шляху.

З іншого боку, з безперервним просуванням світової інтеграції питання освіти більше не може стати проблемою, яку може самостійно вирішити регіон, а оптимізація питань освіти також є культурною базою для впливу на цінності майбутнього світу громадян Китайської народної республіки, сприяти скоординованому управлінню глобальним суспільством і підтримувати світовий мир і безпеку, стабільність і розвиток та інші важливі міжнародні питання.

У 2023 році метою китайського уряду було визначено подальше підвищення міжнародної конкурентоспроможності та рівня освіти університетів. У той же час конкуренція зросте, і університети повинні будуть бути більш прозорими та відкритими, щоб залучати більше найкращих викладачів і найбільш вмотивованих студентів.

Актуальність обраної теми дослідження визначається методологічними й концептуальними засадами відкритої громадянської освіти Китайської

народної республіки й обумовлена стратегічними напрямами державної політики у сфері освіти, що стали пріоритетними, а саме: формування безпечного освітнього середовища, екологізації освіти; розвиток наукової та інноваційної діяльності в освіті, підвищення якості освіти на інноваційній основі; інформатизація освіти; забезпечення проведення національного моніторингу системи освіти; підвищення соціального статусу педагогічних працівників; створення сучасної матеріально-технічної бази системи вищої освіти.

Так феномен, сучасний стан, можливості та проблеми використання засобів доповненої і віртуальної реальностей в освітньому процесі були вивчені Wu H. K., Hsin-Kai Wu, Silvia Wen-Yu Lee, Hsin-Yi Changc, Jyh- Chong Liang.

Наукові огляди щодо розвитку віртуальної і доповненої реальностей виконано S.Yuen, G.Yaoyuneyong, E. Johnson. Аспект навчання учнів з використання AR розкрито в роботах Lee K.

Комунікативний аспекти використання засобів віртуальної і доповненої реальностей досліджено авторами Yun Zhu, Hui Ye, Shukun Tang.

Нині піднімають питання щодо оцінювання якості навчального матеріалу з доповненою реальністю учені S. Giasiranis і L. Sofos.

Martin-Gutierrez J., Guinters E., Perez-Lopez D. зазначають, що доповнена реальність може бути використана для спільної роботи студентів. Особливої актуальності це набуває у процесі виконання лабораторних і практичних робіт під час дистанційного навчання в COVID-19, що забезпечує широкий доступ здобувачів вищої освіти до навчальних курсів.

За допомогою CiteSpace з метою візуалізації карти теоретичних досліджень було проведено аналіз рівня інноваційного розвитку вищої освіти Китаю. Результати показали, що кількість статей, опублікованих стосовно досліджень освіти в Китаї зростала з 2003 по 2023 рік. На тлі відродження економіки сільських регіонів, освіта стала ключовим фактором.

У ході дослідження було визначено, що будь-яка інноваційна викладацька технологія (в тому числі віртуальна) передбачає мистецтво володіння процесом, певну послідовність операцій з використанням необхідних засобів (матеріалів, інструментарію та алгоритму дій), тобто в процесуальному розумінні технологія має дати відповідь на запитання: «Як досягти результату діяльності (з використанням чого і якими засобами)?». Поняття технології при цьому відображає спрямованість наукових чи практичних досліджень на цілеспрямоване вдосконалення діяльності людини, підвищення її результативності, інструментальності, технічності.

Таким чином, інноваційні освітні технології характеризують загальну стратегію розвитку освіти вцілому та освітнього середовища зокрема. Основне призначення освітніх технологій – прогнозування розвитку освітніх систем, їх проєктування, планування та визначення факторів, які відповідають освітнім цілям.

Віртуальне навчальне співтовариство, створене за допомогою різноманітних мережевих платформ, має переваги, яких не досягає звичайна навчальна діяльність. Викладацька діяльність у звичайній аудиторії обмежена часом, місцем і персоналом, а зміст навчання чітко регламентована. Навчання, засноване на віртуальній платформі, порушує обмеження часу та місця, повною мірою використовує різноманітні онлайн-ресурси та ефективно збагачує навчальний контент у класі, а також забезпечує гнучке та зручне місце для навчання, щоб учні могли повністю використовувати свої навчальні можливості.

Наукова новизна одержаних результатів полягає в розробці комплексної системи забезпечення інноваційного розвитку закладів громадянської освіти Китаю шляхом суцільного використання у навчальному процесі VR-систем і додатків, за для акумуляції ефективного функціонування і гармонійного розвитку декількох основних підсистем організації вищої освіти (державне регулювання, генерація знань, інноваційна інфраструктура, трансфер технологій), що визначають результативність національної інноваційної

системи вищої освіти Китаю, головним призначенням якої є формування конкурентноспроможного, висококваліфікованого фахівця з професійними та життєвими компетенціями, що відповідають потребам сучасного розвитку національної економіки.

Важливими завданнями розвитку цієї підсистеми мають бути: по-перше, забезпечення інноваційної спрямованості системи освіти на основі масштабної комп'ютеризації й активізації науково-технічної та інноваційної діяльності вищих навчальних закладів, створення інноваційних структур в їх системі; реформування системи освіти з урахуванням вимог європейських стандартів і збереження культурних та інтелектуальних національних традицій. По-друге, підвищення результативності сектору наукових досліджень і розробок на рівні університетів та коледжів з метою посилення його ролі у забезпеченні інноваційного розвитку національної економіки. Сучасні високі технології залежать від рівня наукових досліджень, оперативності та ефективності їх впровадження у виробництво. Звісно, якість наукових і технологічних розробок залежить від кваліфікації наукових працівників та інженерів, а вони, у свою чергу, є сумарним ефектом системи громадянської освіти, особливо вищої. По-третє, забезпечення розширеного відтворення знань на основі інтеграції вищих навчальних закладів, наукових та дослідницьких інститутів шляхом підвищення рівня інноваційної активності державного сектору наукових досліджень і розробок; концентрації ресурсів на пріоритетних напрямах розвитку науки, техніки та інноваційної діяльності; стимулювання навчання впродовж усього життя, виховання культури інноваційного мислення.

Тривалий час традиційний метод навчання базувався на авторитеті вчителів, і у студентів сформувалася звичка надмірно покладатися на вчителів, що впливає на розвиток їх самостійної здатності до навчання. Результати показали, що загальна оцінка здатності до самостійного навчання та оцінки кожного параметра експериментальної групи були вищими, ніж у контрольної групи після втручання, і відмінності були статистично значущими (P<0,05). Було зазначено, що застосування технології віртуальної реальності в базовому

викладанні для здобувачів освіти медичного коледжу може покращити здатність майбутніх медсестер до самостійного навчання. У той же час викладач відводить 20-30 хвилин студентам для самостійного вивчення контенту автономного навчання у віртуальному програмному забезпеченні. Викладач у цьому випадку набуває функцію ментора, який своєчасно підказує, спонукає і спрямовує учнів до навчання, знаходить і вирішує проблеми, вчасно обмінюється досвідом, а також покращує їхню здатність до самовдосконалення.

Дослідження також мало на меті вивчити ефект застосування та перспективи навчання VR із зануренням у базову підготовку медсестер. За допомогою методу зручної вибірки в одному з університетів Китаю було відібрано 120 студентів чотирирічного курсу навчання медсестер денної форми навчання в третьому семестрі 2021/2022 років. У двох групах було 60 осіб, контрольна група отримувала традиційні навчальні та експериментальні матеріали, а експериментальна група проходила віртуальну класну кімнату та групове обговорення. Оцінки аудиторного тесту, теоретичного тесту та тесту навичок в експериментальній групі були значно вищими, ніж у контрольній групі (P <0,05). Виявляється, навчання зануренням у віртуальну реальність під час навчання основним навичкам медсестринства може повністю мобілізувати ентузіазм студентів, значно покращити практичні здібності студентів, автономну здатність до навчання та ефект викладання, допомогти студентам оволодіти клінічними знаннями та має гарну перспективу застосування.

Водночас із бурхливим розвитком інформаційних технологій і мобільного Інтернету все більше і більше галузей промисловості та мобільного Інтернету почали інтегруватися, що змусило ці галузі прорвати вузьке місце та знайти нові можливості для розвитку. Те саме стосується індустрії освіти, і інтеграція мобільного Інтернету та індустрії освіти сприяла загальному зростанню галузі онлайн-освіти.

Ключові слова: управління, інновації, освіта, вищі навчальні заклади, громадянська освіта, Китай, коледжі, університети, віртуальні технології,

онлайн-навчання, цифровізація, методи викладання, розвиток, якість освіти, COVID-19

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LIST OF SYMBOLS

BRI - the Belt and Road Initiative

PRC - People's Republic of China

(MOOCs) - Massive Open Online Courses

CONTENT

INTRUDUCTION

Relevance of the topic. China's higher education system has become the largest in the world, with more than 44.3 million students, and the gross enrollment rate of higher education has increased from 30 percent in 2012 to 57.8 percent in 2021, an increase of 27.8 percentage points, making a historic leap forward. Higher education has entered a stage of universal access recognized by the world.

The number of people receiving higher education in China has reached 240 million, and the average number of years of education received by the newly added labor force has reached 13.8 years. Major changes have taken place in the quality structure of the labor force, and the quality of the whole nation has steadily improved. Higher education has made continuous innovations in education methods, school-running models, management systems, and security mechanisms, providing strong support for building an important global talent center and innovation plateau.

Through the "211" and "985" projects and the "Double first-class" construction plans, a number of universities and a large number of disciplines have reached the world's advanced level, and the overall level of China's higher education has entered the world's first square.

It has formed the Chinese paradigm for the development of MOOCs and online education. China MOOCs Conference and World MoOCs Conference have been held successively, forming a set of Chinese paradigm for the development of MOOCs, including concepts, technologies, standards, methods, and evaluations. By the end of February 2022, the number of online MOOCs in China has exceeded 52,500, with 370 million registered users, and more than 330 million college students have obtained MOOCs credits, ranking first in the world in terms of the number and application scale of MOOCs. To build the "National Higher Education Smart Education Platform" and initiate the establishment of the World MOOC and online education Alliance, which has become a move and a key move to proactively lead the future development of world higher education "changing track and overtaking" strategy.

The concept of "educational innovation": historiographical review issues. It was based on the research of Ukrainian and Chinese scientists and representatives of developed countries. Many of the data in this research are based on the World Bank and the yearbook of the Ministry of Education of China. Since no scholars have studied the comparison of higher education between China and Ukraine, this is a blank field, so this research has filled it. So, what was obtained determined the choice of the topic of the dissertation research.

Thus, the phenomenon, current state, possibilities and problems of using augmented and virtual reality tools in the educational process were studied by Wu H.K., Hsin-Kai Wu, Silvia Wen-Yu Lee, Hsin-Yi Changc, Jyh-Chong Liang.

S.Yuen, G.Yaoyuneyong, E. Johnson conducted scientific reviews on the development of virtual and augmented reality. An aspect of student learning using AR is explored in the works of Lee K.

Communicative aspects of using virtual and augmented reality tools were investigated by the authors Yun Zhu, Hui Ye, Shukun Tang.

Currently, scientists S. Giasiranis and L. Sofos are raising questions about the quality assessment of educational material with augmented reality.

Martin-Gutierrez J., Guinters E., Perez-Lopez D. note that augmented reality can be used for student collaboration. This becomes especially relevant in the process of performing laboratory and practical work during distance learning in COVID-19, which ensures wide access of higher education seekers to training courses.

Connection of work with scientific programs, plans, topics. The dissertation was carried out in accordance with the directions of research work of the Department of Management named by prof.Mykhailova of the Sumy National Agrarian University: "Development of management in the context of international integration processes" 2019-2023 (state registration number 0119U001336, Ukraine), within by the author was carried out the topic of the management of innovation education development in comparison of Chinese and Ukrainian higher institutions. The dissertation research was also conducted within the research was carried out within the framework of the projects the Ministry of Education Industry

University Cooperative Education Program 2019, Program No: 201901090003 (China).

The Aim and Objectives of the study. The dissertation work is devoted to the substantiation of theoretical and methodological principles and the development of practical proposals for the management of innovative development of civic education of the People's Republic of China comprehensively expound the proposition of China's advantageous higher education management development.

Research tasks that were considered:

- to promote the development of China's higher education;

- to figure out what constitutes the international competitiveness of China's higher education from the perspective of practice;

- to find a way to evaluate the international competitiveness of China's online higher education from the perspective of a normal teacher from university;

- to find out the path for the development of China's advantageous online education industry;

- to guide and drive China's higher education to a bright development though online education to spread the world.

The object of the research is Chinese higher education innovative management development.

The subject of the research is the process of implementation the innovations` development of China's higher education under the international and domestic impact.

Applicant's personal contribution. The dissertation is an independently performed scientific work. All the results of the study, presented in the paper and presented for defense, are received by the author personally.

Research methods. To implement the set tasks, there was a set of methods used: theoretical – analysis and systematization of scientific literature on issues of general, educational, innovative management – with the aim of clarifying the scientific apparatus; specification, systematization of scientific information, study of regulatory, directive, instructional, methodical documents, as well as modelling and

decomposition method - for substantiating and developing a model for introducing innovative management into the system of civil higher education; system-generalizing method - for formulating conclusions based on research results; empirical - observation, interview, questionnaire - to determine the state of implementation of the pedagogical conditions for the implementation of innovative management in an educational institution; expertise - for the purpose of carrying out an expert assessment; experiment (determinative and formative stages) – to find out the effectiveness of the technology for the implementation of pedagogical conditions, to determine its impact on the effectiveness of the management of the educational institution, to develop relevant scientific and methodological recommendations; statistical – quantitative and qualitative analysis of research performance indicators, rating method and mathematical processing of data, in particular, qualitative research – to evaluate the results obtained.

The scientific novelty of the obtained results lies in deepening the existing theoretical provisions and providing scientific, practical and systematic recommendations for the management of educational institutions in China. Scientific achievements are real, and their scientific nature can be expressed as follows:

First obtained:

- a comprehensive system for ensuring the innovative development of China's civic education institutions through the continuous use of VR systems and applications in the educational process, for the accumulation of effective functioning and harmonious development of several main subsystems of the organization of higher education (state regulation, knowledge generation, innovative infrastructure, technology transfer), which determine the effectiveness of the national innovative system of higher education in China, the main purpose of which is the formation of a competitive, highly qualified specialist with professional and life competencies that meet the needs of the modern development of the national economy.

Improved:

- the application of intelligent teaching in the education industry through the highlighting virtual reality technologies that are already used to modernize the

education system, reviewing and determining the relevance of existing applications of augmented and virtual reality used in the modern educational process.

-the practical reform of teaching with new technology (simulation teaching, vr) in education through the analysis on the development status of educational innovation (artificial intelligence, system reform);

- the methodological approaches to the analysis of the management of innovative development in higher education in the context of mapping the contribution of higher education to economic growth in China's Silk Road Economic Belt provinces using the Dennison growth factor analysis method, which confirmed the lack of investment in higher education, the lack of high-level universities in this part of the country, and a serious brain drain.

Further development:

- meaningful filling of the concept of "educational innovation", which is based on ensuring the innovative orientation of the education system through large-scale computerization and activation of scientific, technical and innovative activities of higher educational institutions, creation of innovative structures in their system; reforming the education system taking into account the requirements of European standards and preserving cultural and intellectual national traditions;

- pedagogical conditions for the effective implementation of innovative management in the system of secondary education (normative-legal, social-pedagogical, managerial, psychological-pedagogical);

- summarized research universities as the center of innovation and development of higher Education by studying the impact and trend of big data and artificial intelligence on the online education industry, provide relatively professional insights on the new technologies and trends of the online education market to institutions that are ready to enter or have implemented online education and training, and help them deeply understand the status quo and bottlenecks of the online education and training industry.

The scientific and practical significance of the dissertation. The scientific significance and practical significance of this article. While sorting out the historical

problems and future development of Chinese higher education, this study also builds a bridge between Chinese higher education and Ukrainian higher education, and enhances the application value of higher education. Since the core value of the development of higher education is to serve the people's livelihood of the country, this study has high strategic value. This study is not only of high value to the higher education industry itself and the development of China's national economy, but also has a feeding effect on the full protection of national interests outside the economy and the implementation of China's education economy.

Personal contribution of the applicant. The Ph.D. student has searched and analyzed literature sources on the topic of the work, selected methods and techniques, questionnaire design and survey, statistical processing, and analysis of the results. Interpreter and generalize the obtained results, draw the dissertation's conclusions, and make practical recommendations under the supervisor's guidance.

Approbation of the results of the dissertation. The main provisions and results of the dissertation research were made public by the author at conferences, seminars, meetings, among which the most important The main results of the research were examined at international conferences were: "Science way" (Dnipro, Ukraine, 2019), 37th International Business Information Management Association (IBIMA, 2021, Cordoba, Spain), International conferences in SNAU (Sumy, Ukraine, 2022) and Podilsky socio-economic college (Kamianets-Podilsky, Ukraine, 2019).

Publications. The main results of scientific research were published in 9 scientific articles: 3 articles in specialized publications of Ukraine, 2 articles in journals included in the scientometric databases Scopus and Web of Science, the rest - in other journals and conference proceedings.

Structure and scope. The dissertation consists of an introduction, three chapters, conclusions, a list of references and appendices. The total volume of work is 180 pages. The work contains 23 tables and 16 figures. The references consist 173 publications.

CHAPTER 1. THEORETICAL AND METHODOLOGICAL ASPECTS OF INNOVATIVE DEVELOPMENT THE HIGHER EDUCATION SYSTEM OF THE PRC

1.1. The concept of "educational innovation": historiographical review issues

Educational innovation refers to the idea of reforming and reconstructing the traditional education system to meet the needs of contemporary society. It includes innovative educational technology, teaching methods, learning environment and other aspects of improvement, aiming to improve students' learning outcomes and cultivate their innovative ability. Educational innovation also emphasizes diversified teaching methods such as personalized learning, interdisciplinary cooperation, and practical learning to meet the needs of different students and improve their comprehensive quality.

Both the Chinese government and the Chinese Communist Party see higher education as key to the country's future. The state regards teachers as the creators of the nation, puts forward and implements new ideas, and promotes the quality training of professional talents. China's leaders understand that in order for the country to reach a new level of development, it is necessary to cultivate skilled professionals, and the formation of these talents begins in schools. Therefore, it is necessary to improve the higher education system. As China's 1949 Statistical Communique on National Economic and Social Development pointed out, 80 percent of its 500 million people were illiterate. However, thanks to long-term targeted reforms and appropriate financing, the situation has changed. In the past 30 years, China's education system has basically followed the path taken by developed countries such as Japan and the United States for more than 100 years. China is trying to invest more in education. "The cost of education was 7.7 million yuan in 1979, 9.4 million yuan in 1980, 18.336 million yuan in 1985 and 981.5 billion yuan in 2015," Yan, director of the Teaching Evaluation Center for Higher Education at the Ministry of Education, PRC, said in an interview. Even in times of crisis, growth in education funding has been sustained.

Since 1986 (An &Wu, 2017), China has implemented nine-year compulsory education, including six years of primary education and three years of junior middle education, for students between the ages of 6 and 15. "By 2020, about 82.5 percent of students will choose to continue their high school education for three years." The national unified examination for general higher education is a prerequisite for admission to most higher education institutions. "In 2010, 27 percent of high school graduates went on to four-year undergraduate education."

The resumption of the college entrance examination in 1977 was a milestone in the development of China's higher education, and also opened the prelude to the reform of China's higher education. The college entrance examination, referred to as the National College Entrance examination, is a selection examination from secondary education to higher education, and a high school entrance examination for the college entrance examination. The college entrance examination is considered the most important test in the entire education system (Baotian, & Li, 2001).

The quality of higher education in modern China has changed at different times, reflecting the changes in the political policies implemented by the central government. This article explains each of these major reforms one by one, as shown in Figure 1.1.
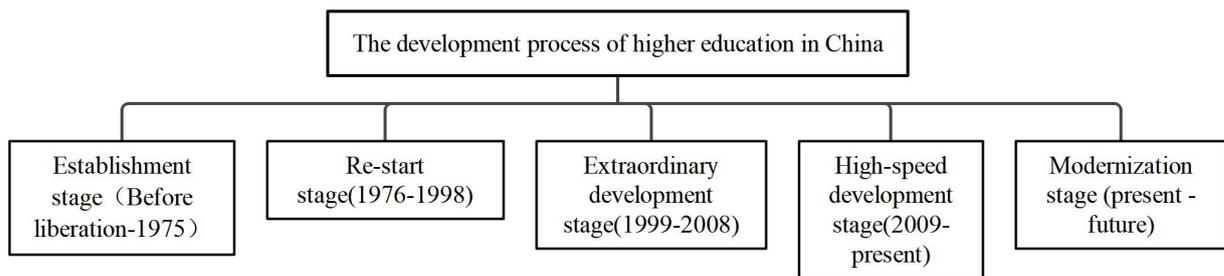
Figure 1.1-The development process of higher education in China

Source: author`s research

1.1.1 Stage of establishment (pre-liberation -1975)

China's higher education development time is relatively short, the real time is only about 100 years, from February 1895, China's first modern university Beiyang Public School, the predecessor of Tianjin University was established to today is only 109 years, compared with other universities in the world, especially some famous universities in Western developed countries such as Europe and the United States, this is more obvious. For example: "Oxford", "Cambridge" and other famous institutions have a history of more than 800 years to more than 1,000 years, much earlier than our country. Therefore, the history of higher education development in

our country is also relatively simple to look back on. The detailed list of universities is shown in Table 1.1.

The Beiyang Government period (1912-1927)

Many of the current well-known colleges and universities in China were founded in the late Qing Dynasty, but they did not have much influence at the beginning. China's new colleges and universities were founded in 1912 during the Beiyang Government (Cai &Wang, 2014).

Table 1.1-The list of universities in establishment stage

The period	Year	No. of University	List of University	Existing Condition
The Beiyang government period	1912-1927	6	Peking University, Northeastern University, Beijing Normal University, Nanjing University, Sun Yat-sen University, Wuhan University and Sichuan University	Northeastern University is vanished
Period of national government	1927-1949	13	National Central University, Peking University, Tsing Hua University, Zhejiang University, Wuhan University, Northwestern University, Jinan University, Chiao Tung University, Sichuan University, Sun Yat-sen University, Beiyang University, Tongji University and Shandong University	Northwestern University and the Jinan University are all vanished
Early days of New China	1949-1975	20	University of Science and Technology of China, Renmin University of China, Jilin University, Huazhong University of Science and Technology were newly established, and include the previous founded university.	

Source: author`s research

At that time, the Beiyang government divided the country into six university districts, and each school district established a higher normal school, which was also the highest national institution of learning in the region. The six national universities founded at that time were the forerunners of Peking University, Northeastern University, Beijing Normal University, Nanjing University, Sun Yat-sen University,

Wuhan University and Sichuan University, all of which are still top universities today except Northeastern University (Cao, Zhu, & Shen, 2022).

Period of National Government (1927-1949)

The Nationalist government ushered in a good period of development of domestic higher education, at that time there were 13 universities very famous in the country, the most famous of which was the National Chuo University (the predecessor of Nanjing University), at that time the world ranking higher than the University of Tokyo .

Among these 13 colleges and universities, National Central University, National Peking University, National Tsinghua University, National Zhejiang University and National Wuhan University are the most prominent five colleges and universities, which were the top five universities at that time. Tsinghua University and Zhejiang University also rose at this time, among which National Northwest University and National Jinan University all fell, and National Central University and National Jiao Tong University were also split into numerous schools (Chunling, 2012).

After Liberation (1949-1975)

When the People's Republic of China was founded, there were many things to be done. Eighty percent of the 400 million people are illiterate, and the average length of schooling is 1.6 years. In 1949, there were only 205 colleges and universities in China, the gross enrollment rate of higher education was only 0.26%, and the total number of students was less than 120,000, including only 30,000 engineering students. After the liberation of China in 1949, the current pattern of higher education in China has been formed after two subject adjustments and large-scale mergers. These universities in this period trained almost all the outstanding figures in the political, cultural, scientific and technological and artistic circles of China in the 20th century, which had a profound impact on the development of China in the 20th century, and also laid a solid foundation for the development of Chinese universities in the future. Today's famous universities in China are basically developed from these universities or on this basis.

After the founding of the People's Republic of China in 1949, the structure of Chinese universities underwent profound changes, especially the great adjustment of faculties in 1952, which carried out large-scale reconstruction and reorganization of the above universities, mainly reorganizing the former comprehensive universities into pure engineering universities and liberal arts universities, as well as specialized medical and agricultural colleges. Simple engineering universities became the top priority at that time and even later, and a large number of engineering colleges and single-engineering universities were set up one after another. At the same time, three universities with special significance and status have been formally established, that is, the People's University of China with liberal arts, the University of Science and Technology of China with science, and the Harbin Military Engineering Institute with engineering as the main body of today's National University of Defense Technology, which is truly a famous university established by the Communist Party of China itself, and is the central "direct army". At this point, the major universities of New China have been basically established (Cui, 2000).

According to the urgent need for specialized talents in China's economic construction at that time, drawing on the experience of the development of higher education in the Soviet Union for the rapid training of counterpart talents in economic construction, it took six years to adjust, and by 1957, there were 229 institutions of higher learning in the country, including 17 comprehensive universities, 44 industrial colleges and 58 normal colleges and universities. It basically changed the situation of the old Chinese higher education, which was heavy in literature and lacking in teachers, complied with the requirements of the Central Committee of the Communist Party of China on higher education "to well meet the needs of national economic development, especially to meet the needs of industrial construction", trained a large number of specialized talents urgently needed for economic construction of the country, and played a huge role in promoting the industrialization of new China.

Ten years after the "Cultural Revolution", the unified enrollment system of national colleges and universities gradually established after the founding of New

China was completely negated, and the whole society had no motivation to learn knowledge, and there was a serious talent gap in national development.

1.1.2 Restart Period (1976-1998)

In 1976, after the end of the Cultural Revolution, the national college entrance examination was resumed. After the resumption of the college entrance examination, the first college entrance examination was held on December 10, 1977. The college entrance examination is also the only one held in winter (Fan & Ma, 2017).

The move is aimed at improving the quality of education and establishing order and stability, calling for an end to political struggles on university campuses and expanding university enrollment. This pressure to maintain the quality of education and reduce spending has led to efforts to improve the efficiency of existing institutions and to develop other college and university programs. Therefore, labor colleges for training agricultural technicians and factory colleges for technical education of workers were established. In addition, 88 institutions and key universities receive special funding, outstanding students and faculty, and other support, and they enroll the most academically qualified students regardless of family background or political activity. The structure of higher education in the People's Republic of China is similar to that of European higher education. The undergraduate program lasts 4-5 years, the master program lasts 2-3 years, and the doctoral program lasts 2-4 years. "But there are age restrictions: masters must not be over 40 years old and PhD.s must not be over 45 years old."

However, reformers realize that the higher education system is far from reaching the goal of modernization and more reform is needed. In 1986, The State Council promulgated the Interim Regulations on the Administration of Institutions of Higher Learning, which made a huge change in the administration and adjusted the opportunities, direction and content of education. With education reforms giving universities and colleges more independence, universities and colleges are able to choose their own teaching programs and courses; To accept projects from other socialist scientific and technological research and development units or to cooperate with other socialist scientific and technological research and development units to

establish "consortiums" for teaching, scientific research and production; To recommend the appointment and dismissal of Deputy General managers and other staff; To be responsible for the allocation of capital investment and state appropriations; To be responsible for international exchanges with funds at the same level.

The reforms also allow universities to receive funding from work units and decide how to spend the money, without having to ask for more money from the department responsible for education. In addition, higher education institutions and work units may enter into contracts to train students.

Institutions of higher learning will play a greater role in running schools across regions and departments. Within state-approved budgets, universities have been given greater freedom to allocate funds as they see fit and to use income from tuition fees, technical and consulting services for their own development, including collective benefits and prizes.

Especially since the 1990s, with the development of "opening up" reform, it is a very unusual historical stage for the development of China's higher education.

To realize the four modernizations requires great progress in science and technology. Under the modernization plan, higher education will become the cornerstone of training and research. In 1993, China launched a project to build 100 world-class universities, merging 708 institutions of higher learning into 302 universities (Chunling, 2012) .

With the reform of the management system as the focus, with "joint construction, transfer, merger, cooperation in running schools and participation in running schools" as the main way, the key breakthrough in the implementation of reform.

(1) Co-construction: By the end of 1997, there were 100 colleges and universities in different forms of co-construction nationwide. Among them, 31 are affiliated to the State Education Commission, 54 are affiliated to other ministries, and 15 are affiliated to local governments. The forms of co-construction include

provinces (municipalities directly under the Central government) and ministries, cities and ministries, and ministries and ministries.

(2) Merger: By the end of 1997, 159 colleges and universities nationwide had been merged into 74, a decrease of 85, making the number of colleges and universities nationwide from 1080 in 1994 to 1020 in 1997. (including a number of new approvals).

(3) Cooperative education: By the end of 1997, the number of colleges and universities conducting various forms of cooperative education had reached 288, forming 162 cooperative education institutions.

(4) Participation in school running and management: By the end of 1997, more than 5,000 enterprises and scientific research institutions nationwide had participated in the running and management of 217 colleges and universities. Its main forms of "participation" are: the establishment of the school board, the establishment of various scholarships in colleges and universities, and the cooperation with colleges and universities to establish secondary colleges, departments, majors, etc., participate in school running and management, promote the connection between colleges and universities and society, promote the integration of "production, learning and research", and enhance the strength and vitality of colleges and universities.

(5) Transfer: some colleges and universities that were transferred to local management were merged with other colleges and universities after the transformation, so that the schools got new opportunities for development.

The development process at Restart Period will be shown in Figure 1.2:
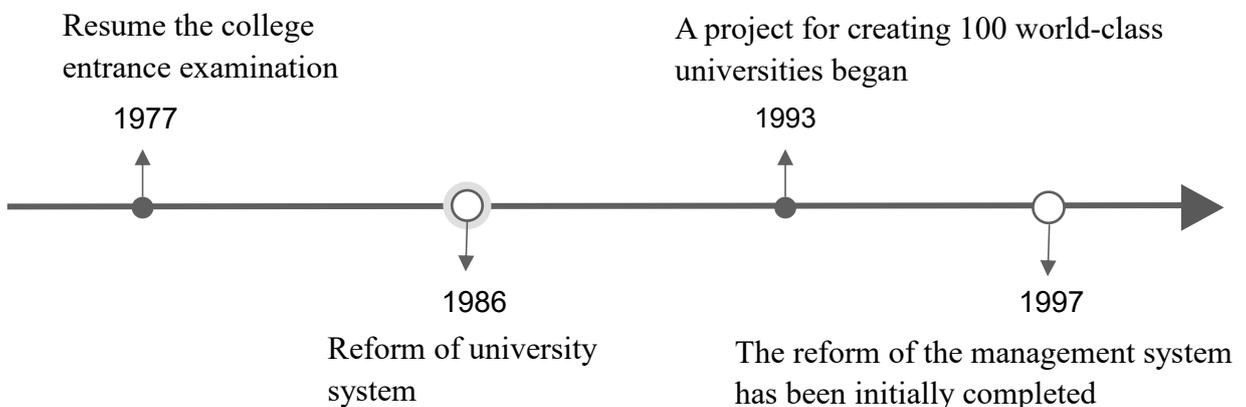
Figure 1.2-The development process of Re-start period

Source: author`s research

1.1.3 Abnormal Development Stage (1998-2008)

In 1998, the Central Committee of the Communist Party of China and The State Council issued the Notice on Forwarding the Opinions of the State Planning Commission on Coping with the Financial Crisis in Southeast Asia and Maintaining the Sustained, Rapid and Healthy Development of the National Economy, which put forward the guiding ideology and several major policy measures to cope with the crisis, and stressed the need to "stand firm". Expand domestic demand and strengthen infrastructure development." This is the first time that the central document has explicitly stated the policy of "expanding domestic demand".

Under the guidance of the spirit of the central document, on the basis of comprehensive multi-party opinions, the education sector enrollment expansion policy has finally been introduced. On June 25, 1999, the major news media across the country issued a strong response under the title "This year's National higher education enrollment has increased significantly", which shocked all sectors of society. The policy of higher education enrollment expansion has been implemented before 1999, but the scope and social impact of the expansion are indeed much larger than in the past. The number of students enrolled in colleges and universities nationwide increased from 1.08 million in 1998 to 1.537 million, and the actual number of students enrolled reached 1.59 million, an increase of more than 41.7 percent (Cai &Wang, 2014).

During this period, the expansion of higher education in China was triggered by the response to the Asian financial crisis and the stimulation of domestic demand. Higher education has entered a period of rapid development and realized the transformation from elite education to mass education. The main features of its investment policy are:

(1) The responsibility of local governments in developing higher education has increased. With the decentralization of authority of relevant central colleges and universities and the adjustment of provincial colleges and universities, the management system of colleges and universities has realized two levels of central and

provincial management, and the implementation of provincial and ministerial management system has strengthened the responsibility of local governments for the development of higher education (Chen, Fan & Gong, 2022).

(2) Social financing has become an important source of university investment. In order to solve the problem of insufficient resources and insufficient funds after enrollment expansion, on the one hand, actively carry out the socialization reform of college logistics, and use social resources to solve the problem of insufficient dormitory and canteen; On the other hand, the use of bank loans to build new campuses and new school buildings to meet the needs of school development; Third, establish independent colleges, expand high-quality education resources, and ease the pressure on students to go to school. In 2006, the 318 independent colleges nationwide had a total of 445,700 undergraduate students, accounting for 21.99 percent of the total number of undergraduate students nationwide.

(3) Improving the quality and level of education in institutions of higher learning. After the transition from elite education to popular education, the training goal has undergone great changes. The quality and level of many students need to be improved, which has aroused widespread concern. After entering the 21st century, the level and quality of higher education have become the subject of concern.

(4) Stabilizing tuition standards, standardizing charging behaviors, controlling arbitrary charges, and establishing a system of student financial aid difficulties are not only the hot spot of social concern, but also the key policy measures of the government during this period.

(5) The diversified mode of higher education investment policy has basically taken shape.

1.1.4 Period of rapid development (2009-present)

After the reform and opening up, China's higher education has been vigorously developed and began to integrate with international standards. The Ministry of Education of the People's Republic of China (MOE) is the government department responsible for all matters relating to education and language. The Ministry noted that China's higher education has "trained a large number of senior talents and experts for

the socialist modernization drive" and played an important role in economic growth, scientific progress and social development. In 2010, 27% of high school graduates will continue their four-year undergraduate education. China is also a major destination for international students, being the most popular country in Asia for international students and the third most popular country in the world. By 2020, China has overtaken the UK to become the second most popular country for international students (An & Wu, 2017).

(1) Overall objectives: Take co-construction, merger and other joint schools as the main form, dilute and change the single subordination relationship of the school, from "segmentation" to "organic combination", optimize the allocation of resources, expand the school investment channels, and appropriately adjust the school service orientation. A higher education system with a reasonable layout, complete disciplines, good economies of scale, high quality of education and meeting the needs of the socialist market economy and modernization has been gradually established.

(2) Target number of schools: By the end of this century or the beginning of the next century, the number of colleges and universities in the country will be adjusted from the current more than 2,100 to about 1,600 (including ordinary colleges and universities, adult colleges and higher vocational schools), of which the number of ordinary undergraduate colleges and universities will be adjusted from more than 1,000 to about 600 (Cao, Zhu & Shen, 2022).

(3) Management system reform objectives: gradually establish a management system of organizers, managers, and organizers, with distinct responsibilities; Multi-channel investment mainly by financial allocation; The central and provincial people's governments are managed at two levels, with division of responsibilities, with the provincial government as the main overall plan, and the organic combination of the new system.

(4) The goal of the adjustment of the layout structure: the formation of a new pattern of "three reasonable layout structures" : first, the structure of colleges and universities with three types of coverage (facing the country, facing the region, facing the province) is reasonable; Second, the structure and layout of the three different

levels of colleges and universities (teaching and research schools, schools focusing on undergraduate teaching, colleges and universities and higher vocational and technical schools) are reasonable; Third, the structure of three different types of colleges and universities (comprehensive, multi-subject, single-subject) is reasonable. For the realization of the new stage and the new goal, there should be a big breakthrough in the concept: break through the bondage of "subordination concept" and increase the intensity of promoting the reform of higher education management system; New breakthroughs should be made in planning, and the overall planning of "reform of higher education management system and adjustment of layout structure" at the national and provincial levels should be strengthened; It is necessary to make new breakthroughs in funding security and effectively solve the unavoidable funding problem in the reform of higher education management system. Further stress on the state's legal guarantee of education funding, that is, it is necessary to ensure that the "three increases" (the growth of education appropriations in the budget is higher than the growth of regular fiscal revenue; Education expenditure per capita has increased year by year. Public expenditure per capita has increased year by year). At the same time, we must ensure that the state's various policy provisions on funds in the reform of the management system of higher education are fully implemented.

1.1.5 Intelligent stage (present and future)

With the development of the country and society, China's higher education will continue to enter the modernization stage. Mainly to promote the wisdom of China's higher education. The report of the Party's "20th National Congress" put forward a series of new ideas, new viewpoints and new conclusions on the development of education, and wrote "promoting the digitalization of education" into the report of the Party Congress, highlighting the strategic goal of further releasing the digitalization potential of education and building an inclusive lifelong education service system.

At present, the "Education Digitalization Strategic Action" has been promoted in depth as a key implementation work of the Ministry of Education, and has achieved remarkable results in new infrastructure construction, teaching innovation, and management system reform. However, on the one hand, China's geographical

development is vast, economic development is unbalanced, and the direction of educational reform also faces the difficulties of unbalanced regional development with different characteristics. It is of great significance to fully learn from the experience of digital education reform in the world for seeking policy fulcrum and perfecting technology path. On the other hand, with the continuous advancement of world integration, the issue of education can no longer become a problem that can be solved independently by a region, and the optimization of education issues is also the cultural base to influence the values of future world citizens, promote the coordinated governance of the global society, and maintain world peace and security, stability and development and other important international issues. In 2023, it aims to further enhance the international competitiveness and education level of universities. At the same time, competition will increase, and universities will need to be more transparent and open to attract more top professors and top students.

The embodiment of the intelligence of China's higher education is mainly reflected in the following aspects (see Figure1.3 for details) :
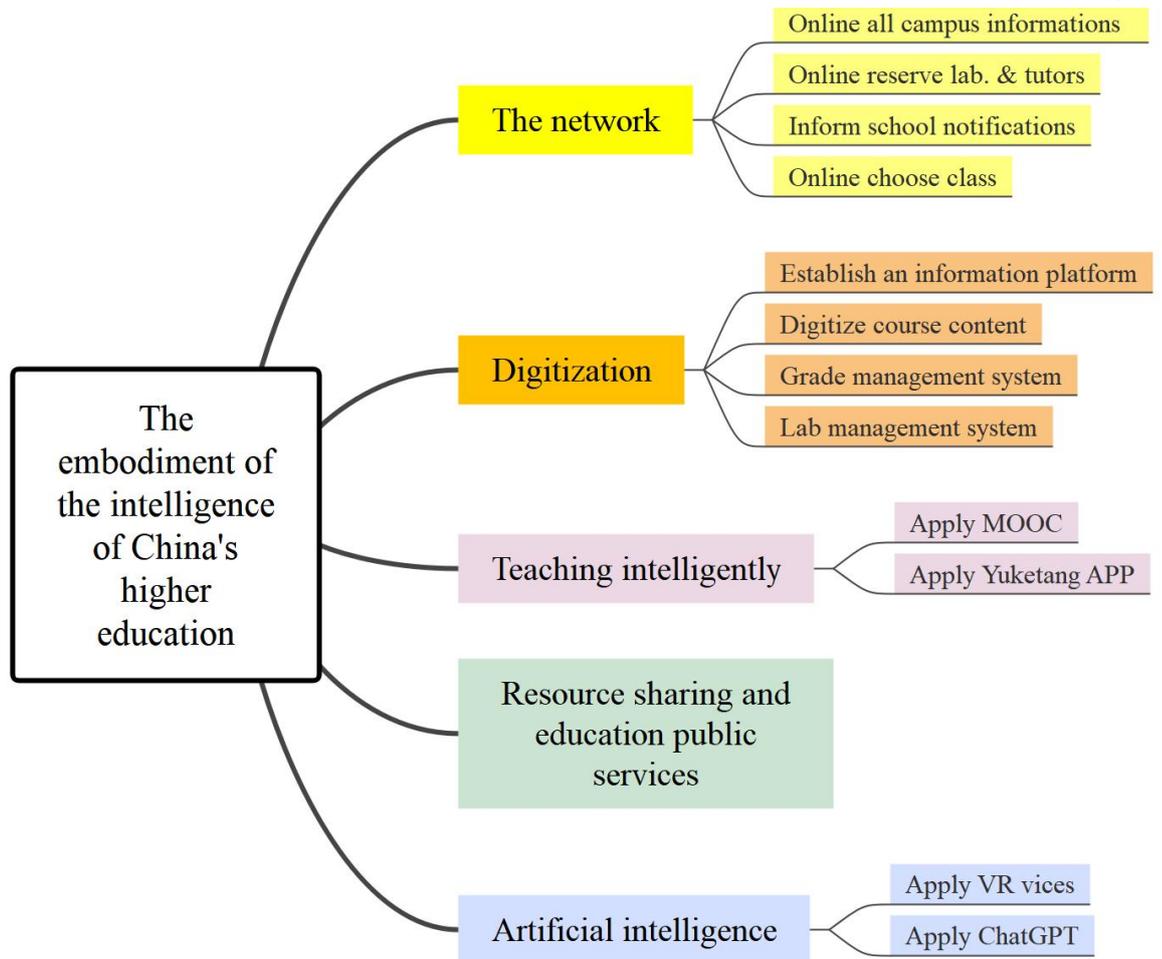
Figure1.3- The embodiment of the intelligence of China's higher education

Source: author`s research

(1) Network: the university has built a whole school network, and students can check the school's publicity through the network, choose courses online, and make appointments to instruct teachers.

(2) Digitalization: the digital construction of colleges and universities on the teaching management and information platform, including course selection system, grade management system, laboratory management system, etc. This series of digital systems can better manage students' academic and teaching quality.

(3) Intelligent teaching: In the teaching process, colleges and universities introduce intelligent teaching technologies, such as intelligent teaching assistance, knowledge graph and other educational technologies, which can help students better understand subject knowledge and help teachers better evaluate teaching.

(4) Resource sharing and education public services: Colleges and universities have built teaching resource sharing platforms, such as MOOC platforms, digital libraries, online libraries, etc. Through these platforms, students can obtain more resources, and at the same time, it can promote educational equity and realize the sharing of educational resources.

(5) Artificial Intelligence: Universities introduce artificial intelligence technology in education, such as personalized recommendation through data analysis, and improve teachers' teaching efficiency and quality through artificial intelligence technology.

In short, the intelligent development of China's higher education is accompanied by the development of information technology, networking, digitization and artificial intelligence technology. Through these technologies, higher education is becoming more and more sustainable, intelligent, and good teaching system and teaching evaluation system.

4.Research frontier analysis

Based on keyword co-occurrence, this paper uses emergent words in CiteSpace visualization software to detect and calculate words with high mutation rate, and analyzes the mutation situation of keywords, so as to grasp the research frontier in this field.Ten emergent keywords in the field of rural education research from 2012 to 2022 are obtained (Figure 4), and the thick line represents the beginning and ending years of emergent keywords. As shown in Figure 2, the top 5 keywords in terms of intensity of emergence are rural revitalization, urbanization, rural areas, countermeasures, and rural teachers.

Top 15 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2003 - 2023
Countermeasure	2003	6.98	2003	2010	
Farmer quality	2005	4.15	2005	2008	
New countryside	2006	5.43	2006	2008	
Education reform	2006	3.29	2006	2013	
Rural economy	2006	3.12	2006	2011	
Enlightenment	2005	4.75	2008	2012	
Education Policy	2006	3.62	2012	2017	
Layout adjustments	2012	3.45	2012	2014	
Urbanization	2003	8.4	2013	2017	
Modernization	2014	3.15	2014	2017	
Rural teachers	2006	21.1	2016	2023	
Rural revitalization	2018	31.1	2018	2023	
Rural school	2005	9.39	2018	2023	
Rural education	2003	30.47	2020	2023	
Education alleviates poverty	2020	3.46	2020	2021	

Figure 1.6 -2003-2023 the strongest citation busts in rural education research

Source: author`s research

Meanwhile, Figure 1.6 shows the frontier mutation of rural education research, which can be roughly divided into three stages.In the first stage,2003-2008,"Countermeasures","Farmer quality","New countryside" appeared many times.At that time, scholars were more concerned with teaching problems caused by economic problems.After the 18th CPC National Congress,From 2012 to 2017 is the second stage, covers a lot of keywords, such as"Layout adjustments", "urbanization" and so on.In the third stage, from 2018 to 2022, keywords such as "rural schools" and ","Rural revitalization" have a high emergence rate.Based on the analysis of emergent keyword map, it is found that the research of rural education presents different frontier scenes in different time periods.At present, "rural revitalization" has become the latest frontier in rural education research field (Cao, Zhu & Shen, 2022).

Based on the analysis of the above data and the content of high-quality literature, it is concluded that the research on rural education after the 18th National Congress of the CPC mainly focuses on rural education categories, rural schools, rural teachers and other topics under the background of rural revitalization.

The important breakthrough of rural vitalization strategy is rural education vitalization.Based on CiteSpace data and secondary literature analysis of rural education, the research categories are mainly derived into the dilemma and countermeasures of rural education and rural compulsory education.

1.2. Institutional and legal support of innovation activity in higher education

The historical change of new China's higher education system is actually a process of continuous reform and improvement. Starting from the formation of new China's higher education system, this paper discusses the course of China's higher education system reform and analyzes the trend of China's higher education system according to the principle of the unification of history and logic.

The higher education system of New China was formed in the early 1950s, which is the product of planned economy. Its basic characteristics are: Higher education is run by the state in a unified way, and almost all the funds required for higher education rely on the financial allocation of the government. The state sets the enrollment scale according to the development plans of industries, departments and regions and assigns enrollment targets according to different levels, majors and schools. The government approves the establishment of majors and prescribes the courses offered. The government provides certain scholarships and corresponding accommodation, medical treatment and other study and living conditions, students after graduation by the government unified arrangement for work. This is the national unified plan, and the government has a high degree of centralized management by administrative order.

This system has been continued for more than 30 years, and has played an important role in the development of higher education in New China and in the cause of socialist construction. It makes our country to form a relatively complete higher education system as soon as possible; A number of key universities and disciplines have been established. A large number of high-quality talents have been trained for our country. Basically met the needs of social and economic development at that time; Some systematic experiences have been accumulated for the higher education development in our country (Fan & Ma, 2017).

However, this system also has obvious limitations, which are mainly manifested in the following aspects: first, the single school-running system and investment system increases the financial pressure of the government, restricts the enthusiasm of the society in running schools, and limits the space for the development of higher education; Second, the highly centralized management system of the government makes the government do too much for colleges and universities, and the schools lack the autonomy of running schools. Third, the departmental school running system leads to division, narrow and single subjects, repeated school running, low benefits, affecting the quality of personnel training; Fourth, the free education of higher education, the system of contracting cadres, and the egalitarian labor and personnel system have suppressed people's enthusiasm and initiative in work and study. With the transformation of the whole social economy, science and technology system, the drawbacks of the old system of higher education have been highlighted. Higher education cannot be further developed without reforming the old system (Fukuhara, 2022).

The first stage is the "brewing and start-up" stage. From the Third Plenary Session of the 11th Central Committee to the publication of the Decision of the CPC Central Committee on the Reform of the Education System (1978-1984), the focus of this stage of reform was to expand the autonomy of colleges and universities in running schools. During this period, the society is in urgent need of talents, and colleges and universities are eager to make more contributions to the society, but they feel that the existing management system and system of higher education have tied

the hands and feet of colleges and universities. Therefore, there is a strong desire and demand to expand the autonomy of colleges and universities.

The second stage is the "full-scale" stage. From the publication of the "Decision of the Central Committee of the Communist Party of China on the reform of the education system" to the reform goal of "establishing a new system of socialist market economy", the characteristics of this stage of reform are: the reform of the "five systems of education" in the "mutual cooperation, mutual promotion and mutual restriction", in an all-round way (see Figure1.4 for details).
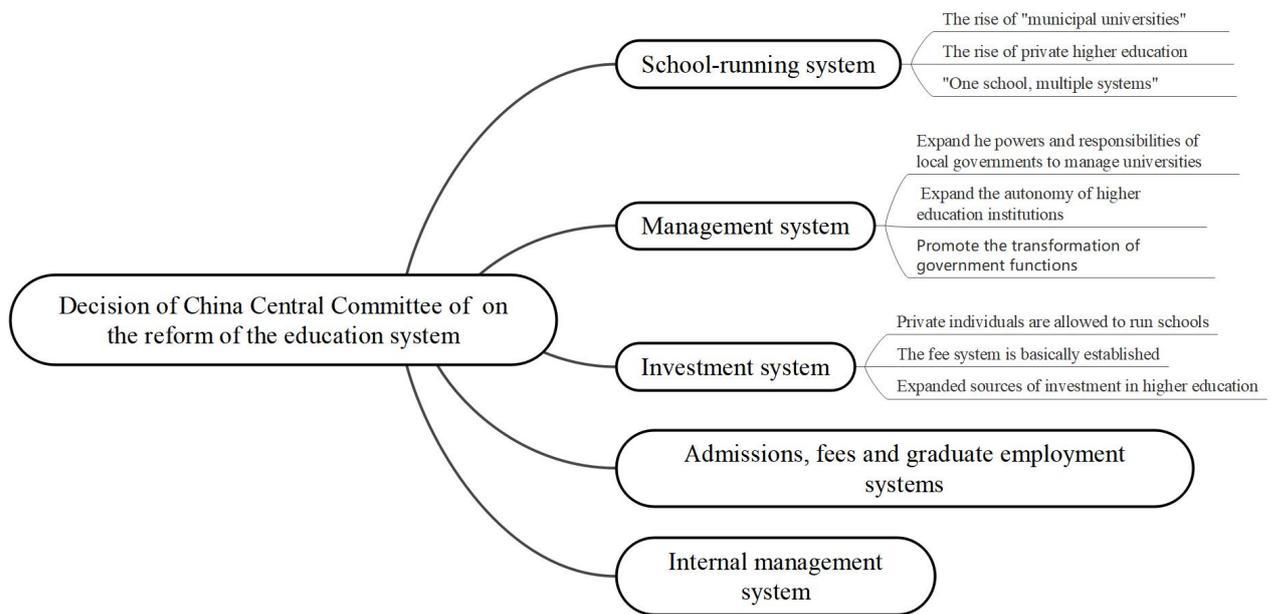
Figure 1.4 - Decision of China Central Committee of on the reform of the education system

Source: author`s research

(1) Promote the reform of the system of running higher education: First, the rise of "city-owned colleges and universities" held in central cities has broken through the previous system of running schools only at the central and provincial levels; Second, the rise of private higher education has further broken through the system of single government running schools; Third, the development of "one school, two systems" and "one school, multiple systems" has opened up a new situation in the reform of China's higher education system. There are two kinds of "one school, two systems" : one means that the subordination relationship is changed from simple to

diversified, and in fact, multi-party investment and joint management; The other is to have both a public and a private part of a university (Kang & Ouyang, 2004).

(2) Promote the reform of higher education management system: First, expand the autonomy of colleges and universities in running schools. The Decision clearly gives universities autonomy in six aspects, that is, "under the premise of implementing national policies, laws and plans, institutions of higher learning have the right to accept commissioning to train and enroll self-financing students outside the plan; Have the right to adjust the professional service direction, formulate teaching plans and syllabuses, write and select teaching materials; The right to accept commissions or cooperate with foreign units to conduct scientific research and technological development, and to establish teaching, scientific research and production consortia; Having the power to nominate and remove vice-presidents and cadres at other levels; The right to make specific arrangements for infrastructure investment and funds allocated by the State; The right to use self-financing to carry out international education and school exchanges", etc. (Kebin, 2023).

Second, it promoted the transformation of government functions. The Government has let go of some of the things it should not have been doing, freeing up energy to do the things it should be doing more effectively. The third is to expand the power and responsibility of local administration of universities, and enhance the enthusiasm and responsibility of provincial governments to manage universities; Local investment in colleges and universities has been increased, and the connection between local economic and social development and higher education has been promoted.

(3) Promote the reform of higher education investment system: first, from a small amount of self-funded pilot, to dual-track coexistence, to the basic establishment of the fee system, opening up a new channel other than state investment -- family and individual investment channels. The second is to set up schools and industries, carry out a wide range of scientific and technological services, and expand the sources of investment in higher education while serving economic construction. The third is the policy of the government to levy a special surcharge for

higher education. The fourth is to accept donations and allow private schools to run in accordance with the law (Knight, Quheng, & Shi, 2016).

(4) Promote the reform of the enrollment, fee and graduate employment systems of colleges and universities: First, break through the single mandatory enrollment plan, try out a new enrollment plan system combining the mandatory plan and the adjustment plan, and gradually expand the adjustment plan. Since 1985, the state has changed the unified admission to the individual admission of schools. In this way, the original system of school enrollment and government enrollment has been changed to a new system of school enrollment and recruitment office supervision. Second, we will try to reform the employment system of graduates with two-way selection. Under the guidance of the state's employment guidelines and policies, a system of graduates choosing their own jobs and employers selecting the best candidates is gradually implemented (Kirby & Eby, 2015).

(5) Promote the reform of the internal management system of colleges and universities: First, promote the transformation of the internal operating mechanism of colleges and universities. It has further broken through the original system shackles of a stagnant pool of personnel management in colleges and universities, and gradually formed a new operating mechanism of fair competition, merit-based employment, more work and more income, and reasonable flow. Second, it promotes the overall improvement of the efficiency and quality of university running, as well as the process of democratization and rule of law Kun & Yu-You, 2019).

The third stage is the stage of "highlighting the key points and difficulties". It is marked by the Outline of China's Education Reform and Development. This stage is characterized by the continuation of the comprehensive deepening of the reform of the "five systems" on the basis of highlighting the focus and difficulty of the "management system reform", concentrating efforts, clarifying goals, and making breakthroughs within a deadline. In this stage, the reform is mainly manifested in two aspects: first, "comprehensive deepening"; Second, focus on key points and difficulties.

(1) Establish new goals for further deepening the reform of the higher education system, and constantly promote the overall deepening of various institutional reforms of higher education. First, in the reform of the school-running system, it further broke the old pattern of the state's sole responsibility for running schools, and "established a new pattern of the central government and the provincial (autonomous region, municipality directly under the Central Government) two levels of running schools, with extensive participation of all sectors of society in running schools." A new pattern of running schools in various forms, such as public colleges and universities, private colleges and universities, private public assistance, and overseas cooperation, has taken shape. Second, in the reform of the investment system, the situation of relying on state appropriations has been changed, and a new system of multi-channel financing of higher education has been established based on state financial appropriations. At the same time, further reform the financial allocation mechanism of colleges and universities, explore the change of the "per capita allocation" method to the "education fund system", for different levels and categories of colleges and universities, the implementation of different funding standards and funding methods, in order to give full play to the macro-control role of funding means. Third, in the reform of enrollment, fees and graduate employment system, first, through the "combination of the two plans" transition (namely "national task plan and adjustment plan"), promote the establishment of a new enrollment macro-control mechanism; Second, through the "dual-track co-existence" transition (that is, public and self-funded) and the "integration" reform, the establishment of the "paid school system"; The third is to promote "a new employment system for the talent market and independent employment" through the transition of "supply and demand meeting and two-way selection within a certain range." Fourth, in the reform of the internal management system of colleges and universities, the reform of the personnel system and the distribution system of colleges and universities has been further promoted.

On the basis of reasonable allocation, the post responsibility system and the appointment system have been implemented for the staff and staff, and the gap in the

distribution has been opened according to the work performance, breaking the egalitarianism, and mobilizing the enthusiasm of the staff and staff. It has promoted the transformation of the internal operating mechanism of the school and the improvement of the level and benefit of running the school. It strengthens the ability of colleges and universities to adapt to the needs of society, and promotes the formation of the mechanism of "self-development and self-restraint" in colleges and universities.

(2) Focus on the reform of the management system, and take "joint construction, transfer, merger, cooperation in running schools and participation in running schools" as the main way to implement key breakthroughs in reform. (1) Co-construction: By the end of 1997, there were 100 colleges and universities in different forms of co-construction nationwide. Among them, 31 are affiliated to the State Education Commission, 54 are affiliated to other ministries, and 15 are affiliated to local governments. The forms of co-construction include provinces (municipalities directly under the Central government) and ministries, cities and ministries, and ministries and ministries. (2) Merger: By the end of 1997, 159 colleges and universities nationwide had been merged into 74, a decrease of 85, making the number of colleges and universities nationwide from 1080 in 1994 to 1020 in 1997. (including a number of new approvals). (3) Cooperative education: By the end of 1997, the number of colleges and universities conducting various forms of cooperative education had reached 288, forming 162 cooperative education institutions. (4) Participation in school running and management: By the end of 1997, more than 5,000 enterprises and scientific research institutions nationwide had participated in the running and management of 217 colleges and universities. Its main forms of "participation" are: the establishment of the school board, the establishment of various scholarships in colleges and universities, and the cooperation with colleges and universities to establish secondary colleges, departments, majors, etc., participate in school running and management, promote the connection between colleges and universities and society, promote the integration of "production, learning and research", and enhance the strength and vitality of colleges and universities. (5)

Transfer: some colleges and universities that were transferred to local management were merged with other colleges and universities after the transformation, so that the schools got new opportunities for development (Kun & Yu-You, 2019).

The fourth stage is the new stage of "deep breakthrough".

(1) General objective: Take co-construction, merger and other joint schools as the main form, dilute and change the single subordination relationship of the school, from "segmentation" to "organic combination", optimize the allocation of resources, expand the school investment channels, and appropriately adjust the school service orientation. A higher education system with a reasonable layout, complete disciplines, good economies of scale, high quality of education and meeting the needs of the socialist market economy and modernization has been gradually established.

(2) Target number of schools: By the end of this century or the beginning of the next century, the number of colleges and universities in China will be adjusted from the current more than 2,100 to about 1,600 (including ordinary colleges and universities, adult colleges and higher vocational schools), of which the number of ordinary undergraduate colleges and universities will be adjusted from more than 1,000 to about 600 (Li, 2009).

(3) Objectives of management system reform: gradually establish a management system of organizers, managers and organizers, with distinct responsibilities; Multi-channel investment mainly by financial allocation; The central and provincial people's governments are managed at two levels, with division of responsibilities, with the provincial government as the main overall plan, and the organic combination of the new system.

(4) Layout structure adjustment objective: to form a new pattern of "three layout structures reasonable": First, three types of coverage of colleges and universities (facing the country, facing the region, facing the province) structure layout reasonable; Second, the structure and layout of the three different levels of colleges and universities (teaching and research schools, schools focusing on undergraduate teaching, colleges and universities and higher vocational and technical schools) are reasonable; Third, the structure of three different types of colleges and

universities (comprehensive, multi-subject, single-subject) is reasonable. For the realization of the new stage and the new goal, there should be a big breakthrough in the concept: break through the bondage of "subordination concept" and increase the intensity of promoting the reform of higher education management system; New breakthroughs should be made in planning, and the overall planning of "reform of higher education management system and adjustment of layout structure" at the national and provincial levels should be strengthened; It is necessary to make new breakthroughs in funding security and effectively solve the unavoidable funding problem in the reform of higher education management system (Li & Chen 2021).

Further stress on the state's legal guarantee of education funding, that is, it is necessary to ensure that the "three increases" (the growth of education appropriations in the budget is higher than the growth of regular fiscal revenue; Education expenditure per capita has increased year by year. Public expenditure per capita has increased year by year). At the same time, we must ensure that the state's various policy provisions on funds in the reform of the management system of higher education are fully implemented (Li, Chen & Guo, 2022).

The logical starting point of China's higher education legal system is derived from the Chinese Constitution, the Education Law and the corresponding Chinese educational legal system, which is the natural extension and logical expansion of China's educational legal system. However, the coexistence of higher education law and degree regulations has led to the technical separation of higher education legal system. In the practice of rule of law, a dual implementation system of higher education and degree management has been formed. Through the systematic analysis of the entity structure and legislative mode of China's higher education legal system, it is proposed that China's higher education legal system should be improved from four aspects: codification, unification, hierarchy and classification during the 14th Five-Year Plan period (Lien & Miao, 2018).

The legal system of higher education in China is a general term for adjusting the relationship between universities and the government, between universities and students, and between universities and society, involving the legal status of

universities, the main rights and obligations of universities, the main rights and obligations of teachers, the main rights and obligations of students, and the legal norms and rights relief. It is based on the higher education system and management norms, and formed by Chinese laws and regulations. Over the past 40 years of reform and opening up, China's higher education has developed continuously, forming a legal system and governance framework for higher education with Chinese characteristics.

British positive jurist Joseph Raz proposed that the existence of legal norms is the existence of a system, a "group". A single law, although it can stand alone, will greatly reduce its role and effectiveness, or even have no effect (Raz, 2003; Wu Yuzhang, 2017). The legal system is an important prerequisite and foundation for realizing the rule of law, and an important part of the basic structure of the rule of law system (Qu Guangdi, 2015). To systematically review and constantly reform and improve the contemporary Chinese higher education legal system, evaluate the process and effect of higher education legal system construction, and reflect on the existing mode of education legal system construction in China are the basis for promoting the development of higher education and the modernization of university governance system and governance capacity. It is an important guarantee for accelerating the construction of first-class universities and realizing high-quality development in the new era.

According to the requirement of uniformity, China's higher education legal system should have only one basic point in higher education standards, namely the Higher Education Law of the People's Republic of China. However, in the historical development, in a parallel sense, there are two laws, namely the Regulations of the People's Republic of China on Academic Degrees in 1980 and the Higher Education Law of the People's Republic of China enacted by the Standing Committee of the National People's Congress in 1998, which are the two legislative foundations of the legal system of higher education in China. These two laws, together with other relevant laws, administrative regulations and local educational regulations, constitute the legal system of higher education in China (Lin, Gao & Liu, 2018).

The legislation of the Regulations on Academic Degrees does not state any legislative basis for statutory law, but stipulates in Article 1: "These Regulations are formulated for the purpose of promoting the growth of scientific talents in our country, promoting the improvement of the academic level of various disciplines and the development of education and science, and meeting the needs of socialist modernization." To put it simply, the legislative basis for the Degree Ordinance is based on the need for professional development. Around 1979, graduate education in China was suspended for more than a decade. Reform and opening up and economic development urgently need to establish a degree system, clarify degree classification and degree awarding standards, and resume high-level personnel training. In view of the fact that degree management is the core issue of higher education management, the special political and economic situation accelerated the formulation of degree regulations, which made it the first education law enacted by the highest state authority since the founding of New China, and finally formed the legislative pattern of higher education legal system and degree management standardization in the process of higher education in China (Liu , 2019).

Although the logical starting point is the same, it has caused the technical separation of the legal system of higher education and formed a dual implementation system of higher education and degree management in the practice of the rule of law. This duality is required by the national conditions in the early stage of China's higher education reform and opening up. At that time, many schools were not authorized by the Ministry of Education to award degrees and qualifications, but there was an urgent need to cultivate more knowledge-based talents. Degree represents learning experience, degree represents learning level and level. First of all, it is necessary to choose academic education to provide talent support for the country's reform and opening up. However, when China's higher education enters the period of "double first-class" development and popularization, its shortcomings become more and more obvious. Both the Higher Education Law and the Regulations on Academic Degrees are actually implemented by the administrative department of Education under The State Council. The administrative department takes the actual Ministry of Education

and the fictitious Academic Degrees Committee of The State Council as the lead agency, and according to regulations, the academic Degrees Committee of The State Council serves as the deliberative coordinating body. The artificial separation of education management institutions and degree management institutions is not only different from the degree management practices in foreign countries or regions, but also causes the unreasonable separation of degree certificates and degree certificates in practice, and the education and degree management system formed in practice can not be effectively and reasonably explained for a long time (Liu, 2016).

Theoretically speaking, degree management is one of the important issues in the educational legal system. The education administration department, as the competent department, has the ability to manage and does not need to set up a degree management committee. In order to meet the requirements of scientific development, the management of academic qualifications and degrees should be unified. Fundamentally speaking, the problem of legislation on the separation of higher education needs to be solved by improving legislation. At least, under the current situation of amending the Regulations on Academic Degrees or even intending to be amended into the Law on Academic Degrees, the legislative basis should be clearly defined (Ma & Xu, 2002).

China's higher education legal system has formed a corresponding entity structure in practice. We believe that the entity structure of China's higher education legal system can be divided into meta-structure, hierarchical structure and category structure.

First, the meta-structure of China's higher education Law. The meta-structure of China's higher education legal system refers to the establishment of special higher education laws in the top-level structure of China's higher education legal system. At present, in the structure of China's higher education legal system, the specialized law of higher education presents a dual structure, including the Higher Education Law passed by the Standing Committee of the National People's Congress in 1998, and the Regulations on Academic Degrees passed by the Standing Committee of the National People's Congress in 1980. In fact, degree management is only one component of

higher education management. Throughout the world, the vast majority of countries above the undergraduate school issued a certificate, that is, a degree certificate, only China and Russia two countries to follow the former Soviet Union's diploma and degree certificate dual certificate system, the formation of diploma and degree two systems (Mok, 2021).

Second, the hierarchical structure of China's higher education legal system. In addition to the meta-structure, China's higher education legal system includes:

(1) China's higher education related laws. At present, China has many laws related to higher education. It can be said that in the current education laws and regulations system, in addition to the laws specifically related to basic education, such as compulsory education law, Education Law, Teachers Law, vocational education Law, private education promotion Law and other laws are related to higher education, and should be incorporated into the higher education laws and regulations system. Among them, the "Education Law" stipulates the basic system and common principles of all types of education at all levels, the "Teachers Law" stipulates the teachers of colleges and universities, the "Vocational Education Law" stipulates the higher vocational education, and the "Private Education Promotion Law" stipulates the private higher education. Therefore, they are all laws related to higher education.

(2) Regulations on the Administration of Higher Education in China.In China, administrative regulations are formulated by The State Council, and these regulations are few, mainly the "Provisional Measures for the implementation of the Regulations of the People's Republic of China on Academic Degrees", "Provisional Regulations on the Self-study Examination of Higher Education", "Provisional Regulations on the establishment of ordinary institutions of higher Learning" and so on.

(3) Administrative regulations of higher education in China.The administrative regulations applicable to all levels of education in China also apply to the field of higher education. Such as the "Regulations on Education Supervision", "Law of the People's Republic of China on the Promotion of Private Education", "Regulations on the Implementation of the Law of the People's Republic of China on Chinese-Foreign Cooperation in Running Schools", "Regulations on the Qualification

of Teachers of the People's Republic of China", "Regulations on the Award of Teaching Achievements", "Education Law for the Disabled", "Regulations on School Physical Education Work", "Regulations on School Health Work" and so on. They are also part of the legal and regulatory system of higher education. Among them, there are some special provisions, such as the "Teaching Results Management Regulations", which are fully applicable in the field of education. However, because it has been implemented only in the field of higher education for a long time, it is often mistaken for being specifically applicable to the field of higher education (Ouyang &Tan, 2021).

(4) Local people's congresses shall enact local laws and regulations concerning higher education.

First, the relevant measures to implement the Higher Education Law. For example, Shanxi Higher Education Law implementation Measures. Second, local laws and regulations on higher education formulated by local people's congresses, such as the Regulations of Shanghai Municipality on the Promotion of Higher Education.

In addition, the administrative department of education and relevant departments of The State Council have also formulated many administrative rules and normative documents. According to the general legislative requirements, they are not part of the legal and regulatory system, but they play an extremely important role.

Third, the category structure of China's higher education legal system. So far, the classification structure of China's higher education legal system is not perfect. At present, the classification of higher education in China mainly refers to general higher education. In addition to the provisions of the Vocational Education Law and the Privately-run Higher Education Law, there are no special and corresponding administrative regulations and local regulations on higher vocational education and privately-run higher education (Shaw, Katsaiti & Pecoraro, 2015).

Therefore, the classification development of higher vocational education and private higher education is not enough. It is gratifying to see that the education administration department of The State Council has recently issued many documents

on higher vocational education. For example, the Ministry of Education's "Several Opinions on Improving the quality of Higher Vocational Education and human resources Guarantee", the Ministry of Education's "Opinions on Promoting the economic transformation and upgrading of Higher vocational Colleges and Implementing the continuing education of employees in service Enterprises", the Ministry of Education's "Development of Higher Vocational Education Innovation Action Plan (2015-2018)" and so on. The Diagnosis and Improvement of the Internal Quality Certificate system in higher Vocational Colleges of the Ministry of Education has promoted the reform and development of higher vocational education. Administrative regulations and working documents have been issued to promote the reform and development of private higher education. However, these administrative regulations and working documents should be upgraded to administrative regulations to regulate and guide the classified development and reform of higher education (Ren & Zuo, 2019).

1.3. Methodological approaches to the analysis of the management of innovative development in higher education

There is a close relationship between education in China's rural areas and educational innovation and development. Educational innovation can promote the development of education in rural areas, and the educational demand in rural areas can also drive and stimulate educational innovation.

First of all, educational innovation can provide the path and direction of educational reform in rural areas. Rural areas are faced with many educational problems, such as lack of teachers, lack of educational resources, outdated teaching methods and so on. Through educational innovation, education models, teaching methods and management mechanisms applicable to rural areas can be explored to meet the diverse needs of local students and improve the quality of education.

Secondly, educational innovation can promote the balanced distribution of educational resources in rural areas. Education resources in rural areas are relatively concentrated in urban and developed areas, which leads to the lack of infrastructure, teaching materials and teaching equipment in rural schools. Through educational innovation, modern scientific and technological means (such as distance education and online learning platforms) can be used to break the geographical restrictions, deliver high-quality educational resources to rural areas, and promote the fair and balanced development of education (Shijian & Na, 2019).

In addition, the actual needs of rural areas can also provide impetus for innovation in education. Education problems and challenges in rural areas are unique, such as left-behind children and students from poor families. Through the analysis of these problems, it shows the innovative development of Chinese education.

Under the background of the rural revitalization strategy, the research on rural education has achieved fruitful results. CiteSpace visualization software was used to draw a knowledge map of the literature related to rural education included in the CNKI database from 2003 to 2023 and sort it out. The results showed that the number of papers published in rural education research in China was on the rise from 2003 to 2023; Under the background of rural revitalization, rural education, rural schools and rural teachers have become three major research topics; "Rural revitalization" has become a hot word. The study believes that in the new stage of development, rural education should always adhere to the leadership of the Party and follow the guidance of national policies; The focus of the research should be on the teaching quality of rural schools, rural education in the western minority areas, etc. The research should focus on the micro-level of rural education in the research perspective, and combine theoretical research with empirical research in the research methods.

The searches the core journals of Peking University and CSSCI journals in the CNKI database with the theme of "rural education" or including "rural education". The search range is set to January 2003 to March 2023. A total of 1350 valid documents are selected as research samples.

This research uses CiteSpace software to carry out bibliometric statistics on the existing documents and draw a map of the number of published documents, research authors and research institutions, key words and research frontiers, so as to better show the research frontiers and development direction of rural education since the 18th National Congress.

From 2003 to 2023 is shown in Figure 1.5. Since the 18th National Congress of the Communist Party of China, the number of research documents related to rural education has been on the rise, which can be divided into two stages. The first stage is 2003-2013, and the trend of rural education is inverted V-shaped, falling first and then rising. During this period, the lowest number of papers was in 2013, and after 2013, the number of papers was steadily increasing. This is because since 2014, the ideas and policies of "targeted poverty alleviation" and "education poverty alleviation" have been intensively implemented. The second stage is from 2018 to now, and the number of papers issued by rural education continues to rise. This is because the rural revitalization strategy has pointed out the direction for the construction of new rural education, and the number of documents issued has been continuously rising. On the whole, the research heat in the field of rural education has gradually increased, and more and more attention has been paid by the academic community.
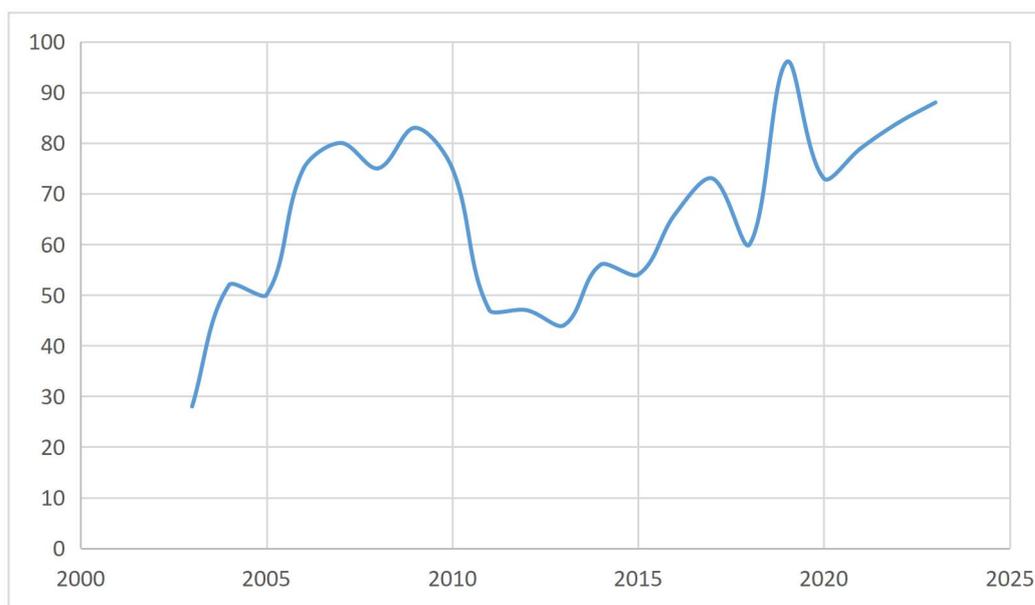
Figure 1.5. - 2003 -2023 publishing number in rural education research

From 2003 to 2023, several high-producing authors in the field of rural education research are shown in Table 1.2.

Table 1.2 - 2003-2023 top ten publishing research authors

Order	Frequency	Year	Author
1	50	2004	Yuan,Guilin
2	19	2013	Qu,Tiehua
3	19	2019	Hao,Wenwu
4	18	2010	Liu,Shanhuai
5	17	2018	Qin,Yuyou
6	15	2013	Zhu,Dequan
7	9	2010	Yang,Dongping
8	8	2015	Zhou,Ye
9	8	2012	Ren,Shenghong
10	8	2013	Ji,Dekui

As can be seen from the author frequency table, the top three authors are Yuan Guilin, Qu Tiehua and Hao Wenwu , indicating that these three authors have made the greatest contribution to the field of rural education research.As can be seen from the graph, although the overall distribution of authors is discrete, there are still lines, indicating that there is cooperation among some authors, but no centralized cooperative team has been formed.From the perspective of the regions of authors in the map, there are more authors in northeast and southwest regions, while fewer authors in Northwest China, indicating that the research on rural education in Northwest China is relatively weak.

The transformed literature data is imported into the software for analysis, and the statistical table of high-frequency keywords is finally obtained. High-frequency keywords can reveal the research hot spot of a certain field, and the greater the

frequency, the more attention the keyword is paid by the academic circle. For example, in Table 1.3, the frequency of rural revitalization reaches 78 times, indicating that this keyword has attracted close attention from the academic community and is a research hot spot in the field of rural education.The top ten keywords with the highest frequency are shown in Table 2. The top three keywords are rural revitalization, rural education (rural education) and rural teachers, which are the research hot spots in the field of rural education.

Table 1.3 - 2003-2023 top ten high-frequency keywords

Order	Frequency	Year	Keywords
1	826	2003	Rural education
2	361	2003	Countryside education
3	91	2006	Countryside teachers
4	78	2018	Rural revitalization
5	36	2005	Rural school
6	34	2003	Urbanization
7	25	2003	Countermeasure
8	23	2004	Rural teachers
9	23	2003	Primary education
10	21	2005	Rural culture

Source: author`s research

From the perspective of research, most researchers study from the macro level such as rural education policies, but have not focused on the micro level of rural education. Therefore, it is necessary to strengthen the micro level research on the psychological problems of rural teachers and the development of rural children, build a complete research system, and promote the continuous and comprehensive development of rural education research. In the new development stage, with the change of the national rural education policy, the perspective of rural research should be further expanded, both at the macro level and at the micro level (Sri, Tiara, Della & Ji, (2021).

From the perspective of research methods, it is necessary to combine theoretical research with empirical research.From the current literature data, rural

education research is mainly speculative research, empirical research is few.Next, rural education research should give full play to the value orientation of theoretical research and combine with empirical research to stimulate the endogenous impetus of revitalizing rural education.

Since the creation of the human capital theory in the 1960s, human capital as a factor input has been regarded as the main factor affecting the economic growth and per capita income gap between countries or regions, and has been widely used in the research and analysis of economic growth (Tang, 2020). Higher education is an important way to deliver human capital to society, and it can indirectly promote economic and social development by improving the quality of workers and labor productivity (To, Marvelle, Labrozzi & Yu, 2013).

Undoubtedly, studying the contribution of higher education to economic growth is of great significance for promoting economic growth. How to measure the contribution of higher education to economic growth through data is a major difficulty in the field of higher education research and economic development research (Wang & Jin, 2021). Scholars in China and at abroad have proposed many methods for measuring the contribution rate of education, such as the remainder analysis method of the American economist Schultz, the growth factor analysis method of Denison, and the complex labor simplification method of the former Soviet Union scholar Strumilin.

Many domestic scholars have done a lot of research based on our country's reality, but they still started late. Yuping Cui (2022) used the same method as Dennison and Madison to estimate the contribution of higher education to economic growth in China from 1982 to 1990; Hongtian Li (2016) used Dennison's method to calculate the contribution of China's education development to the annual GDP growth rate in the 1990s; Tianping Yang (2018) , Junsheng Chen (2019), Shengyong Mao (2018), Huaming Song (2020), Xing Fan (2016), Yuduo Yan (2019) respectively measured the contribution of higher education to economic growth in different periods in western China; Wenbo Cai (2016) and Cheng Zheng (2017) respectively measured the contribution of higher education to economic growth in

the western region in different periods; Yongjie Lang (2016), Xichao Wang (2018), Hongling Zhou (2020), Jianguo Yang (2014), Yonghua Zuo (2016) respectively measured the contribution of higher education in Shanxi, Hebei, Guangdong, Sichuan and Jiangxi to economic growth.

However, without exception, they are all based on the Cobb-Douglas (Cobb-Douglas) production function, and most of them are still at the estimation level and have not been studied in depth. The Silk Road Economic Belt and Road Initiative is a hot area of research in recent years, and higher education is relatively lagging. Based on the Cobb-Douglas (Cobb-Douglas) production function, this paper uses Denison's growth factor analysis method to comprehensively measure the contribution of higher education development to economic growth in the provinces of the Silk Road Economic Belt in the past 16 years, in order to arouse people's contribution to development of the education especially higher education at the Silk Road Economic Belt, to realize the good interaction between the silk road and the education and the economy.

American mathematician Cobb (C. W. Cobb) and economist Paul Douglas (Paul H. Douglas) proposed the famous Cobb-Douglas production function (Cobb-Douglas Production Function) in the 1930s. The basic form of this function is:

$$Y = AK^{\alpha}L^{\beta} \tag{1.1}$$

In the formula, Y represents output, A represents technology level, K represents capital input, L represents labor input, α and β represent the corresponding output elasticity coefficient, and $\alpha>0$, $\beta>0$, $\alpha+\beta=1$. This function is standardised by labour units in order to avoid multicollinearity between capital and labor.

Dennison's growth factor analysis method is based on the Cobb-Douglas production function, taking into account the impact of educational factors on labor quality, and decomposing labor input L into the product of initial labor L0 and education input E. So the formula evolves into:

$$Y = AK^{\alpha}(L_0 + E)^{\beta} \tag{1.2}$$

In the formula, Y is the average annual growth rate of economic output, K is the average annual growth rate of capital input, L0 is the average annual growth rate of initial labor input, and E is the average annual growth rate of education input.

Dennison's growth factor analysis method assumes:

$$F(L_0, E) = F_L(L_{0,}E)L_0 + F_E(L_0, E)E \tag{1.3}$$

Also, FL and FE are homogeneous of degree zero, meaning that the rate of education depend only on the ratio L0/E=Ce.

And, FEL > 0, meaning that education and labor are complementary. Finally, all inputs are essential: F (0, L) = F (E, 0) = 0.

Taking the logarithmic derivative of the above formula, the resulting difference equation the contribution rate of education to economic growth can be expressed as:

$$C_e = {\beta L_0 E}\big/{Y} \tag{1.4}$$

It needs to be emphasized that the labor output elasticity coefficient β in the formula generally takes a value of 0.6 to 0.8 internationally, and the value of China's economic sector is generally 0.7 to 0.8, but there is no universally determined value as a reference in China. For the convenience of international comparison, the author uses Denison's experience value of 0.73. Rate instead, E is the average annual growth rate of education investment and in actual calculations, it can be replaced by the average annual growth rate of the Education Composite Index (Re) calculated based on the average years of education per capita. Y is the average annual growth rate of economic output, which is usually expressed by the average annual growth rate of gross domestic product (GDP) in calculations (Wang & Jin, 2021).

The research object is the Silk Road Economic Belt, including five northwest provinces (regions) such as Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang, and

four southwest provinces (cities, districts) including Sichuan, Chongqing, Yunnan, and Guangxi. In the process of estimating the contribution rate of higher education and economic growth, we usually take the average annual growth rate of education input. It calculated with the average annual growth rate of the education composite index (Re). Re calculated by the average years of education as a substitute variable, and take the GDP as a proxy variable of economic growth.

According to our country's current education system, the duration of primary school education is 6 years, instead junior high and senior high schools are 3 years, and higher education (junior college and above) is regarded as 4 years. Accoding the stastics of Chinese Education Department yearbooks, Table 1.4 shows educational level composition of employees in various provinces in the silk road economic belt in 2001 and 2021.

Table 1.4 - Educational level composition of employees in various provinces in the Silk Road Economic Belt in 2001 and 2021 Unit, %

	2001					2021				
	Illiterate	Primary School	Junior School	High School	Higher Education	Illiterate	Primary School	Junior School	High School	Higher Education
China	780	30.90	42.30	13.50	5.60	2.30	16.90	43.40	18.00	19.40
Guangxi	4.50	35.90	43.40	12.50	3.60	1.00	18.00	51.60	15.30	14.00
Chongqing	8.90	43.10	34.90	9.40	3.80	1.90	27.20	33.30	17.00	20.50
Sichuan	10.90	38.70	34.80	10.10	5.50	3.40	29.40	39.20	13.90	14.10
Yunnan	17.50	48.70	24.30	7.00	2.50	4.70	32.60	42.80	9.80	10.20
Shaanxi	10.10	28.40	41.10	14.40	5.90	2.30	13.00	44.20	18.60	21.90
Gansu	20.30	30.60	31.40	12.90	4.60	4.80	24.60	40.60	15.00	15.10
Qinghai	27.50	31.70	27.80	9.30	3.70	6.10	25.10	35.70	12.90	20.20
Ningxia	15.80	26.90	37.10	12.90	7.20	5.20	16.50	39.70	16.00	22.70
Xinjiang	6.70	34.90	34.30	13.30	10.80	1.40	16.30	40.70	16.70	24.90

Source: author`s research

According the Table 1.4, the higher education level of the whole China populaion is increased from5.6% up to 19.4%,alomst 4 times improved in 18

years,but each province of the Silk Road Economic Belt is not as the same rate as the national increased rate.

The relevant data on the education level composition and GDP of employed persons are from the 2002-2021 "China Labor Statistics Yearbook". Data on education funding, the number of regular colleges and universities, and the number of full-time teachers come from the "China Educational Expenditure Statistical Yearbook 2022" and "China Educational Statistics Yearbook 2022". To eliminate the influence of price fluctuations in different periods, we revised the GDP to the constant price of 2001 before calculation.

Combining with the statistical data of the education level of the employed persons in China (Table 1.4), the average years of education of the employed persons at all levels of academic qualifications can be calculated. The calculation formula is as follows:

$$P_{ij} = N_j \sum X_{ij}/100 \tag{1.5}$$

In the formula, P_{ij} is the number of years of education per capita for employees with j degree in the i-th year; N_j is the number of years of education received by the j degree; X_{ij} is the composition of the education level (%) of employees with j degree in the i-th year; i is year, j is the stage of education at all levels.

Eg: Per capita years of primary school education = the proportion of employees with primary school education and above × (6/100)

According to the above formula, it can be concluded that the average number of years of education of employees in each province of the Silk Road Economic Belt is shown in Table 1.5.

Table 1.5- The number of years of education per employee in each province (cities, districts) of the Silk Road Economic Belt in 2001 and 2021 Unit, years

Region	2001				2021			
	Primary School	Junior School	High School	Higher Education	Primary School	Junior School	High School	Higher Education

China	5.54	1.84	0.57	0.22	5.86	2.42	1.12	0,78
Guangxi	5.72	1.79	0.48	0.14	5.94	2.43	0.88	0.56
Chongqing	5.47	1.44	0.40	0.15	5.88	2.13	1.13	0.82
Sichuan	5.35	1.51	0.47	0.22	5.79	2.02	0.84	0.56
Yunnan	4.95	1.01	0.29	0.10	5.72	1.88	0.60	0.41
Shaanxi	5.39	1.84	0.61	0.24	5.86	2.54	1.21	0.88
Gansu	4.77	1.47	0.53	0.18	5.71	2.12	0.90	0.60
Qinghai	4.35	1.22	0.39	0.15	5.63	2.06	0.99	0.81
Ningxia	5.05	1.72	0.60	0.29	5.69	2.35	1.16	0.91
Xinjiang	5.60	1.75	0.72	0.43	5.91	2.47	1.25	1.00

Source: author`s research

According to the above data, it can be seen that the number of years of education per capita in each province has been greatly increased compared with that of the whole country, which may be related to the international educational exchanges brought about by the Silk Road policy.

To calculate the average annual growth rate of the comprehensive education index, we must calculate the comprehensive education index for 2001 and 2017 at first. The calculation formula for the comprehensive education index is as follows:

$$R_e = \sum \gamma P_{ij} \tag{1.5}$$

In the formula, R_e is the comprehensive index of education; γ is the labor simplification coefficient; P_{ij} is the average number of years of education per capita.

To calculate the comprehensive index of education, we must determine the labor simplification coefficient of employees at first. According to the income of employees with different education levels, combined with relevant research results [5-6, 16], the labor simplification coefficients of primary school, junior school, high school and higher education are determined as 1, 1.2, 1.4 and 2.0. The calculation results are shown in Table 1.6.

Due to the increase in the number of years of education per capita, the comprehensive education index also has a substantial increase. This is also proved

by the average annual growth rate of the comprehensive education index, the growth rate of most provinces is higher than that of the whole country.

To calculate the contribution rate of higher education to economic growth, first of all, it is necessary to calculate the average annual growth rate of the comprehensive index of education after excluding higher education. The difference between the average annual growth rate of the comprehensive index of education and the average annual growth rate of the comprehensive index of education after excluding higher education is the average annual growth rate of the comprehensive index of higher education. Secondly, we need to calculate the proportion of the average annual growth rate of the education composite index at the higher education stage to the average annual growth rate of the education composite index (Wang, Kong, Liu, & Zhao, 2023).

Table 1.6- The comprehensive education index and average annual growth rate of each province in the Silk Road Economic Belt

Region	Comprehensive Education Index in 2001	Comprehensive Education Index in 2021	Average annual growth rate of education composite index%
China	9.00	11.90	1.76
Guangxi	8.83	11.21	1.50
Chongqing	8.06	11.65	2.33
Sichuan	8.26	10.52	1.53
Yunnan	6.77	9.63	2.23
Shaanxi	8.92	12.36	2.06
Gansu	7.63	10.73	2.15
Qinghai	6.66	11.12	3.25
Ningxia	8.53	11.95	2.14
Xinjiang	9.58	12.61	1.74

Source: author`s research

Next, we need to calculate the average annual growth rate of GDP (y) and use the GDP index for the period 2001-2017 (in constant prices 0f 2001). Finally, we need to calculate the contribution rate of higher education to the average annual GDP growth rate. So far, the contribution rate of education to economic growth (Ce) can be calculated by formula (4), and then the contribution rate of higher education to economic growth (Cn) can be calculated (Table 1.7).

From the calculation results, first, the contribution of higher education to economic growth in the Silk Road Economic Belt is relatively low. It can be seen from Table 1.7 that compared with the whole country, the contribution rate of higher education in the provinces of the Silk Road Economic Belt to economic growth is lower than the national level (4.75%) except for Qinghai.

Table 1.7- The average annual GDP growth rate (y), Ce and Cn of each province in the Silk Road Economic Belt

Region	Annual average GDP growth rate (y), %	Contribution rate of education to economic growth (Ce), %	Contribution rate of higher education to economic growth (Cn) %
China	9.37	14.82	4.75
Guangxi	11.23	10.89	3.32
Chongqing	12.74	14.91	4.63
Sichuan	11.55	10.10	2.47
Yunnan	10.67	16.83	2.77
Shaanxi	12.00	12.75	3.88
Gansu	10.22	16.36	3.39
Qinghai	11.38	21.96	4.85
Ningxia	10.83	14.19	4.01
Xinjiang	10.21	13.30	3.75

Source: author`s research

Compared with Western developed countries, when the level of economic development is equivalent, it is only equivalent to the level of Japan and Germany in the 1970s, and there is still a huge gap compared with the United States, France, and the United Kingdom in the same period. The paper showed in 2011, China's per capita GDP was US $5,445, while that of France and Germany reached US $5,265 and US $5,457 respectively in 1974; that of the United States was US $5,836 in 1972; that of the United Kingdom was US $5,785 in 1978; and that of Japan was US $6,230 in 1976. In other words, China's per capita GDP at this stage is roughly equal to the level of the world's major developed countries in the 1970s. On the basis of the same level of economic development, the comparison of the contribution rate of higher education to economic growth can better reflect the gap between China's higher education and developed countries.It shows that higher education in the Silk Road Economic Belt failed to promote economic growth well in 14 years (Wang & Li, 2021).

The development of education in the Silk Road Economic Belt lags economic development. It can be seen from Tables 1.3 and 1.4 that the average annual growth rate of the comprehensive education index of all provinces in the Silk Road Economic Belt is below 4%, while the average annual growth rate of GDP is above 10%. There is a significant gap between the two, indicating that during the 14 years, the development of education in the Silk Road Economic Belt lags behind economic development, and the coordination between education and economy is poor.

Higher education is an important way to deliver human capital to society, and it can indirectly promote economic growth by improving the quality of workers and labor productivity. Therefore, to increase the contribution of higher education to economic growth, it is possible to increase investment in higher education to provide a guarantee for the output of human capital. According to the 2013 OECD Country Education Development Report "Educationataglance 2013: OECDIndicators" published on the UNESCO website, the average level of higher education expenditure per student in major OECD countries in 2010 was US $13528.

According to the Statistics Yearbook of China's Education Expenditure, the average expenditure on higher education in China was 19952 yuan, the average expenditure on higher education in China was 2999 dollars, less than 1/4 of the average level of OECD countries (Wang & Li, 2021).

There is a comparison of educational outlays of higher educational institutions in the eastern region and the silk road economic belt in 2021 (Table 1.8).

As well as the strong support of national policies, the economy of the Silk Road Economic Belt has developed rapidly. In addition, the higher education investment has increased significantly, but due to weak economic foundation Compared with the eastern region, the gap is still very obvious. It means that central and local investment in higher education is generally lower than that in the eastern region, and the Matthew effect of education investment still exists.

Table 1.8. - Comparison of Educational Outlays of Higher Educational Institutions in the Eastern Region and the Silk Road Economic Belt in 2021 (Unit: million yuan)

The Eastern Region			The Silk Road Economic Belt		
Region	Total education expenditure	Education expenditure per student	Region	Total education expenditure	Education expenditure per student
Beijing	11220.66	7.29	Guangxi	2286.55	2.39
Tianjin	29203,72	4.74	Chongqing	2531.50	2.84
Hebei	29696.82	2.26	Sichuan	4731.11	2.75
Shanghai	60792.38	6.42	Yunnan	1819.16	2.26
Jiangsu	75950.16	3.64	Shaanxi	4353.16	3.27
Zhejiang	53078.78	4.33	Gansu	1594.47	2.93
Fujian	27745.18	3.48	Qinghai	3043.65	3.98
Shandong	52381.41	2.39	Ningxia	4199.74	3.63
Guangdong	83941.87	3.81	Xinjiang	1099.36	2.60

Hainan	5361.30	3.06			

Source: author`s research

In order to carefully analyze the changes brought by the One Belt And One Road higher education belt to the economy and make clear whether there is a relationship between the educational expenditure in Table 1.8 and the number of schools, this paper also makes statistics on the number of schools.

It can be clearly shown from Table 1.9 that in 2021, the number of ordinary colleges and universities in the eastern region was 1,015, while there were only 563 in the Silk Road Economic Belt. Among them, there are 77 in the eastern region, while only 18 are in the Silk Road Economic Belt; there are 509 undergraduate colleges in the eastern region, and there are only 251 in the Silk Road Economic Belt. The limited number of higher education institutions in the Silk Road Economic Belt, especially the limited number of high-level universities, is difficult to meet the public's demand for high-quality education and is not conducive to improving the overall quality of local employees.

Table1.9 - Comparison of the number of ordinary higher education institutions in the eastern region and the Silk Road Economic Belt in 2021

| The Easten Region | | | | | The Silk Road Economic Belt | | | | |
Province	Total	Universities under the central government	Colleges and universities	Higher vocational colleges	Province	Total	Universities under the central government	Colleges and universities	Higher vocational colleges
Beijing	92	38	67	25	Guangxi	75	0	36	39
Tianjin	56	3	30	26	Chongqing	65	2	25	40
Hebei	122	4	61	61	Sichuan	119	6	51	68
Shanghai	64	10	39	25	Yunnan	79	1	32	47
Jiangsu	167	10	77	90	Shaanxi	95	6	55	40
Zhejiang	108	2	60	48	Gansu	49	2	22	27
Fujian	89	2	37	52	Qinghai	12	0	4	8
Shandong	145	3	67	78	Ningxia	19	1	8	11
Guangdong	152	5	64	88	Xinjiang	50	0	18	32
Hainan	20	0	7	13					

Source: author`s research

Comparing the ratio of teachers with senior titles and professional titles to the total number of full-time teachers in the provinces of the Eastern Region and the provinces of the Silk Road Economic Belt, the average level of the provinces of the Silk Road Economic Belt is relatively low.

The ratio of teachers with senior titles and professional titles to the total number of full-time teachers can reflect the quality and level of regional higher education teachers to a certain extent. The quality of teachers is an important factor affecting the quality of higher education training. This paper makes a statistical analysis of the professional titles of teachers in the eastern provinces of China(Table 1.10) and the Silk Road provinces (Table 1.11) to compare the total number of full-time teachers, the number and proportion of teachers with senior and associate professional titles.

Table 1.10- Proportion of teachers with senior title and professional title in eastern provinces in 2021 Unit, person

Province	Number of full-time teachers	Senior	Associate professors	Proportion of senior and associate title,%	Proportion of senior title, %
Beijing	71095	20378	25302	64.25	28.66
Tianjin	31362	4948	10350	48.78	15.78
Hebei	75454	10432	22847	44.11	13.83
Shanghai	45855	8462	14403	51.28	18.98
Jiangsu	116350	16355	40380	48.76	14.06
Zhejiang	34333	9532	19471	45.72	15.03
Fujian	46555	5886	14314	43.39	12.64
Shandong	112717	11993	33588	40.44	10.64
Guangdong	108222	14805	29423	40.87	13.68
Hainan	10082	1318	2907	41.91	13.07

Source: author`s research

It can be clearly understood from Table 1.10 that the proportion of senior titles and professional titles in Beijing is much higher than any other province. When Beijing is excluded from the table, the average proportion of senior titles and senior titles in the remaining eastern provinces is 46.95% and 15.64% (Table 1.10). While the average proportions of senior titles and professional titles in the Silk Road Economic Belt provinces are 41.31% and 12.28%, both lower than the eastern region (Table 1.11).

Table 1.11-Proportion of teachers with senior title and full senior title in provinces of the Silk Road Economic Belt in 2021 Unit, person

Province	Number of full-time teachers	Senior	Associate professors	Senior title proportion, %	Proportion of senior professional title %
Guangxi	45211	4905	12164	37.75	10.85
Chongqing	42946	5137	12278	40.55	11.96
Sichuan	86997	9666	23447	38.06	11.11
Yunnan	40102	4247	11146	38.38	10.59
Shaanxi	68459	9180	20973	44.05	13.41
Gansu	28939	3534	9601	45.39	12.21
Qinghai	4746	752	1494	47.32	15.84
Ningxia	8185	1419	2314	45.61	17.34
Xinjiang	20797	1491	5724	34.69	7.17

Source: author`s research

The provinces in the Silk Road Economic Belt are in relatively backward areas, and the employment environment and policies have no advantages. The phenomenon of brain drain is serious. Many talented college students "go East rather than return West", resulting in serious brain drain. According to Baicai Sun 's latest research (Wang, Wang & Jin, 2021), the western region belongs to the area of net outflow of talents, and the gap in the absolute number of talents between the western region and the developed eastern regions is widening year by year. The number of graduates from the western region who have flowed out of the western region is higher than the number of graduates who have flowed into the western region from other places. There is a clear "surplus" of qualified personnel flow in the western region . Therefore, although the country and the provinces of the Silk Road Economic Belt attach great importance to the phenomenon of brain drain and have formulated a series of measures to attract talents, they still cannot effectively prevent the brain drain.

For a long time, higher education investment and resource allocation have been more in the East than in the West, and the development level of higher

education has been strong in the East and weak in the West. As a result, the contribution of higher education to economic growth in the Silk Road Economic Belt has a large gap compared with the eastern region. From central to local governments, government departments should increase their investment in higher education in the Silk Road Economic Belt, increase their share of higher education resources, and provide a guarantee for the talent training environment (Wang & Li, 2023).

The provinces of the Silk Road Economic Belt should further deepen the reform of the higher education system and education and teaching, continuously optimize the structure of higher education, and highlight the characteristics of higher education. Governments at all levels should support colleges and universities in resolving debts, so that colleges and universities can speed up their development. We must pay attention to the modernity of the school system, improve the management system of colleges and universities, and improve the level of school governance and modern management. It is necessary to further support the comprehensive reform of colleges and universities, promote the process of modernizing the university system, expand the autonomous rights of colleges and universities, introduce social capital to run schools, and fully release the vitality of college development. We must pay attention to the openness of the school-running philosophy, promote the internationalization of higher education, so that universities can get more high-quality social education resources for use (Xie, 2022).

To further enhance the construction of teachers for the Silk Road Economic Belt province based on the reality, focus on the future. Provide the supplement the number of necessary teachers, reduce the teacher-student ratio, formulate and implement special promotion plans for young teachers to avoid the gap between the old and the new, and strengthen the construction of teachers' ethics at the same time. In the introduction of outstanding talents at the same time, but also to enhance their own teaching ability, in order to create a group of teachers solid theoretical knowledge, excellent teacher ethics, advanced education ideas and outstanding scientific research, in order to improve the soft and actual intensity of higher

education and high-quality personnel training to provide strong support (Yang, Li & Quan, 2012).

If the universities in Silk Road Economic Belt want to attract and retain talents, it must first promote industrial development and attract talents with its strong industrial agglomeration capabilities. Second, the attention must be paid to the career development of talents and ensure that the channels for career development of talents are never blocked. In addition, it is necessary to create a fair and good social and cultural environment for the basic life of talents, vocational training, children's education, and personal development.

Conclusion to the Chapter 1

Contribution level of higher education to economic growth by the development level of higher education itself and the influence of various factors, such as higher education input levels further through the comparative analysis of domestic and international data, China lags behind in many development indicators can be found mainly in developed countries, in terms of domestic, the provincial (city, area) the phenomenon of unbalanced development of higher education is also presented.

The research shows that the contribution rate of higher education to economic growth in the Silk Road Economic Belt is low, lower than the national average level. The main reasons are the low investment in higher education, the lack of high-level universities and the serious brain drain. If the country can start from the following aspects: increase investment in higher education, optimize the allocation of higher education resources; Further improve the running level of colleges and universities, improve the quality of talent training; Strengthening the construction of teachers, enhancing the soft power of higher education, perfecting the mechanism of attracting and retaining talents, and creating a favorable development environment will increase the contribution rate of higher education to economic growth in the provinces of the Silk Road Economic Belt.

Based on the Cobb-Douglas production function, the contribution rate of higher education to economic growth in the provinces of the Silk Road Economic Belt in the past 16 years is comprehensively calculated using Dennison's growth factor analysis method. The results show that the contribution rate of higher education to economic growth in the Silk Road Economic Belt is low, which is lower than the national average level. Low investment in higher education, few high-level universities and serious brain drain are the main reasons for the low economic contribution rate of higher education in the Silk Road Economic Belt. The main ways to improve the contribution rate of higher education to economic growth in the provinces of the Silk Road Economic Belt are as follows: increase the investment in higher education, optimize the allocation of higher education resources; Further improve the running water level of colleges and universities, improve the quality of talent training; Strengthen the construction of teachers and enhance the soft power of higher education; We will improve the mechanism for attracting and retaining employees and create a favorable environment for development.

CHAPTER 2. ANALYZES THE CURRENT SITUATION OF INNOVATION ACTIVITIES IN COLLEGES AND UNIVERSITIES

2.1. Research universities as the center of innovation and development of higher education

Education is the foundation of a hundred-year plan. Keeping pace with The Times, China's higher education has built the world's largest higher education system and trained a large number of highly qualified professionals, playing an extremely important role in national rejuvenation, economic construction, social development, and scientific and technological progress. China's higher education has made historic achievements and undergone major changes.

Along with The Times, China's higher education has created remarkable development achievements, which are mainly reflected in the following four aspects:

China has built the world's largest higher education system, with more than 44.3 million students in total. The gross enrollment rate of higher education has increased from 30 percent in 2012 to 57.8 percent in 2021, an increase of 27.8 percentage points, marking a historic leap forward, and higher education has entered a stage of universal access recognized by the world.

The number of people receiving higher education in China has reached 240 million, the average years of education of the newly added labor force has reached 13.8 years, and the quality structure of the labor force has undergone major changes, and the quality of the whole nation has been steadily improved. Higher education has made continuous innovations in education methods, school-running models, management systems, and security mechanisms, providing strong support for building an important global talent center and innovation plateau.

Through the "211" and "985" projects and the "Double first-class" construction plans, a number of universities and a large number of disciplines have reached the world's advanced level, and the overall level of China's higher education has entered the world's first square (Zhang, Hu &Wang, 2020).

It has formed the Chinese paradigm for the development of MOOCs and online education. China MOOCs Conference and World MoOCs Conference have been held successively, forming a set of Chinese paradigm for the development of MOOCs, including concepts, technologies, standards, methods, and evaluations. By the end of February 2022, the number of online MOOCs in China has exceeded 52,500, with 370 million registered users, and more than 330 million college students have obtained MOOCs credits, ranking first in the world in terms of the number and application scale of MOOCs. To build the "National Higher Education Smart Education Platform" and initiate the establishment of the World MOOC and online education Alliance, which has become a move and a key move to proactively lead the future development of world higher education "changing track and overtaking" strategy (Zhang, 2020).

Innovation and entrepreneurship education leads the world. China has continued to deepen the reform of innovation and entrepreneurship education in colleges and universities, offering more than 30,000 specialized courses on innovation and entrepreneurship and more than 11,000 open online courses, employing 174,000 outstanding professionals as full-time and part-time teachers on innovation and entrepreneurship, and 1.39 million college students from more than 1,000 colleges and universities participating in the National Innovation and Entrepreneurship Training Program for College Students. The China International "Internet Plus" College Student Innovation and Entrepreneurship Competition has been successfully held for seven sessions, attracting 6.03 million teams and 25.33 million college students from more than 120 countries and regions on five continents. The competition has directly created 750,000 jobs and indirectly provided 5.16 million jobs, and promoted the formation of a new concept of talent training and quality (Zheng, 2021).

The capacity of higher education to serve the country has been significantly improved. Higher education has taken the initiative to subordinate the "small logic" service of its own development to the "big logic" of the country's economic and social development. The capacity of higher education institutions to serve the

country's major strategies has been continuously enhanced, and they have won more than 60% of the three national science and technology awards. More than 60% of the country's basic research and more than 80% of the National Natural Science Foundation projects are undertaken by higher education institutions. Universities and colleges have provided key technologies for high-speed rail, nuclear power, biological breeding, vaccine research and development, national defense and military industries, participated in the development of supercomputers, Beidou navigation satellite system, Shenzhou series and other national weapons, and supported and led the construction of a strong culture, a strong talent, a strong sports, a healthy China, a beautiful China, and a safe China (Zhou & Li, 2021).

"People-oriented" and "four returns" are deeply rooted in the hearts of the people, and "students are busy, teachers are strong, the system is hard, and the quality is high" has become the general consensus and direction of efforts on the front. Guided by the "Double Million Plan" for the construction of first-class majors and first-class courses, a total of 8,031 national and 8,632 provincial first-class professional construction points were identified, and the first batch of 3,559 national first-class courses were selected and identified. For three consecutive years, the Teaching Master Award, Outstanding Teaching Award and Innovation and Entrepreneurship Talent Award have been selected, and a large number of "big Mr." such as Yao Qizhi, Zhang Boli and Lin Yifu (2020) have made outstanding contributions in the front line of universities and colleges have been selected, effectively encouraging and guiding the majority of teachers to improve their teaching ability and devote themselves to teaching and educating people.

We will promote the construction of the "Four new", and carry out all-round reforms in personnel training paradigms such as education ideas, development concepts, quality standards, technology methods, and quality evaluation. In the face of a new round of scientific and technological revolution and industrial transformation, in the face of socialist modernization, and in the face of the development of world higher education, it has made an educational response, an era response, an active response, and a Chinese response.

To deepen the construction of new engineering projects, comprehensively promote innovation in organizational models, theoretical research, content and methods, and practical systems, implement 1,457 new engineering projects, explore the establishment of a multi-factor integration of industry-university-research and multi-entity education mechanism, and support more than 1,100 undergraduate colleges and universities to cooperate with nearly 800 enterprises to establish 37,000 projects. The company provided about 11.2 billion yuan in funding and hardware and software support. With the innovation of the organizational model of colleges and departments as the starting point, we will promote the construction of 28 demonstration microelectronics colleges, 11 first-class cybersecurity colleges, 50 modern industry colleges, 33 characteristic demonstration software colleges, and the first 12 future technology colleges, so as to promote the deep-seated reform of engineering education (Zhiwu, 2021).

Deepen the construction of new medical science, position "big country plan", "big people's livelihood", "big discipline" and "big specialty", strengthen the cultivation of Taoist, humane, academic, technical and artistic skills of medical students, and lead the innovation and development of medical education. Medical and educational cooperation to build a "5+3" as the main body of clinical medical personnel training national system. Accelerate the training of high-level innovative talents in composite medicine, hold 10 consecutive sessions of the Chinese College Students Medical Technology and Skills Competition, support 11 universities to carry out eight-year clinical medical education, and promote the pilot reform of "Medicine +X" composite talent training. We will integrate mentoring education into the whole process of training TCM talents, and basically establish a talent training system that conforms to the characteristics of TCM. Recognized by the World Federation of Medical Education, a medical education professional certification system with Chinese characteristics and international substantive equivalence has been established (Zhou, Zhang & Zhang, 2022).

We deepened the construction of new agricultural science, built a complete system of new agricultural science construction from the macro, meso and micro

levels, and set up the first batch of 407 new agricultural science practice projects. It has comprehensively strengthened agricultural education in colleges and universities, launched a series of online open courses on agriculture, Rural areas and farmers in a large country, completed 36 state-level first-class courses on agricultural education, compiled and published the first new agricultural science and new form of teaching materials of Ten Lectures on Agricultural Education, and built 184 bases for agricultural education practice. We will continue to strengthen the training of specialized personnel in the field of seed industry, support 48 universities to offer undergraduate programs in seed science and engineering, and train high-quality innovative talents in the seed industry to strongly support and lead the construction of new agriculture, new countryside, new farmers and new ecology (Zhou & Li, 2018).

We will deepen the development of new liberal arts, and define the overall goal of building a world-class, Chinese-style system for cultivating liberal arts talents. 1,011 new liberal arts projects have been set up in 22 selected topics in 6 major fields to meet the needs of the economy and society, and more than 3,000 new interdisciplinary integration points of liberal arts, science, arts and engineering have been added. We have set up 70 top-notch talent training bases for basic liberal arts disciplines in 29 colleges and universities, and accelerated the training of personnel related to foreign rule of law, international communication, and international organizations. The four major lecture halls on China's political and legal practice, journalism and communication, economy and art have been launched to create "China's Golden Course" and promote the close integration of liberal arts education with social practice (Yin et al., 2019).

We have fully launched the basic Discipline Excellence Plan 2.0, built 288 student training bases in 77 colleges and universities, explored the "Chinese paradigm" of training top talents in basic disciplines, attracted more than 10,000 outstanding students to join basic disciplines, and formed an "echelon network" of top talents in basic disciplines. In order to take the road of independent talent

training well, We will lay a solid foundation for building a major global talent center and innovation hub.

The degree-conferring system, professional catalog system and management system of universities with Chinese characteristics have been continuously improved. Actively integrate into the national strategy and industry development, align with the new development pattern to adjust and optimize the layout of disciplines, and promote interdisciplinary integration in order to solve practical problems. Since the 18th National Congress of the Communist Party of China, 265 new majors have been included in the catalog of undergraduate majors, of which 771 are currently included. A total of 17,000 undergraduate majors were added, 10,000 were cancelled or suspended, and the adaptability of personnel training to new technologies, new industries and new forms of business was significantly enhanced (Xin, Ye & Jiang, 2020).

Further progress was made in revitalizing and developing higher education in the central and western regions. Centering on the strategic layout of "four points, one front and one side", revitalize higher education in the central and western regions, jointly with relevant ministries and commissions, launch basic capacity building projects for universities in the central and western regions, and consolidate the foundation for running schools. During the 13th Five-Year Plan period, a total of 10.7 billion yuan was allocated from the central budget to implement the "One province, one school" and "one school, one plan". Each school receives about 100 million yuan of financial support from the central government every year. In addition, 119 subordinate universities and high-level universities in the east participated in supporting 103 universities in the central and western regions, covering all 12 western provinces (autonomous regions and municipalities directly under the central government) and the Xinjiang Production and Construction Corps.

The joint construction of colleges and universities has achieved remarkable results. An additional 151 colleges and universities were jointly built with relevant ministries and commissions, large enterprises and local governments. Relying on the co-construction mechanism, the first batch of "double first-class" co-construction of

local governments invested a total of more than 66 billion yuan in construction funds, and provincial and ministry co-construction of local colleges and universities received a total of more than 100 billion yuan during the "13th Five-Year Plan" period, effectively improving the overall level of co-construction of colleges and universities and serving national and regional major strategic capabilities.

China's system of higher education has its modern-day roots in reforms introduced by Deng Xiaoping soon after the death of Mao Zedong in 1976. Characterized by a reform agenda known as the Four Modernizations , Deng's policies began a process that current higher education policymakers hope will end with the establishment of a network of world-class universities able to compete for the best minds not only in China but also across the globe (Wu, Zhang, Jiang & Zhu, 2015).

Deng's desire was to see China "catch up" with the rest of the world and to engage the global community as a socialist market economy through advancements in four broad sectors: agriculture, industry, science and technology and the military. Central to this catch-up policy was the development of a higher education infrastructure capable of meeting the demanding research and human resource needs of the new Chinese economy. Since Deng's retirement from the political scene in 1992, higher education policies enacted by third- and fourth-generation leaders have not lost sight of this vision; indeed, they are a continuation along a similar path.

The complex challenges of competing in the global economy, especially after China's entry into the World Trade Organization in 2001, have had a dramatic impact on higher education in China. Two broad goals characterize the reform agendas of the 1990s: rapidly increase gross enrollment rates and improve the quantity and quality of China's research output, especially in technical and scientific fields, by building a network of world-class universities. Central to the latter goal are two policies that have come to be known as Project 211 and Project 985. The goal of increasing enrollments has been tackled in part through the liberalization of regulations governing private education, alongside the expansion of public provision

(Wang & Li, 2023). The following will be specifically introduced the major projects in the Chinese universities (Figure 2.1).

Figure 2.1.- Notable University of China in 2021

Source: author`s research

In 2021, according "2021 Education Statistics" published by MOE, the total number of higher education in PRC reached 37.79 million, and the enrollment rate of higher education reached 45.7%. There are 2,631 general higher education institutions across the country (including 265 independent colleges), an increase of 35 over the previous year, an increase of 1.35%. Among them, 1243 undergraduate colleges, 6 more than the previous year; 1388 higher vocational (associate) colleges, an increase of 29 over the previous year. There are 282 adult higher education institutions nationwide, 2 fewer than the previous year; 815 postgraduate training institutions, including 578 colleges and universities and 237 scientific research institutions(Table 2.1). The average school size of ordinary higher education

institutions 10,430 people, including 14,639 undergraduate schools and 6,662 high vocational (associate) schools.

Table 2.1 - Number of Higher Education Institution in China in 2021

Type of school	Total	Central Ministries & Agencies	Local Authority	Private
1.Postgraduate Programs	815	304	505	6
Regular HEIs	578	110	463	5
Research Institutes	237	194	42	1
2.Graduate Programs	2631	119	1766	746
Regular HEIs	1243	114	703	426
Independent Institutions	265	0	0	265
Vocational Colleges	1388	5	1063	320
3. Adult HEIs	282	13	268	1
4. Other Non-government HEIs	800	0	0	800

Source: author`s research

Graduate students enrolled 806,100 students, of which 691,900 were full-time. There are 83,900 doctoral students and 722,200 master students. There are 2,369,600 postgraduate students, including 362,000 doctoral students and 2,277,600 postgraduate students. There are 576,800 graduate students, including 58,000 graduated doctoral students and 52,000 graduated master students (Table 2.2).

Ordinary undergraduate enrollment was 7,174,900, an increase of 127,800 over the previous year, an increase of 1.72%; the number of students enrolled was 2,735,900, an increase of 574,400 over the previous year, an increase of 2.14%; the graduates of 7,358,300, an increase of 316,500 over the previous year People, an increase of 4.49%.

The number of adult enrollment students was 2,175,300, an increase of 63,000 from the previous year, an increase of 2.98%; the number of students enrolled was 5,441,400, a decrease of 40.25 million over the previous year, a decrease of 6.89%; the number of graduates was 2,470,400, an increase of 25,700 over the previous year. People, an increase of 1.05%.

Table 2.2 - Number of Students of Formal Education by Type and Level in Higher Education (unit:person)

Type of level	Graduates	Entrants	Enrolment
Postgraduates*	578045	806103	2639561
Doctor´s Degree	58032	83878	361997
Master´s Degree	520013	722225	2277564
Undergraduate in Regular HEIs	7358287	7614893	27535869
Bachelor Degree	3841839	4107534	16486320
Associate Degree	3516448	3507359	11049549
Undergraduate in Adult HEIs	2470370	2175302	5441429
Bachelor Degree	1091226	1023981	2589809
Associate Degree	1379144	1151321	2851620
Web-based Undergraduates	1777905	2861143	7359267
Bachelor Degree	659559	993253	2587338
Associate Degree	1118346	1867890	4771929
College-preparatory Class	—	—	45420
Postgraduate Courses	9244	—	12237
Faculty Training	8996653	—	8338925
Foreign Students	121419	153445	274809
* The number of postgraduate students includes full-time and part-time students.			

Source: author`s research

The national higher education self-study exam qualification education applied for 4,709,400 person-times, and obtained a graduation certificate of 552,700.

The number of faculty and staff of ordinary institutions of higher learning was 2,433,000, an increase of 38,200 over the previous year (Table 2.3), an increase of 1.59%; the number of full-time teachers was 1,633,200, an increase of 31,300 over the previous year, an increase of 1.95%. The average student-teacher ratio is 17.52:1, of which 17.42:1 for undergraduate schools and 17.74:1 for higher vocational (associate) schools. Adult colleges and universities have 41,400 faculty members, a decrease of 1,711 from the previous year; 24,000 full-time teachers, a decrease of 1,224 from the previous year.

Table 2.3. - Number of Schools, Educational Personnel and Full-time Teachers by Type and Level

Type of school	Schools' amount	Educational Personnel(person)	Full-time Teachers(person)
Total Postgraduate Programs	815	—	—
Regular HEIs	578	—	—
Research Institutes	237	—	—
Total Bachelor Degree Programs	2631	2442995	1633248
Regular HEIs	1243	1772342	1150467
Independent Institutions	265	162330	122151
Higher Vocational Colleges	1388	669521	482070
Other Institutions	24	1132	711
Adult HEIs	282	41408	23990
Other Non-government HEIs	800	20882	9643

Source: author`s research

The fundamental of industrial transformation and upgrading is to break the original growth model, which depends to a great extent on technological innovation, especially the improvement of independent innovation ability. The study of higher education reform in Ukraine is conducive to enriching China's knowledge system about Ukraine, expanding the field of higher education research in China, and attracting more scholars' attention to education reform and development in developing countries. This paper analyzes the basic characteristics of higher education models in China and Ukraine, compares the scientific, technological and innovative activities of higher education institutions in China and Ukraine, and puts forward the innovative development path combining modern science. In China, the expenditure on education per student in ordinary colleges and universities shows a downward trend and then an upward trend, while the dispersion of GDP per student in China shows a downward trend year by year. Higher education should conform to the trend of the world economy, change the concept of education, carry out ideological and political education, strive to cultivate innovative talents, promote the integration of Industry-University-Research, vigorously improve the quality of teachers, and accelerate the reform of higher education in all aspects.

Improving people's living standards is one of the main goals of economic policy, in other words, the development of the whole national economy cannot be separated from the development and improvement of the education system (Erfort & Zbarazskaya, 2020). Since the founding of New China, tertiary education has always been an education system with state control and financial investment as the mainstay. Because of the low starting point in the field of education, there are a large number of supply gaps, and the efficiency evaluation of education investment is completely based on the planned economic system. From a global perspective, people's understanding of education is also quite different. However, with the arrival of modern industrial civilization, the development of education in various countries generally presents several types and development models, such as market dominance, state control, limited government and limited market (Dan, Qingyang & Bilal, 2021).

The education system in developed countries has also been adjusted and improved for many years, which has achieved a high efficiency of human resources training. From the official launch of the Bologna process in 2001 to 2013, the Bologna process has gone through 14 years of development, and its influence has exceeded the scope of Europe [4]. With the spread and development of the Bologna process, researchers should reflect on the tertiary education policy in a wider scope and in a more systematic way. The Ukrainian government has made remarkable achievements in strengthening the mobility of teachers and students, improving the fairness of accreditation, and improving the quality of tertiary education through measures such as rebuilding the national degree qualification framework, implementing the European credit conversion and accumulation system, and improving the quality assurance system (Cui, 2000). However, it also faces the market crisis brought by the coexistence of old and new systems and tertiary education.

The innovation of education system is mainly to improve the quality of education, especially to develop the market competitiveness of educational service institutions. The innovation of educational system involves the innovation of educational institutions, which may lead to changes in the status, functions and educational system of educational institutions. Unified education and science is the starting point of Ukraine's national education policy. China has a vast territory, a large population and a weak foundation, and its economic transition has obvious stage characteristics. The core issues of higher education are the training quality of experts, the priority of distribution, conscious innovation and making correct decisions. While pursuing economic growth, economic development pays more attention to the improvement of economic quality and comprehensive social welfare (Chunling, 2012). Correspondingly, the intensified discussion on education industrialization and education fairness since the 21st century has highlighted social humanistic care.

The fundamental of industrial transformation and upgrading is to break the original growth model, which largely depends on technological innovation, especially

the improvement of independent innovation ability. The members of the Bologna Process are not only EU countries, but also non-EU countries, some of which are not even European countries, such as Kazakhstan and Turkey. These member countries have political, economic, cultural and educational systems completely different from those in traditional Europe. The main steps of Ukraine's joining the Bologna process are the reconstruction of the academic qualification framework, the realization of the European credit conversion system, the creation of a new quality assurance system, the support for the mobility of teachers and students, the government giving universities more autonomy rights, and taking new measures to prevent plagiarism, and universities giving students' trade unions more rights, making the government more democratic (Chen, Fan & Gong, 2022).

In the process of globalization, as a country of the former Soviet Union, after opening the market economy, Ukraine realized that its long-term planned economy closed it to the outside world and could not compete with western countries. As an aspect of society, higher education is naturally influenced by Soviet policies. The overall, leading and basic position of higher education plays an important role in promoting the transformation of the national economy. Therefore, it is of great practical significance to adjust the specialty setting and student training direction of colleges and universities to meet the needs of national economy and industrial development, and to promote the transformation of national economic growth momentum and the upgrading of industrial structure through the improvement of human capital and scientific and technological innovation ability. Science and modern information technology provide high-quality databases and networks, which can expand educational opportunities under the complex information perception background (Cao, Zhu & Shen, 2022).

In the process of Bologna, Ukrainian higher education has made great achievements in these fields, but it also faces great challenges. As a part of the world economy, Ukraine has an irreplaceable position as the geopolitical center of Europe. With the continuous development of its economy, the field of education should also receive more attention. This paper analyzes the basic characteristics of Ukrainian

higher education model in the process of China and Bologna during the economic transition, compares the scientific, technological and innovative activities of higher education institutions in China and Ukraine, and puts forward the innovative development path combining modern science.

From the perspective of economic growth, when more and more developed countries' economic growth experience is applied to developing countries after economic take-off, these policies have not achieved obvious results. The main reason is that developed countries such as Europe and America have formed a mature human capital system and have sufficient supply of high-quality talents. After surpassing the advantages of relying on resources and demographic dividend in the early days, developing countries lack the human and scientific and technological capabilities to make full use of limited material resources. After the end of the cold war, the pattern of multi-polarization in the world is taking shape, and international competition is becoming increasingly fierce (Dan, Qingyang, & Bilal, 2021).

Since the 1990s, western countries have been adjusting their strategies, and they all put the fulcrum of winning competition on science and technology. In the stage of globalization, as a country of the former Soviet Union, after opening the market economy, Ukraine realized that its long-term planned economy made it closed to the outside world and could not compete with western countries. As an aspect of society, tertiary education is naturally influenced by Soviet policies. Human capital is the most important promoting factor after the economic growth slows down, and it is also a necessary supplement to material capital. The theory of human capital highlights the relationship between education and economic growth, and makes people realize that education is not only an investment and consumption, but also a productive behavior that can bring huge benefits in the future, which greatly affects the educational reform in all countries of the world.

The course of educational reform since the founding of the People's Republic of China generally reflects the adjustment stage of national concept and social logic, from the state arranging society and monopolizing education to paying attention to social needs and market factors. The proportion of investment in education reflects a

country's government's emphasis on and support for education. Especially after the formation of the government-led education development system after World War II, all countries have actively developed national education with government financial investment as the mainstay. Table 2.4 shows the proportion of education investment in GDP from 2012 to 2020.

Since 2012, the expenditure on education in China has reached more than 4%. The educational structure is the proportional relationship and interconnection between levels in the vertical educational system and the proportional relationship and interconnection between classes in the horizontal educational system (Fan & Ma, 2017).

Table 2.4 - Proportion of education investment in GDP from 2012 to 2020

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
China										
Education points out (100 million yuan)	16485	21315	21845	22588	36125	38879	42562	46143	50175	53034
Proportion (%)	3.48	4.12	4.3	4.15	4.26	4.22	4.14	4.11	4.04	4.22
Ukraine										
Education points out (100 million yuan)	2022	2674	3288	3956	4778	5232	6099	7589	7956	8345
Proportion (%)	1,11	1,16	1,02	0,72	0,66	0,74	0,79	0,82	1,09	1,15

Source: author`s research

The strength of social education, especially the main source of education investment in developed countries, has not yet developed in China. However, some existing market-oriented educational institutions do have many problems, which have a lot to do with the imperfect management and regulation system of the market-oriented part of the education field. Driven by economic globalization and information technology revolution, the world economy and science and technology have advanced by leaps and bounds, with eight major science and technology industries as the leaders: information science and technology, life science and technology, new energy technology, new material technology, space technology, marine technology, environmental technology and soft science and technology.

Western education opposes determining the social status of individuals according to their parents' social status, and attaches importance to selecting talents through education to promote people's mobility at all levels. Sociology also points out that the higher the degree of individualized development of students, the higher the educational efficiency. If an education system inhibits the development of students' personality, then its efficiency is low.

Ukraine is aware of the need for reform, but the actual reform process is slow, difficult and sometimes even unaware of the direction of reform. Scientific research investment focuses on information technology, biotechnology and life sciences.
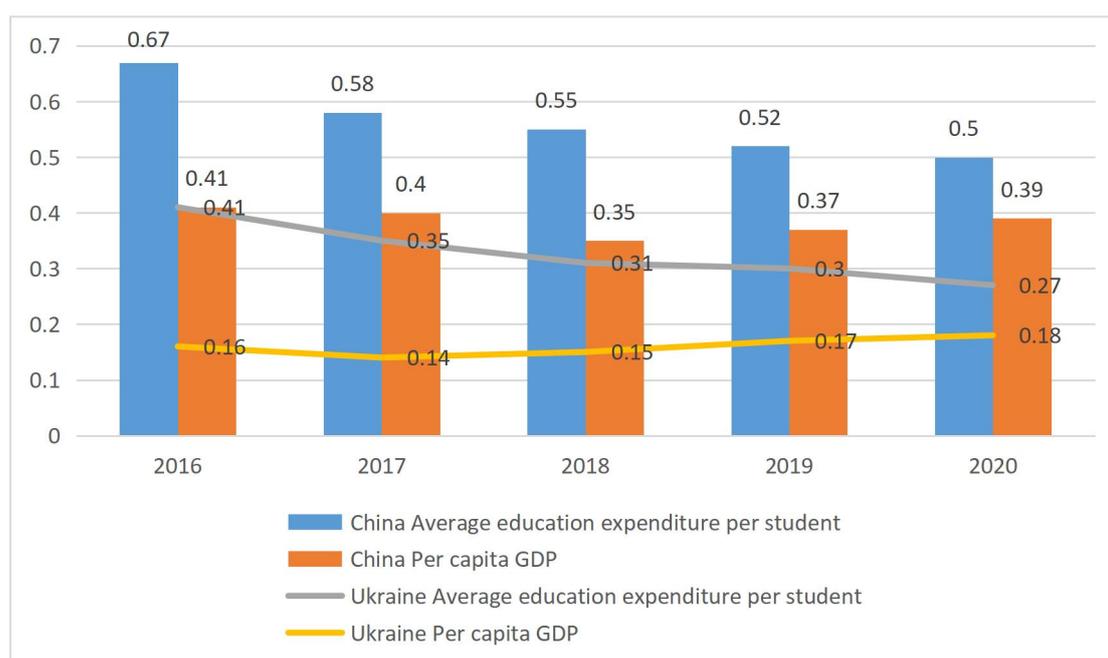
Figure 2.2-Expenditure and per capita trend of education funds per student in colleges and universities from 2017 to 2020, million yuan

Source: author`s research

The development of multinational companies will introduce western culture, which will further affect the economy and even politics of the capital-invested countries; At the same time, it is difficult to avoid inequality in the stage of economic globalization. For tertiary education, the social purpose of cultivating talents, the inheritance and sublation of culture, and the creation of social basic theories and advanced ideas; The promotion of social stratum mobility plays a very important role in cultivating students' individuality and giving full play to their specialties. The technological resources of high-tech enterprises in China can only rely on their own research and development, technological innovation and intellectual property rights; High-tech multinational companies will March into China to compete with China high-tech enterprises or other institutions for senior technical talents.

As can be seen from Figure 2.2, the per capita expenditure on education in colleges and universities in China shows a trend of first decreasing and then increasing, while the dispersion of per capita GDP in China shows a trend of decreasing year by year. It shows that after several years' development, the imbalance of GDP per capita in different provinces in China has declined, while the imbalance among tertiary education regions has not improved, and it still exists widely, and it has a tendency to spread in recent two years. At present, the study of educational efficiency from the perspective of economics is still more concerned with the contribution to the economy and productivity. This not only stems from the characteristics of economic research, but also lies in the selection of data collection and analysis methods. The definition of personal color is still a challenging field in economics.

Besides the deviation degree of per capita education funds, there are also standard deviation and extreme difference rate. Among them, the standard deviation

reflects the absolute difference of indicators, and the range rate reflects the extreme situation of indicators. Table 2.5 reflects the absolute differences in the per capita education expenditure of tertiary education students in different regions. Table 3.5 shows the standard deviation and extreme difference rate of the expenditure on teaching expenses per student in colleges and universities from 2017 to 2020.

Tertiary education is characterized by the integration of knowledge creation, processing, dissemination and application. It is a bridge linking economic growth with scientific research and personnel training, and its fundamental task is to cultivate high-quality innovative talents.

Table 2.5-Standard deviation and range rate of per capita expenditure on education in colleges and universities from 2017 to 2020, yuan

Year	Standard deviation		Range rate	
	China	Ukraine	China	Ukraine
2017	6477.46	1921.33	25111.12	3894.20
2018	6788.24	2055.10	32145.91	4211.33
2019	6811.33	1854.32	31124.23	4856.16
2020	8148.55	2098.91	39468.53	5637.20

Source: author`s research

To a certain extent, the development of tertiary education can determine whether a nation can be invincible in the challenge of knowledge economy. There is still a sharp debate on the proposal of educational efficiency, and some even think that education can't be said to be "efficient" because it is a process involving marketization and commercialization, which contradicts the public welfare of education. Although the industrialization of education seems to have no obstacles from the technical level. However, the mode of production of education is still a special behavior, which can't even be called "production" strictly speaking (Kang & Ouyang, 2020). Facing the rapid growth and changes of world economy, population,

science and technology, and facing the challenges of knowledge economy, tertiary education should make important contributions. Although tertiary education is not the direct supply of human capital, and the trading and exchange of labor market does not take place in schools, colleges and universities are the main places where human capital is generated.

Promoting quality education in an all-round way and cultivating students' innovative ideas, innovative spirit and practical ability is the glorious mission of China universities, and it is a historic and significant measure to meet the challenge of knowledge economy and win the initiative. Nowadays, interdisciplinary, marginal and interdisciplinary scientific research has become a new growth point for the world's science and technology to make breakthrough progress. Cultivating this cross-century compound talent is a major issue facing tertiary education today. Tertiary education cultivates human capital that can contribute to economic growth. As a special factor of production, workers exchange their own labor for a certain income while giving play to their production functions, thus satisfying their own desires for survival and consumption. The scientific and technological activities of universities can not be confined to the laboratory, but must be involved in the technological innovation activities of high-tech enterprises (Liu, 2022).

At the same time, driven by the world's high-tech revolution, economic growth requires universities to provide faster and more powerful support in talents and scientific research achievements, and universities and research institutes shoulder the heavy responsibility of providing sufficient talent reserves and technical support for the development of high-tech industries. Tertiary education's investment in human capital often plays a double-edged sword role, and the purpose of investment is to obtain certain expected returns in the future, which is the same as the general meaning of investment theory.

The social participation in the quality evaluation of tertiary education is constantly improving. Students, university staff and all walks of life in Ukraine are gradually participating in the quality evaluation of tertiary education, which makes the evaluation no longer a matter for universities and experts, but also a matter for

students, enterprises and other social groups. On the issue of establishing a quality assurance system, an inspection team composed of social organizations, national accreditation committees, student organizations, foreign experts, etc. may have doubts about the examination of professional qualifications, curriculum setting, teacher appointment, etc. of colleges and universities because of the subjective reasons of the evaluation experts, thus hindering the independent management of interdisciplinary subjects, courses, resource allocation and other fields in colleges and universities, and interfering with the academic freedom and diversified development of colleges and universities (Tang, 2020).

In 1999, 29 European countries held a meeting in Bologna, Italy. The objectives of the meeting were: to remove obstacles to the flow of students between countries in Europe; Improve the attractiveness of European higher education in the world; Determine the common framework of higher education system in Europe, and establish the higher education structure of undergraduate and postgraduate stages within this framework. Universities in Ukraine are also attracting foreign experts to participate in various academic activities, using academic organizations in European countries and regions to invite a large number of experts to make suggestions for curriculum reform, teaching reform and other activities, and many universities directly invite international experts to participate in quality evaluation.

For the public, faced with how to choose the old and new degree structures, there will naturally be some confusion, and it will also bring trouble to international exchanges and cooperation. However, the reality is that employers and society still recognize expert degrees, and the newly established bachelor's and master's degrees are not as good as expert degrees for employment to a certain extent. The Ukrainian government should strive to create a good social environment for the healthy development of tertiary education, including legal environment, political environment and policy environment. The government's management of universities should be more limited to formulating national strategic plans and objectives for the development of tertiary education, approving the establishment of tertiary education, evaluating the quality of tertiary education, and monitoring and auditing the use of

university funds, rather than involving too many problems in the internal operation of universities such as personnel recruitment and curriculum setting (To, Marvelle, Labrozzi & Yu, 2019).

In order to eliminate this obstacle and reduce the negative impact of system transformation, the Ukrainian government should strengthen the explanation and publicity of the content, results and significance of degree reform while promoting the reform. The horizontal structure of education investment, that is, the distribution of education investment among regions. The ultimate goal of financial allocation is to narrow the gap between the development level of tertiary education and the educational resources per student in various regions and keep it within a reasonable range. It is not enough to simply recognize the gap in the level of education investment in various fields, because the government believes that family investment can make up for the lack of government investment, thus reducing the pressure on government investment in education. The financing system of tertiary education in Ukraine is shown in Figure 2.3.
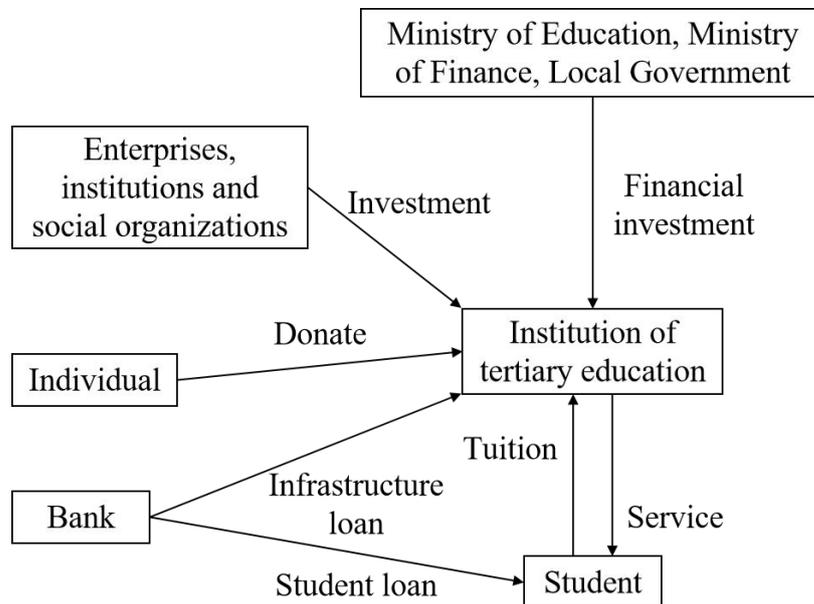
Figure 3.3- Tertiary education financing system in Ukraine

Source: author`s research

While increasing the total investment in education, China pays more attention to the improvement of efficiency, especially in the light of the demographic changes in recent two years. It will be one of the major issues that governments at all levels need to consider to ensure the sustainability of higher education development in China by adjusting the investment structure in education and changing the development direction.

In the Bologna process, the construction of university power is an important part of the university system, but the change of government role is undoubtedly more urgent. How to coordinate the relationship between universities and the state is a difficult problem, and there are irreconcilable contradictions in theory. The acceptance of the Bologna process reform by Ukrainian people directly affects the international mobility and employment mobility of Ukrainian students. Therefore, the Ukrainian government and universities should jointly undertake the responsibility of publicizing the Bologna process-related reforms in Ukraine, ensure the awareness and implementation of the Bologna process reform, and formulate corresponding plans to complete the national degree system in line with the international standards as soon as possible. Solving the employment problem of graduates in the goal of Bologna process means supporting the scientific research activities of universities. But the output and research and development of knowledge cannot be separated from economy. The economy is the main cradle of job creation and innovation, and the economic miracle is built on thousands of micro-enterprises. The development of today's international society is inseparable from cooperation and competition. Cooperation is the premise of development, and competition is the unchangeable rule in cooperation. Combining the two in the field of education means that both partners can share international educational resources through cooperation.

Industry-University-Research's joint innovation among universities, enterprises and governments is a stage of internalizing external innovation resources, which has the characteristics of emphasizing formal institutional constraints among innovation subjects, unity and cooperation, highlighting internal resource sharing and

information openness, and encouraging members to flow across regions (Wang, 2020).

Under the guidance of the education market, the forms of international cooperation should gradually become flexible and diverse, and the success or failure of cooperation should not be measured only in quantity. Although many cooperation projects have been developed in many times, most of the agreements are just signed, and the full demonstration work in the early stage has not been done well. When the specific implementation encounters obstacles or the feasibility is insufficient, it is just a dead letter. Therefore, to deepen the achievements of cooperation, we should not only pay attention to successful experiences, but also pay attention to development trends, pay attention to actual results, and show cooperation and exchanges in a targeted manner. Industry-University-Research's alliance is an important way to introduce social capital into the field of tertiary education. At the same time, as the main body of knowledge production and transfer, colleges and universities can also play their roles in talent cultivation, technological innovation and supporting the sustainable development of the national economy.

After its independence, Ukraine has been actively seeking opportunities for cooperation and development, including not only economic cooperation, but also educational cooperation and exchanges. The government actively encourages the development of mutual benefit and various forms of bilateral tertiary education cooperation, and has established good cooperative relations with EU member States and most neighboring countries. Especially after joining the Bologna process, Ukraine has accelerated the pace of cross-border cooperation and exchanges and achieved corresponding results. Cross-border cooperation and exchanges in Ukraine from 2008 to 2020 are shown in Table 2.6.

Table 2.6-Cross-border cooperation and exchanges in Ukraine from 2008 to 2020

	Number of	Number of	Number of	Number of

	international cooperation and exchange agreements signed	countries where students studying and visiting in Ukraine belong	Ukrainian students studying abroad	foreign students studying in Ukraine
2008	58	79	1600	1235
2013	139	65	12000	23000
2020	156	145	22000	42000

Source: author`s research

The efficiency of education investment is closely related to the investment structure, while the investment structure of education and the stage characteristics of economic development are interrelated. The exchanges and cooperation between China University and foreign universities and research institutes have not only improved the teaching level of higher education in China, but also introduced the frontier information of relevant theoretical research and technology development into China. Correspondingly, the deepening reform of China's higher education has also made many domestic universities participate in the global higher education service, international talent training and transnational science and technology joint development activities.

In the stage of Bologna, European countries are constantly exploring the relationship between cooperation and competition. How to continue to move forward in the contradiction and coordination between the two is a problem that needs to be faced and urgently solved in the new development stage of the process, and it is also a problem that must be faced in the stage of internationalization of tertiary education in China. Through various investment modes, we will expand and improve the sources of educational funds and management system, and then achieve the goal of improving the teaching quality and educational efficiency of colleges and universities in China.

It is necessary to change the concept of education as a consumer undertaking and establish the values of educational production and industrialization; Establish the concept of development, change the previous strategy of excessively restricting the development of tertiary education, expand the scale of tertiary education through various forms and ways, realize popularization at an early date, and reserve enough high-quality talents to meet the arrival of knowledge economy; Establish a new concept of talents, change the traditional concept of emphasizing knowledge over ability, emphasizing specialty over all-round quality, emphasizing inheritance over innovation, and take cultivating senior professionals with innovative spirit and creative practice ability as the central task. The basic situation of the proportion of investment in scientific and technological innovation in tertiary education is shown in Table 2.7.

It is worth noting that the establishment of cooperation mechanism in the stage of internationalization should be based on the local culture of the nation, which is a two-way or multi-directional cooperation. In the stage of cooperation, we should not only introduce and input, but also pay attention to the export of our national culture. In view of the existing problems in the field of tertiary education investment in China, policy subjects, policy action modes and specific policies are the main aspects that need to be paid attention to in government planning and design.

Table 2.7-Basic situation of investment ratio of scientific and technological innovation in tertiary education

	1995	2000	2005	2010	2015	2020
Developed countries (China, Japan, USA, Canada)	5.7	4.8	4.7	5.4	5.5	6.5
Less developed country (Ukraine, Moldova, Albania, Georgia)	3.9	3.7	3.9	4.2	4.2	4.5
Least developed country (Afghanistan, Africa region)	3.2	2.8	2.5	2.2	2.9	3.7
All countries	4.8	4.9	4.8	4.8	4.9	4.9

Source: author`s research

Among them, the policy subject is the most active factor to determine the investment efficiency of tertiary education; The mode of policy action is a summary based on the development model of tertiary education in China. Specific policies are the means and methods chosen by the government in combination with the mode of action. Promoting the combination of Industry-University-Research and speeding up the transformation of science and technology into productive forces is conducive to the combination of science and technology, education and economy, to the development of high-tech industries and the whole national economy in China, and to improving the teaching and scientific research level of colleges and universities and cultivating innovative talents.

The initiation and promotion of the Bologna process has deepened the sense of identity of European countries with national culture. Ukraine's higher education has long been closely linked with enterprises and markets in terms of teaching mode, management system, specialty setting and curriculum development. It pays attention not only to the cultivation of students' scientific research ability and practical application ability, but also to the cultivation of students' comprehensive ability and innovation ability, all of which show the idea that higher education serves the national economic construction. Since 2012, the expenditure on education in China has reached more than 4%. The educational structure is the proportional relationship and interconnection between levels in the vertical system of education and the proportional relationship and interconnection between classes in the horizontal system of education. In the Bologna process, European countries are constantly exploring the relationship between cooperation and competition. How to continue to move forward in the contradiction and coordination between the two is a problem that needs to be faced squarely and urgently solved in the new development stage of the process. The establishment of cooperation mechanism in the process of internationalization should be based on the local culture of the nation, which is a

two-way or multi-directional cooperation. In the process of cooperation, we should not only introduce and input, but also pay attention to the export of our national culture.

2.2. Analysis on the development status of educational innovation (artificial intelligence, system reform)

In the new form of civilization with data as the core, a new round of scientific revolution and educational revolution has also kicked off. All kinds of human behaviors have left digital traces, and the laws of individual and group behavior contained in these traces are enough to change our understanding of individuals, organizations, society and even nature. The mastery and application of these laws, and the benefit of human and social progress and development through this, have become the fundamental driving force for the development of digital civilization.

Promote the building of a community with a shared future for mankind." As an important participant, builder and contributor of the global digital civilization, the world needs China to provide solutions for the emerging digital civilization, and universities should focus on the construction of digital China, accelerate the implementation of educational digital strategic actions with a long-term vision, and use Chinese wisdom to empower digital civilization and higher education.

The era of digital civilization has given higher education a new mission. The dual attributes of humanity and computing of data itself have naturally dispelled the barriers between natural science and humanities and social science, and also made the professional boundaries serving the social division of labor fuzzy and integrated in a positive sense. Only by realizing the integration of knowledge, research methods, disciplines and specialties, and science and education can China's new type of higher

education provide reliable intellectual support for the digital civilization that benefits mankind. On the other hand, with the rapid development of digital economy and technology, the uncertainty of digital civilization is also increasing. The "digital divide" caused by "digital hegemony" continues to widen, and the "digital deficit" in global governance continues to become prominent. The international community urgently needs to answer the questions of The Times, "What is wrong with the world" and "where is humanity going?" In the face of profound changes unseen in a century, higher education undertakes the important mission of providing public goods of thought to the world. In particular, it is necessary to carry out the fundamental task of cultivating morality and educating people, hold high the banner of a community with a shared future for mankind, carry forward the common values of mankind, contribute Chinese wisdom to the exchange and mutual learning of digital civilizations among countries, and put forward Chinese proposals in the joint exploration of good governance of global digital civilization.

The development of digital civilization has injected new momentum into higher education. The digital revolution has profoundly changed the way people think and behave. Cultivating people with higher digital literacy, awareness and skills has become the basic, guiding and strategic need of socialist education with Chinese characteristics. 5G, big data, cloud computing, artificial intelligence and other new generation digital technologies are fully applied. It has promoted the digital transformation of higher education in the aspects of education concept, teaching mode, course form, organization mode and governance system. Through the construction of emerging infrastructure such as information network, platform system, digital resources, smart campus, educational brain, ideological and political AI, higher education can fully penetrate the essence and results of digital civilization into all aspects of talent training, and explore educational methods and training systems with digital literacy and digital ability as the core. The establishment of digitalized higher education with full sharing of educational resources and deep integration of teaching and research will provide China with a vision of strategic leadership for the development of world higher education.

The transformation of digital civilization reshapes the new ecology of higher education. With the application of massive heterogeneous data, powerful computing equipment, various software tools and intelligent platform facilities, higher education can build innovation laboratories and new scientific research practice platforms with knowledge sharing, wisdom collaboration and diverse results, and actively serve the latest needs from the government, society, industry and other practical frontline. In the combination of theoretical breakthrough and scene application, "heaven and earth", Reform the scientific research transformation mechanism and innovate the scientific research management system, so that it can not only meet the individual needs of talent training, but also maximize the co-construction and sharing of educational resources, digital facilities, social services and innovation results, and realize the precise docking between majors, schools and society. It provides more possibilities for the deep integration of higher education personnel training, scientific research, and social service functions, so as to contribute a Chinese model of world significance to exploring the way for higher education to serve the new needs of human civilization development.

Digital civilization construction creates a new time and space for higher education. Higher education undertakes the important mission of collecting information, producing knowledge, cultivating culture, continuing the context and inheriting civilization. With the support of emerging digital media and communication technologies such as VR/AR, 5G/6G, new media and meta-universe, higher education can create an international communication platform featuring diversity, equality and harmonious coexistence, create a more convenient, deeper and more colorful digital communication mode, create a new pattern of global people-to-people exchanges, and actively carry out domestic and international dialogue. To understand others in the connectivity of the digital space, so as to cross the gap between cultures and civilizations, better present the beautiful vision provided by Chinese civilization for the future of mankind to the world audience, and build a Chinese platform for the exchange and mutual learning of world civilizations.

Digital civilization based on the future achievements of higher education pioneers. Colleges and universities are an important force for the national innovation system and the construction of independent knowledge system, and are also an important soil for the majority of young people to struggle and pursue progress. Under the mission coordinate of the new era and new journey, universities should continue to explore in the process of civilization development, and extensively introduce the latest achievements of digital information technology to the construction of new carriers such as new think tanks, new research and development institutions, new laboratories, and joint practice bases with Chinese characteristics, so as to provide the most suitable technical support for academic research and provide the best growth path for student training. To provide the best incubation environment for the transformation of results, create Chinese solutions with Chinese wisdom, strive to be a pioneer in improving digital governance, promoting digital innovation, and stimulating digital vitality, and build a test field that gathers wisdom and forces to serve the development of civilization.

(1) The United States has always been at the forefront of the world in information technology research. The online education industry has also blossomed with the support of its advanced information technology. At the same time, the US government is also very supportive of the online education industry, and has revised a series of policies to promote the development of online education. In this favorable environment, the online education industry in the United States has developed rapidly. After the "first year of online education" in 2012, the three major online education platforms (Coursera, Udacity, Edx) have grown rapidly with the east wind of MOOC, integrating a large number of high-quality education resources in a short period of time, and realizing and sharing them on the Internet, breaking the boundaries of higher education. This model has swept the world and has been highly concerned and used for reference by global higher education. At the same time, some American universities have also launched their own online education courses to meet the needs of different students. The research on the online education industry in the United States has always been dominated by MOOCs. Several professional

institutions, led by the Online Education Consortium, conduct a comprehensive survey of the development of online higher education in the United States every year. According to its latest research report, the number of online higher education enrolments in the United States has reached 20 million, but the growth rate is gradually slowing. For all the convenience MOOCs have brought, they have also exposed a number of problems, mainly in the uneven quality of courses, low acceptance of online education by teachers, low completion rates, and regionalization (students tend to choose online education courses from in-state universities or teachers). Although MOOC is well received by students, its non-certification, non-mandatory, non-academic shortcomings restrict its further development. Therefore, how to make up for the above shortcomings is an urgent problem for online education in the United States.

（2）India and China are both located in Asia and are both populous and developing countries. Therefore, the development of India's online education industry can be used as a reference for the development of China's online education industry. India's own lack of higher education resources has led many young Indians to focus on acquiring knowledge through online learning. According to statistics, Indian students account for up to 10% of international students registered on online education platforms in the United States. India's online education resources are mainly concentrated in a few national universities in the country, including Indira Gandhi National Open University, which has transplanted the British open education model and some courses. However, in the process of transplantation, there are also some problems, such as the inconsistency between the professional setting and the market demand, the unsolved problem of educational equity, and the difficulty in ensuring the quality of courses. Although there are many problems with online education in India, it is worth learning from the degree of acceptance of online education, for students who study through online education, the test can obtain a qualification certificate issued by the university.

(3) Japan and China have a long history of exchange and learning.

The two countries are not only geographically close, but also have similarities in population density, cultural cognition and living habits. Therefore, Japanese online education is also of great reference significance for China. Japan began to operate Internet education in 1984, experienced the communication education and open education stage, in 2006 by a number of well-known universities in Japan jointly established the International Open Courseware Alliance (OCWC), and in the same year officially established the Japan Open Courseware Alliance (JOCW), as of the end of June 2017, JOCW has accumulated millions of visits, 3,061 open courses.

With the arrival of the first year of MOOCs in 2012, Japan established a localized JMOOC in 2013, becoming the largest MOOC organization in Japan. By the end of June 2022, the total number of students has exceeded 1.2 million, and is in a period of leap development. Unlike online education in other countries, online education in Japan is more closely combined with credits, and even more demanding than school education. Not only are online education courses strictly produced and reviewed, but after completing online education courses, they also need to participate in written tests at prescribed examination centers. It can be seen that Japan attaches great importance to the quality of online education. At the same time, Japan also emphasizes the homogenization of online education, and the official has not only led the development of unified electronic textbooks, but also developed a unified education cloud platform. Although the development of online education in Japan has begun to take shape and has good development opportunities, it is still difficult to face many problems such as shortage of funds, shortage of teachers, and ineffective teaching effect. How to further utilize existing advantages to absorb funds, train more teachers, accurately evaluate and improve teaching effect is the focus of the current development of online education in Japan (Fukuhara,2022).

Due to the uneven distribution of educational resources in China, high-quality educational resources are often concentrated in first-tier cities, so the demand for high-quality educational resources is very large in second - and third-tier cities. At the same time, first-tier cities, due to their fast pace, in addition to

increasing learning pressure, the learning and growth demand of working people also has a blowout growth under increasing competitive pressure. The rise of online education just to meet these strong demand for education, so when online education spsprout in China, has been widely concerned, a number of traditional education institutions quickly completed the Internet transformation, and in a short period of time to absorb a lot of investment, become the first batch of people to eat crabs, to achieve leapfrog development. From 2019 to 2022, the market size of China's online education industry and the growth rate of the number of users have remained above 30%, which has doubled in just three years. In 2022, the market size of China's online education industry has exceeded 350 billion yuan, and the number of users has reached 140 million, which shows its rapid development.

At the same time, the traditional education industry has accelerated the transformation of the Internet, has begun to try the combination of online and offline (O2O) model, and the Internet giants, using the rich customer resources they have accumulated, also quickly built online education platforms, have entered the education market, ready for their strategic deployment. Such as NetEase cloud class, Baidu Education, QQ education, YY education, Taobao University and so on. See Figure 2.3 for the specific classification of the development status of domestic online education industry
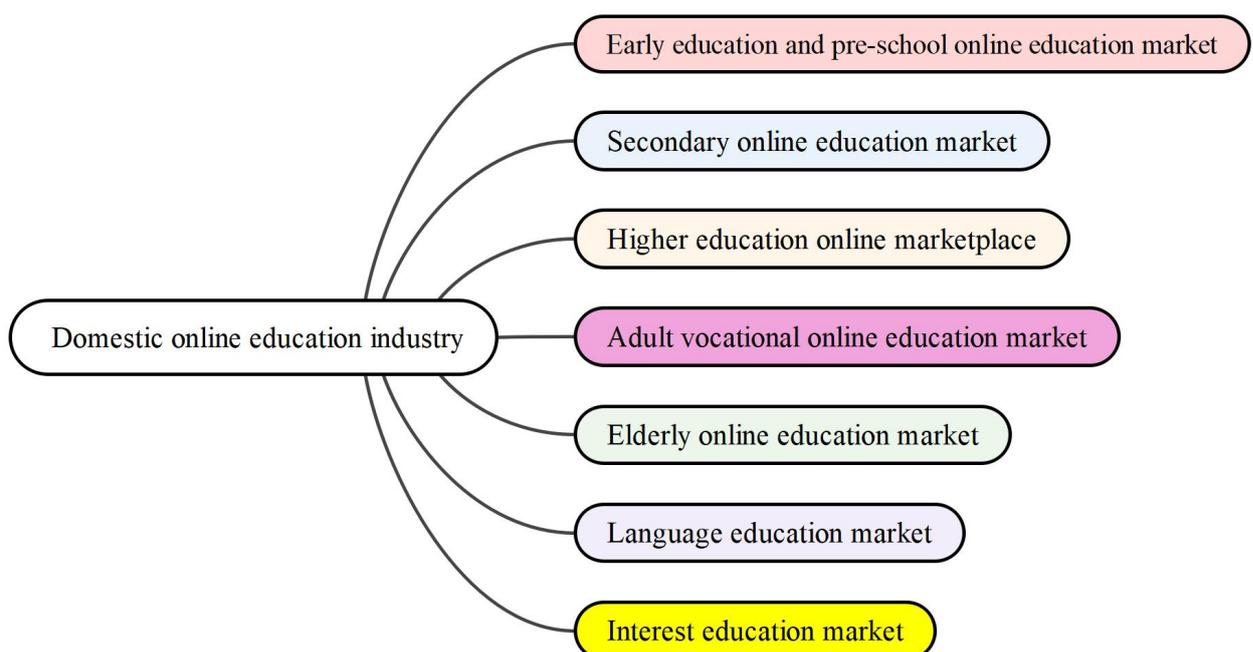
Figure 2.3 -The development status of domestic online education industry

Source: author`s research

(1) Early education and pre-school online education market

The proportion of early education and preschool education market has always been small, accounting for less than 1%, and the development is slow. As the education target of early education and preschool education market is mainly children, they need to keep a long sleep every day, and out of the protection of children's eyesight and avoid the formation of children's bad habits, children can be used for online learning time is quite limited.

Most parents are more inclined to give their children to offline education institutions to participate in learning. At the same time, since early education and preschool education especially emphasize the interaction, playfulness and participation of children, offline education institutions have great advantages, and online education can only serve as a supplement and supplement. In recent years, although the ratio of newborns has increased due to the national two-child policy, and parents who have a second child also pay more attention to early childhood education, there is still a large space for development of early childhood education and preschool education market. However, most of these Spaces will be occupied by offline education, and the growth of online education is limited.

Although the early education and pre-school online education market is so severely restricted, it still has development opportunities. At present, the products in the online education market mainly lack interactivity, pertinency and systematicness, and lack of high-quality products. At present, virtual reality technology is becoming more and more mature, and the interactivity of the early education and preschool education market is expected to be solved. If some educational institutions can increase investment and develop targeted and systematic online education products, Or linking online education products with the recruitment exam of key primary schools will soon become a monopoly position in the industry, gain the favor of investors, and have strong barriers to entry. In the short term, the early education and

preschool online education market can only be used as a supplement to offline education, and it needs to be developed by enterprises.

(2) Secondary online education market

There is a great difference between Chinese middle school education and foreign middle school education in terms of definition and content. Middle school education in China mainly refers to the three stages of primary school, junior high school and senior high school, which are all facing strong pressure for further study and have a great demand for subject education. Therefore, the content of middle school education in China is mainly subject education in primary school, junior high school and senior high school, and the proportion of interest and skills is relatively small, especially online education (Zheng, 2021).

At the same time, due to the imbalance of educational resources in middle schools in the east and the west, the entire market has an urgent demand for high-quality educational resources. As parents who buy one side, they have a strong willingness and purchasing power to buy high-quality products in order to help their children improve their performance.

And online education, just to meet the needs of parents to buy. Therefore, China's secondary school online education market has the highest proportion, reaching 39% by the end of 2022, and is expected to continue to increase. The popularity of China's secondary education market is inseparable from the gradual decline of the pressure of China's college entrance examination. Qualified parents will send their children to study abroad, but with the gradual weakening of the returnee fever, many returnee children are more difficult to find employment, and study abroad tends to be rational, so most of the middle school students will still participate in the college entrance examination to study in domestic universities (Zhou & Li, 2021).

Although China vigorously promotes quality education at the middle school stage and deepens the reform of independent college enrollment, some first-tier cities have tried out the "spring and autumn two tests" model, and the combination of students' regular high school grades, academic proficiency tests (referred to as the

"college entrance examination") and college entrance examination results comprehensively determines students' admission results (Zhiwu, 2021).

To a certain extent, it reduces the phenomenon that candidates can not enter the ideal university because of their abnormal play when the "one test is set for life", and can evaluate the comprehensive quality of students more comprehensively, but it also invisibly increases the learning pressure of middle school students. The pressure to study, which originally began in the third year of high school, has extended to the entire high school stage, and has affected junior high school and even primary school stage.

Parents generally agree that only the "key primary school - key junior high school - key high school" education route can ensure that children enter key universities, in order to have a bright future. Although China's college entrance examination reform has optimized the student evaluation system and made it easier for students with excellent performance in school to enter the ideal university, it has intensified the study pressure of students to a certain extent.

Therefore, in the secondary education stage, the demand for education is growing, and therefore led to the growth of the online education market, the market proportion of secondary online education is growing year by year, it is predicted that the proportion will reach 60% in 2025. In the middle school online education market, various social training institutions occupy a dominant position, these institutions based on their years of offline operation experience, realized the transformation to online, and gained a place in the field of middle school online education.

However, most of the online education products in middle schools only copy offline products onto online standardized products, lacking pertinence, it is difficult to target students' personal learning characteristics to teach, and due to the lack of on-site teaching feeling, students often have low learning efficiency, so the learning effect is significantly lower than offline education. In addition to social training institutions devoted to high school online education, there are also officially sponsored online education platforms emerged, these platforms reference the

university MOOC teaching form, gradually transferred offline school education to online.

In high school learning, Shanghai, under the leadership of the government, established a large high school MOOC platform - Shanghai High school MOOC teaching platform, sponsored by the Shanghai Municipal Education Commission, began trial operation in 2016, three months has more than 970,000 high school students participated in a total of 26 courses. The platform brings together high-quality teacher resources from Shanghai's top high school schools and provides high-quality high school courses. At the same time, the platform also evaluates and assesses students' learning interest, network behavior norms, cooperation spirit, persistence spirit, self-learning ability and other aspects.

Those who pass the platform can obtain the MOOC certificate signed by the course teacher, certified by the high school and issued by the MOOC certificate. The courses provided by this platform take into account the interaction. Apart from making teaching videos, teachers also have to take into account the communication and interaction of MOOC students and give timely feedback on learning effects, which greatly improves the pertinity of courses relatively speaking. At the same time, these teachers also need to ensure their teaching tasks in high school, which increases the pressure of these teachers. This has become an urgent problem for the platform to solve. Moreover, due to the lack of autonomy of students, the completion rate of the course is not satisfactory. Although the MOOC platform in Shanghai's top high schools still faces various problems, it is also an exploration and attempt of online education products in middle schools, which provides reference for improving and upgrading online education in middle schools (Zhou, Zhang & Zhang, 2022).

(3) Higher education online marketplace

The target of higher education is undergraduates and postgraduates, who have more independent learning time and strong thirst for knowledge. They can freely choose the courses they are interested in and supplement the knowledge points in class. Therefore, the online market of higher education can be divided into three

parts with adult vocational education and secondary education, and is known as one of the main forces of the current online education market. In higher education, online education is presented in the form of MOOC and SPOC (SmallPrivateOnlineCourse), and MOOC is the main force of higher online education with a wide audience and a large number of universities. Similar to the shortcomings of foreign MOOCs, domestic MOOCs also have some general problems, such as lack of systematization, low course completion rate, and obvious regionalism (Zhou & Li, 2018).

In addition, most of the MOOCs in domestic universities are a copy of traditional classroom teaching, lacking innovation and interest, and lacking personalized teaching. At the same time, MOOCs in domestic universities are too dependent on foreign MOOC platforms, with too wide choices and a lack of systematic course system construction. More importantly, MOOC courses in domestic universities lack an effective learning evaluation mechanism. As a result, although MOOC courses are popular, there are almost no courses that can truly allow students to obtain credit recognition. MOOC can only serve as an aid to extracurricular learning, and it is difficult to reflect students' learning level, which further aggravates the phenomenon that students cannot persist in completing MOOC courses. The form of SPOC, although more targeted and interactive than MOOC, reflects the student-centered teaching idea, but also faces the dilemma of not being recognized for credits. Therefore, the main problem facing the online market of higher education is the lack of effective quality evaluation and learning effect evaluation system, which will affect the evaluation and recognition of the overall online education quality.

(4) Adult vocational online education market

Adult vocational online education, as a new growth point of online education, goes hand in hand with secondary online education. If the enterprise E-learning is included in the adult online education market, the adult online education market will exceed the scale of secondary online education. The education object of adult vocational online education has a strong willingness to learn and improve, its

learning demand is growing, and this part of the population has a good economic strength and willingness to pay, so the adult vocational online education market has developed rapidly.

According to the different payers, the adult vocational online education market can be divided into two parts: enterprise E-learning and vocational online education. As a part of employee training, enterprise E-learning is paid for by enterprises and attracts more and more attention from large and medium-sized enterprises. Through investment in E-learning, enterprises can implement standardized training courses across regional barriers and significantly reduce training costs. This feature becomes more obvious with the growth of enterprise scale. Moreover, most enterprises link the learning of E-learning with employees' personal performance, which improves the course completion rate (Liu Jinglan, 2020).

Despite all these advantages, the proportion of enterprise E-learning in the overall online education market has been very fixed, fluctuating within 0.5%, and lacking a breakthrough. The reason for this, to a large extent, lies in the original intention of enterprises to invest in E-learning, which is to save the training cost of employees. As a result, many E-learning courses are only videos of enterprise training, lacking pertinacity and participation, and can only serve as the transmission carrier of knowledge and skills, which is difficult to enhance the enthusiasm of employees. At the same time, the lack of two-way training feedback mechanism for employees' participation in E-learning makes it more difficult to improve E-learning.

Professional online education is paid for by employees themselves, and employees are free to decide on training courses, rather than passively accepting them like E-learning. Employees use spare time or fragmented time to learn and improve, so as to ensure sufficient learning time. Moreover, due to the increasing employment pressure, promotion pressure, work pressure and competition pressure faced by employees, their own learning needs and willingness to pay have also risen. From 2014 to 2016, the market size of vocational online education was always higher than that of secondary online education.

Although the market size is relatively large, compared with the characteristics of secondary education focusing on subject education, the course content of vocational online education is scattered and more utilitarian. It is precisely because of this feature that the competition in the vocational online education market is very obvious, which leads to the quality of its online courses is uneven, and most of the online courses are of poor quality.

The phenomenon of valuing "quantity" over "quality" is very obvious. Moreover, due to excessive emphasis on sales, the pertinency and individuation of online education products are ignored, and employees are difficult to choose high-quality online education products due to information asymmetry, and there is a lack of objective evaluation and summary of the quality of online education products by third-party institutions. In the long run, this will eventually lead to the collapse of the entire vocational online education market. Both E-learning and vocational online education reflect the urgent needs of enterprises and employees for education and learning. It also reflects the demand for the quality evaluation system of training products (Xuehui et al., 2023).

(5) Elderly online education market

The market size of online education for the elderly is very small, but it has great potential for development. The elderly are relatively slow to accept new things, and will fully question the rationality of new things, but once the elderly experience the convenience brought by new things, they will quickly turn into loyal users. In addition, the elderly have more free time, and with the popularity of aging and mobile Internet, if the learning characteristics of the elderly can be utilized to meet the potential educational needs of the elderly, the prospect of the online education market for the elderly is still very optimistic.

At present, the learning of the elderly is still mainly based on the offline classroom of the university for the elderly, with the purpose of enriching the life of the elderly. Its content is more inclined to interest, health and practical life skills, etc. At the same time, considering the scope of action of the elderly, relatively large geographical restrictions. Therefore, online education that can cross geographical

restrictions can help the elderly to receive better education and learning resources, and has broad prospects in this respect. In addition, the elderly also have strong social needs, which is one of the main reasons why the elderly are keen on group activities. Online education can organize online communication and interaction through the form of simulated classroom, promote the mutual communication of the elderly from different regions, and meet the social needs of the elderly. Therefore, although the size of the online education market for the elderly is small, its development potential is worthy of attention.

(6) Language education market

Language education is undoubtedly an important field of online education, which occupies a very important proportion in secondary schools, higher education, vocational education and even elderly education. In 2017, China's online language education market size was more than 35 billion yuan, with an average annual growth rate of more than 20%, accounting for more than 20% of the overall online education market size, which shows the prosperity of the language education market. In the middle school and higher education market, online language education is mainly test-oriented, to meet the needs of students in grade examination, study abroad, oral English and other aspects. In the vocational education market, online language education in addition to part of the value of test-taking, more inclined to the application of language, not only pay attention to the traditional reading and writing, more inclined to listen to, speak, pay attention to the influence of the language environment (Wang Shibei, Yan Hanbing, 2019).

Traditional online language education is based on offline education, and gradually develop online language education platform and course system, called O2O model, such as New Oriental even found the opportunity of online education, and successfully transformed the layout of online education market, providing an example for traditional offline language education enterprises. Of course, pure online online language education enterprises have also seized the opportunity of the rapid development of online education, and quickly expanded the market by B2C (Business to Costumer) or C2C (Costumer to Costumer).

For example, VIPKID, a rising star in online language education, invites North American teachers to teach Chinese students in an online one-to-one way, fully integrates North American educational resources, meets the needs of domestic students for foreign teachers, and realizes the efficient matching of Chinese and American educational resources. In 2017, the number of foreign teachers in North America has reached 20,000. The number of paying students exceeded 200,000, and the business revenue exceeded 5 billion yuan. It can be seen that the online language education market has broad room for growth, both in terms of scale and potential.

(7) Interest education market

Interest education is the potential growth point of online education market. With people's continuous pursuit of quality of life, rich spare time life has become the focus of attention. Among them, being able to do what they are interested in has become a new definition of happiness for people. In this context, interest education has become a new highlight of people's spare time life.

There are a wide range of courses for interest education, including not only art courses such as singing, dancing, painting and calligraphy, but also sports courses such as yoga, Go and chess, as well as life courses such as flower arrangement, cooking and embroidery, and cultural courses such as history and literature. Training targets can come from different age groups, both young and old.

At present, because many interest courses require necessary equipment and tools, enough space and other conditions, most interest education courses are mainly offline, difficult to achieve online. However, if the use of VR/AR and other virtual reality technology, these equipment tools and space conditions to be realized online, and can fully realize real-time interaction, then the market potential of interest education will be rapidly explored, without leaving the house, you can fully experience and learn knowledge and skills related to their interests at home, there will be a very large market demand (Zhao Shikui, Ren Zhiguang, 2020).

In addition, if the content of online interest education is redesigned, it can help students fully understand the framework system and main context of the course content they are interested in in a short time, and choose the part they are most

interested in to learn. Take "Water Margin" as an example, through one story to draw out and depict characters, and finally let us know all 108 Liangshan. But this Liangshan 108 will, everyone's correlation to the main story, the heat of people's attention are not the same, we need to clear up these characters through a longer time. But after the design of online education, you can start with these characters from Liangshan 108, through understanding the main character's experience, personality, character relationships, stunts, etc., to clarify the main plot, understand the secondary characters to clarify the sub-plot, and then understand the whole "Water Margin", this way, not only can help students improve learning efficiency, It can also effectively distinguish between ordinary students and interested students, and push related content separately to achieve differentiated operation (Zhang Xiujuan, 2020).

Such a redesign is similar to the difference between the chronicle and the chronicle in historical books. Although the chronicle allows us to fully understand the sequence of the overall historical events, it takes a longer time to sort out the context of events and the role played by key figures, while the chronicle can help us understand their behavior in various historical events from the key figures. To understand the main process of the whole historical event, in this way, can significantly improve our reading efficiency. It can be seen that the online interest education market has strong potential and needs to be tapped.

2.3. Influence of artificial intelligence on education industry

Promote the effective support of education services for Common prosperity. The official launch of this platform is a milestone achievement of the Education Digitalization Strategy Action launched by the Ministry of Education, and an important step towards building a networked, digital, personalized, and lifelong education system through practical actions. At the same time, the situation of the

COVID-19 across the country has been very serious recently. The launch of the national smart education platform is also a need to coordinate the prevention and control of the epidemic and the reform and development of education. By providing high-quality digital education resources, efforts have been made to create an online classroom that is always online, so as to better serve teachers and students and show the educational role in the fight against the epidemic.

The National Smart Education Platform is a comprehensive and integrated platform. The first phase of the project includes four sub platforms: the National Smart Education Platform for Primary and Secondary Schools, the National Vocational Education Smart Education Platform, the National Higher Education Smart Education Platform, and the National 24365 College Student Employment Service Platform. In the future, it will be gradually increased in stages and batches. The National Smart Education Public Service Platform was officially launched on March 28, 2022. Since the launch of the National Smart Education Public Service Platform, it has built the world's largest education and teaching resource library. As of June 2023, the platform has accumulated a total of 26 billion views, with over 1.92 billion visitors, covering over 200 countries and regions (Yuen, Yaoyuneyong & Johnson, 2021).

The national higher education smart education platform includes four aspects of content. The first is the background of platform construction, the second is the design concept of the platform, the third is the main innovation of the platform, and the fourth is the consideration of future work.

1. Background of platform construction. You can take a look at the roadmap for the development of digital action in higher education. The first year of MOOC in China was 2013, when we established the Online Education Research Center of the Ministry of Education. In 2017, we launched the first batch of national high-quality online open courses. In 2019, we held the China MOOC Conference and launched the National First Class Curriculum Double 10000 Program, which includes online first-class courses. In 2020, during the outbreak stage of the epidemic, we proposed to carry out online teaching in all universities across the country on the second day of

the Chinese New Year, proposing the concept of "no stop teaching, no stop teaching". Then, in April of that year, we launched two international platforms for online teaching in universities, and at the end of the year, we also held the World MOOC Conference. In 2021, in order to promote the high-quality development of higher education in the central and western regions, we launched the "Muke Western Tour". On March 28th of this year, we officially launched the Smart Higher Education Platform (Lee, 2022).

The construction of online courses includes two stages. One is to lead from following to running. We only had five MOOCs in 2013, and now the number of MOOCs has exceeded 52500. In 2013, we only had over a hundred registered users, and now we have over 370 million users. The number of MOOCs and learners in China ranks first in the world and is still growing rapidly. Secondly, we have been tested for the epidemic. In 2020, in the face of the sudden outbreak of the epidemic, we proposed the concept of "no stop teaching, no stop learning". After large-scale online education in the spring, we achieved "three stability" and "four changes". We stabilized universities in Wuhan, Hubei, and the whole country. We changed the teaching of teachers, the learning of students, the management of schools, and the form of education.

Faced with the serious situation of the epidemic again this year, teachers and students in colleges and universities across the country have changed from the original sense of freshness to the current New normal. National universities are "one click in hand, instant switching, and calmly responding". As you can see, in Jilin, where the epidemic is concentrated, Jilin University has opened more than 2200 courses a week, with a class opening rate of 100%. In Shanghai Jiaotong University, online courses+cloud homework, teachers+online teaching assistants have been implemented. All universities across the country have now implemented a one click switch between online and offline teaching, ensuring a calm, orderly, and calm response (Zhu, 2017).

2. The design concept of the platform. This idea has one goal, two functions, and five major characteristics. One goal, expressed as the "six most", is to build a

global higher education smart open course platform with the largest scale, most comprehensive categories, and the most users. We aim to gather the best universities, teachers, and courses both domestically and internationally, and become a national level comprehensive higher education course platform.

Two functions, one is to provide various high-quality course resources and teaching services for all university teachers and students and social learners. The second is to provide Big data monitoring, analysis and research services for education departments and university administrators.

The five major characteristics are to become the "five most": the first characteristic is the world's largest, most comprehensive, and most user oriented higher education platform. Our first launch was to select the best among over 52000 high-quality courses, selecting 20000 courses covering 13 subject categories and 92 professional categories, allowing all university teachers, students, and social learners to enter the university's online classroom.

The second characteristic is a comprehensive platform that brings together the best universities, teachers, and courses. The first batch of online courses have gathered high-quality courses of many famous teachers, academicians and scholars, such as the course of economist Justin Yifu Lin, the course of medical expert Zhang Wenhong (2020), the course of Dunhuang scholar Fan Jinshi (2021), and the course of Turing Award winner and international higher education master John Hopcroft (2018). All these courses are open on this platform.

The third characteristic is that we are a resource platform that provides efficient and convenient teaching and learning services. The higher education smart platform provides multiple search methods such as course names, subject majors, universities, platforms, popular courses, first-class courses, etc. It can be said that the one-stop search for excellent courses on the entire network is in front of us, providing learners with friendly and convenient personalized services.

Fourth, we are a Open platform providing multilingual and international courses. The intelligent platform of higher education links two international online teaching platforms of colleges and universities, namely "Love Course" and

"XuetangX", to provide thousands of multi language courses and supporting learning guidance services for all college students and global learners at home and abroad.

Fifth, we are a management platform that provides intelligent analysis services for teaching and learning. We provide Big data analysis and research services for the Ministry of Education, local education administrative departments, and schools. In the New normal of online teaching construction, use, learning, and management, we implement intelligent governance throughout the process to improve the level of decision-making and management.

3. Main innovations of the platform

This platform has three modules, one is the course service platform, one is the course data service center, and one is the credit course data monitoring center. It provides full chain management for teachers and students' learning, education department management, and data decision-making analysis.

Firstly, it is necessary to gather national and even global gold teachers' gold courses, becoming an always online "gold classroom". In terms of the core curriculum system, core textbook system, core teacher team, and core experimental training system, it is necessary to establish good courses, textbooks, teachers, and experiments that cover all disciplines and majors in higher education.

The second is to provide convenient one-stop services for millions of university teachers, tens of millions of college students, and billions of social learners. College students can break through the physics fence, have a platform in hand, and gather good lessons from all over the world. Social learners can achieve the dream of being accessible to everyone at all times and everywhere. University teachers can use the platform to manage and capture students' learning progress, learning status, and learning outcomes in a full process, all-round, and panoramic manner, allowing teachers to have "thousand mile eyes" and "smooth ears".

Thirdly, in promoting fairness and improving quality, we aim to maximize the openness and sharing of high-quality resources. One is to "build good schools and courses", where various high-level universities jointly build high-quality courses to achieve mutual recognition of credit courses. The second is to "strengthen schools

and guide weak ones", implement the MOOCE Western Travel Plan, improve the quality of teaching and learning in western higher education institutions, and ensure the overall improvement of students' learning and teaching quality (Giasiranis, Sofos, 2016).

The fourth is to set sail and contribute Chinese strength to world higher education. We have signed a high-quality online course agreement with Indonesia. There are over 3000 higher education institutions in Indonesia, and we provide 60 high-quality online course resources to provide teaching services to these 3000 universities. The Director of the Education Innovation and Skills Development Department of the UNESCO Asia Pacific Regional Bureau of Education wrote specifically on University World News, stating that "this collaboration is an important achievement in the international flow of high-quality educational content and teaching methods, contributing to the access to high-quality resources, high-quality and equitable development of higher education in the Asian region (Martin-Gutierrez, Guinters, Perez-Lopez, 2022).

We have initiated and established the World MOOC and Online Education Alliance in China, implementing mutual credit recognition and offering 168 integrated courses at 13 world-renowned universities in 11 countries. Peking University, Tsinghua University, and Shanghai Jiao Tong University provide the best quality schools, teachers, and courses in China.

The fifth is to fully bloom and deeply promote the digital strategic action of higher education. We need to accelerate the promotion and application of the platform, making it an important carrier for innovation in China's higher education learning and teaching paradigms. We need to use informatization, digitization, and intelligence to force higher education reform.

4. There is an understanding of the digitization of higher education that digitization is a new and significant event. Now we are going to turn this sense of freshness into a New normal, turn this important event into a great event, and strive to build a new form of higher education characterized by digitalization.

The development of artificial intelligence is related to the future trend of the

world. As an important part of the new round of scientific and technological revolution, artificial intelligence has brought new challenges and new opportunities for the Artificial intelligence technology can fully empower smart education, including the following six examples:

1. In terms of reshaping the role of education. The official launch of the open-source artificial intelligence system represented by ChatGPT has opened up new systems, multiple modes, new forms, and new elements in education, including people-oriented learning in the new system, active personalized learning in the new mode, ultra remote teachers in the new form, and teaching robots in the new element, ultimately achieving personalized education, that is, "tailor-made" education.

2. In terms of knowledge space innovation. Including expanding knowledge space, multimodal knowledge representation, and diversified knowledge analysis and dissemination. Among them, expanding the knowledge space includes deep knowledge mining, knowledge cross fusion, and knowledge space innovation, thereby strengthening goal oriented attention, improving cognitive ability of generalization recognition, and achieving educational extension and knowledge innovation.

3. In terms of the synergy of educational resources. Since its launch more than a year ago, the "National Smart Education Public Service Platform" has received over 6.7 billion visits and has become the world's largest education resource library, with over ten thousand classrooms and courses of renowned higher education teachers, achieving educational integration.

4. In terms of authoritative immersion space. Taking Beijing Institute of Technology as an example, Beijing Institute of Technology has initiated a smart ideological and political, immersive teaching platform in colleges and universities across the country. Through virtual reality, simulation technology, including the on-site technology of the surrounding environment, students can take the Long March again and have a personal experience of climbing snow mountains and grasslands; By utilizing technologies such as online cloud experiments and pocket laboratories, immersive education can be achieved.

5. In terms of full chain depth perception. It can track the learning process, form student profiles, conduct intelligent teaching evaluations, customize personal plans, achieve personalization, precision, high efficiency, and full chain, and achieve "individualized teaching" through precise education.

6. In terms of full-time intelligent management. Full time health monitoring, full context data collection, full process auxiliary management, full coverage equipment management, and campus wide security monitoring can be constructed, achieving "transparent control" through controllable education development of higher education.

AI enabling education has both opportunities and challenges. Its challenges include privacy disclosure, false information, Internet fraud, bad guidance, online growth and algorithm deviation. Therefore, the comprehensive application of artificial intelligence will also bring hidden dangers to educational security. To this end, the following three aspects of work need to be done well: first, to build an ethical system for new technologies in the era of artificial intelligence. Technology ethics is the first layer of constraint framework for smart education. The openness and intelligence of artificial intelligence have broken down cultural barriers in various countries, and at the same time, it will generate new thinking on technology ethics (Zwass, 2022).

Therefore, it is urgent to improve the new system of technological ethics in the era of artificial intelligence. Secondly, build a secure platform for intelligent algorithms. Algorithm security is the second layer constraint framework of smart education, which includes detection of algorithm bias and discrimination, as well as evaluation of algorithm bias, in order to maintain sensitivity to algorithm bias and ensure educational fairness. Finally, protect educational privacy. Privacy protection is the third layer constraint framework of smart education, which includes personal privacy, illegal disclosure of personal privacy, illegal transactions of personal privacy, and the large amount of private data generated during the process of AI empowerment education, all of which need to be carefully managed.

In summary, it is achieved through technological ethics, intelligent algorithms,

and educational privacy protection to achieve the intelligent use, application, governance, and control of artificial intelligence technology. Intelligent use refers to the intelligent application of artificial intelligence technology to improve educational efficiency; 'Zhi' is the effective use of artificial intelligence technology to solve pain points; 'Governance' refers to the application of artificial intelligence technology to govern the entire process of education and teaching; 'Regulation' refers to the application of artificial intelligence technology to regulate ethical risks in education. In summary, the goal of artificial intelligence empowerment education is to promote the development of smart education in the digital age, enhance the humanized training efficiency of artificial intelligence technology empowerment education, and cultivate top-notch innovative talents that meet the development needs of the new era.

Conclusion to the Chapter 2

The network learning community constructed by using various network platforms has the advantages that normal teaching activities can not achieve. The teaching activities in the ordinary classroom are limited by time, place and personnel, and the learning content is limited. The study based on the network platform breaks the limitation of time and place, makes fully use of various online resources, and effectively enriches the teaching content in the classroom, it also provides a flexible and convenient learning place for learners to make full use of their fragmented time and carry out their learning activities efficiently. But the establishment of the network learning community makes the learners, scholars and tutors establish the good interpersonal relationship, draws the distance between teachers and students, and urges each member to find his own sense of belonging a education.

For a long time, the traditional teaching method is based on teachers' teaching and indoctrinating knowledge, and students have formed the habit of over-relying on teachers, which affects the development of their autonomous learning ability.

The results showed that the total score of self-directed learning ability and the scores of each dimension of the experimental group were higher than those of the control group after the intervention, and the differences were statistically significant

(P<0.05). It indicated that the application of VR technology in basic nursing teaching can improve the autonomous learning ability of nursing students. At the same time, the teacher sets aside 20 to 30 minutes for nursing students to independently explore the autonomous learning content in the virtual software. The teacher makes the rounds, timely prompts, urges and guides the students to learn, find and solve problems, timely exchanges and answers the students' problems, and improves their autonomous learning ability.

The simulation teaching method helps to cultivate students' enthusiasm and initiative and promotes self-learning ability. This paper is expected to provide nurse educators with guidance to aid future development of innovative and interactive teaching and learning strategies.

This paper analyzes the basic characteristics of Ukrainian higher education model in the process of China and Bologna during the economic transition, compares the scientific, technological and innovative activities of higher education institutions in China and Ukraine, and puts forward the innovative development path combining modern science. It pays attention not only to the cultivation of students' scientific research ability and practical application ability, but also to the cultivation of students' comprehensive ability and innovation ability, all of which show the idea that higher education serves the national economic construction. Since 2012, the expenditure on education in China has reached more than 4%.

The educational structure is the proportional relationship and interconnection between levels in the vertical system of education and the proportional relationship and interconnection between classes in the horizontal system of education. In the Bologna process, European countries are constantly exploring the relationship between cooperation and competition. How to continue to move forward in the contradiction and coordination between the two is a problem that needs to be faced squarely and urgently solved in the new development stage of the process. The establishment of cooperation mechanism in the process of internationalization should be based on the local culture of the nation, which is a two-way or multi-directional

cooperation. In the process of cooperation, we should not only introduce and input, but also pay attention to the export of our national culture.

CHAPTER 3. THE FUTURE TREND OF INNOVATION ACTIVITIES OF HIGHER EDUCATION INSTITUTIONS IN PRC

3.1. Application of intelligent teaching in the education industry

During COVID-19 outbreak,set one university students as the object of study,under the theoretical basis of learning community in sociology.This study discusses the methods and advantages of building a network learning community, research the differences between this and regular educate organization to provide reference for the online learning in the future.

Because COVID-19 outbreak in the worldwide, everyone should stay at home to work and study. How to make sure the quality of online leaning, a lot of teachers worried about it. This study research on a new method to contain the quality of online leaning and make a close connection with teachers and students ,include tutor and supervisors. The new method is contract network learning community in the university under the COVID-19 quarantine period. And it will offer some guild-lines for the future online learning.

Leaning community, originated from the concept of community in sociology. In 1995, educator Erner L.Boyer extended to the field of education, he believes that the "learning community" is an organization where all people learn together through one same mission and toward a same will. People who in this community share a same interest in learning, working together to find a journey to knowledge and an understanding of how the world works, interacting and participating together towards the same goal of education.

Educator Zhang think that the definition of the Learning Community is mainly from the perspective of group relations and social organizations. Any group that constructs knowledge by sociological method can be called "Learning Community" (Zhang Zhimin, Zhao Shikui, 2020)

In traditional teaching, teachers and students take part in teaching activities in the same classroom at the same time. It is easy to have face-to-face communication

with each other and naturally form a certain learning community, for example, a study group, a class, or even a school may become a learning community. In the web-based distance learning environment, the learning community must be consciously designed to form. Due to the lack of face-to-face contact with learners, teachers in online teaching often do not realize that they are communicating with learners in different places, which will reduce the learners' recognition and commitment to the learning community.

At present, the concept of online learning community is defined as "an interactive and cooperative learning community composed of learners who take the Internet as their main means of learning, and teachers, experts and assistants who assist scholars" (Zhang Xiujuan, 2020)

During the home isolation period of the new crown disease, the physiological and security needs of a large number of people were met according to Maslow's hierarchy of needs theory of pyramidal structure, due to the isolation at home with less contact with people, there are emotional and belonging needs. According to the study by National Sun Yat-sen University, 55.1% of universities students looked at the report of the epidemic report every day during the quarantine period, and 35.3% of students believed that their psychology was affected by the suspension of classes and schools (Zhang Xuehui, Ye Tiantian, Yao Lijuan, Song Langui, WU Zhong-dao, 2022).

Research shows that learning community is an important way to meet learners' needs of self-esteem and belonging. The learners' sense of belonging to the community, the sense of identity and the sense of respect from other members help to enhance the learners' participation in the community and maintain their continuous and hard learning activities (Liu Jinglan, 2022)

It is believed that in the community of online learning, the different support functions of the learners lead to different communication behaviors in the interaction between the learners and their members, and these communication behaviors also contribute to the formation of the social relations of the learners.While meeting the individual needs of students, it also meets the emotional and belonging needs of

scholars (teachers and teaching assistants), forming a win-win situation (Wang Shibei, Yan Hanbing, 2019).

Learning community is one kind of organization, but it is different from in the general organization as "the function body".The online learning community is an informal organization that all the members naturally combine for the same purpose and meeting the needs of all the members. In such this organization, meeting the needs of its members is more important than growth. In this study, we compare online learning community with traditional offline learning organization in six aspects (see Table 3.1)

Table 3.1 Differences Of E-Learning & Traditional Learning Organization

	E-Learning Organization	Offline Learning Organization
Example	Online Learning Community	School
Type	Informal	Official
Subject	Learner, Teachers And Teaching Assistants,Tutors	Teachers,Students And Administrative Personnel, Support Staff,Etc
Aims	Through Communication, Communication To Complete The Learning Task	Cultivating Talent
Form	a Group, Class,Etc	Major, Class
Platform	Coursera,TED,Etc	Classroom
Typical Characteristics	Focus On The Development Of Interpersonal Relationship	Focus On The Grades

Source: author`s research

The premise of network learning community-Common goal "behind the obvious, ambiguous 'peoples', there is a common goal, clearly rooted in the political sphere, " said Max Weber, the chief founder of the classical sociology. It is clear that even the political sphere needs a common goal in order to build a community. It is also applied on the learning community, which can be formed only when all

members share a common interest, a common goal and work towards it (Li Mang, 2017).

Identity is a basic question of philosophy. A social person has multiple identities, but in school, in a loose organization, as an ordinary student, whether he has a strong sense of mission. In the learning community, all members work for a common goal, all members have a strong sense of identity for their students, which increases the intimacy of the learning community and lays the foundation for the formation of the learning community.

As a social person, one of his social needs is a sense of belonging. During the quarantine period , the students couldn't see each other in the class, and the sense of belonging in their studies vanished. In the Organization of learning community, each member can find his own sense of belonging and become the bond of learning community because of the emergence of "common understanding" .

Web-based learning community expert McCarty, in his 1999 classic paper states that web-based learning community consists of six elements: participants, goals, rules, web-based system, collective learning and reflective practice.

Most scholars in China think that the elements of network learning community include: Learners, aid scholars, information flow and network environment (Zhang Xiujuan, 2020)

According to the above researches, this paper divides the construction of network learning community into four aspects: members, activity process, platform environment and learning evaluation (Figure 3.2).

The members are divided into learners, scholars and tutors. Scholars are the important driving force to guide the transformation of learners' knowledge in the community. In order to promote learners' knowledge acquisition, their main task should be to set topics to promote learners' interaction, to conduct effective guidance, triggering deeper discussions, followed by the release of information and technical help. Scholars have a high influence in the community and play a key role in the formation and development of group cohesion. Scholars act as intermediaries of

different kinds and are able to control the flow of information within the community (Wang Meichun, 2020).
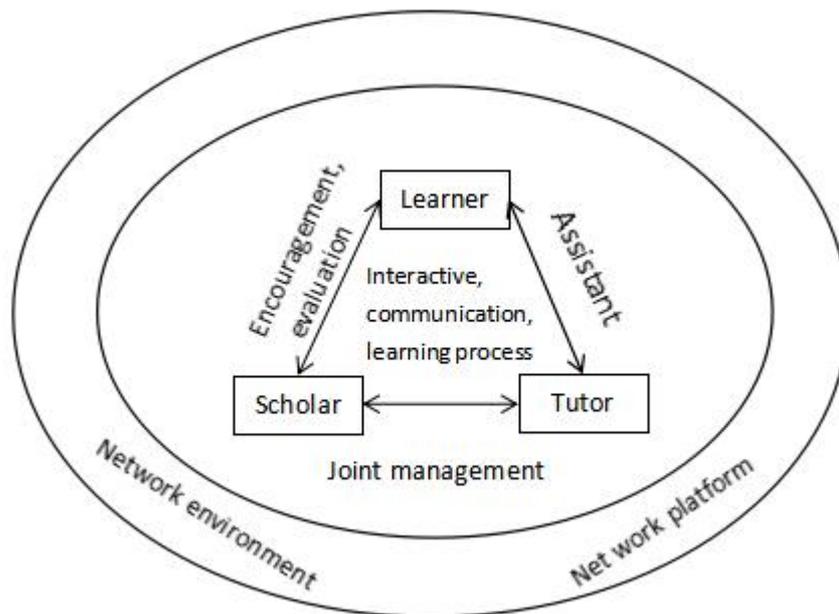
Figure 3.2 - The Construction Of Network Learning Community

Source: author`s research

The learners, scholars and tutors. work together to complete the learning process. The learners, scholars and tutors communicate and discuss to carry out the whole process of learning. The teaching idea of online learning is "input-type teaching" and "output-type learning", which is based on task-oriented teaching, reorganizes the teaching content, is to guide the students to find the connection between knowledge and stimulate their thinking. During the live broadcast, "input-type teaching" is carried out, in the form of open assignments, allowing learners to learn   coursera resources on their own initiative, consult literature, etc. Let the recessive thought process form the explicit "the output type study" .

Make full apply of various learning platforms: coursera, Chinese University MOOCs, and other kinds of learning software, more extensive on-line learning resources, to achieve good teaching results. Due to the impact of the epidemic, the need for home isolation, some students could not pay fully attention, there is a need

to be able to conduct a live monitoring learning inside the network learning community.

As long as it is a learning process, there is a learning evaluation. Because of the particularity of network teaching, the teaching evaluation mode is different from the general teaching evaluation mode. In the network learning community, the teaching evaluation model is different from the policy of online teaching. In addition to online testing, random testing, and other forms.In the learning community, members can communicate with each other to understand the learning situation. Increased the degree of stickiness of the learning community, the members are more closely connected. See Figure 3.3 for details of the evaluation system.
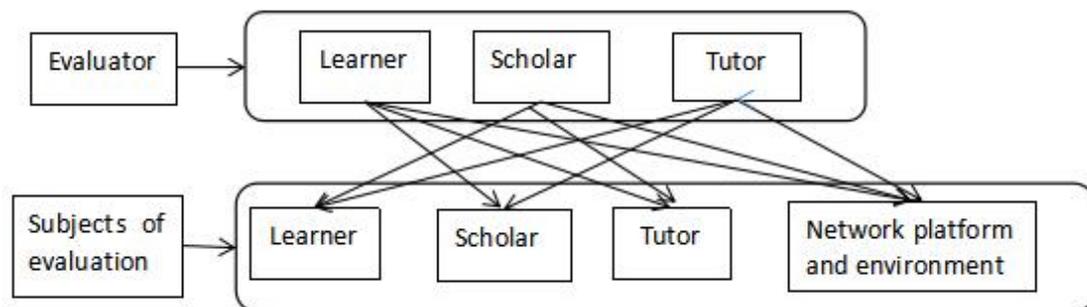
Figure 3.3- Evaluation System of Network Learning Community

Source: author`s research

Due to the teaching activities of about 10 weeks during COVID-19 quarantine period, the network learning community constructed by using various network platforms has the advantages that normal teaching activities can not achieve. The teaching activities in the ordinary classroom are limited by time, place and personnel, and the learning content is limited. The study based on the network platform breaks the limitation of time and place, makes fully use of various online resources, and effectively enriches the teaching content in the classroom, it also provides a flexible and convenient learning place for learners to make full use of their fragmented time and carry out their learning activities efficiently. But the establishment of the network learning community makes the learners, scholars and tutors establish the

good interpersonal relationship, draws the distance between teachers and students, and urges each member to find his own sense of belonging a education.

To sum up, since the 18th National Congress of the CPC, the development of rural education has been closely related to the social and political situation, which reflects the strong characteristics of The Times. The relevant policies of rural education have always led the research hotspot in this field. In terms of quantity, the number of articles on rural education shows a trend of continuous growth on the whole, especially after the 19th National Congress, entering a period of steady growth. The authors of the current study are mainly researchers in normal universities, with representative figures such as Wu Zhihui, Hao Wenwu, Qu Tiehua and Liu Shanhuai (2020). Institutions with strong research strength include Faculty of Education of Northeast Normal University, Faculty of Education of Southwest University, Faculty of Education of Beijing Normal University and other research institutions.

Through data and literature analysis, it can be seen that the hot topics of rural education focus on rural revitalization, rural teachers and rural school research. Since 2019, it has been the focus of continuous attention in the academic circle.   In the future, rural education research should always adhere to the leadership of the Party, more closely combine with the guidance of national policies, and promote the development of rural education by grasping the research content, broadening the research horizon and using a variety of research methods.

1.   The development of rural education should follow the guidance of national policies. Since the 18th National Congress of the CPC, from vigorously promoting educational equity, rational allocation of educational resources, focusing on rural, remote, poor and ethnic minority areas, to strengthening the overall planning of rural education, improving the quality of rural basic education, and promoting the development of rural vocational education and continuing education in terms of the research content, the focus should be placed on the teaching quality of rural schools, rural education in northwest China, the improvement of "soft power" in rural areas and left-behind children. The teaching quality of rural schools

is the core of rural education, but the research content about the teaching quality of rural schools is very little. The research on rural education in Northeast and Southwest areas is relatively mature, while the research on rural education in northwest minority areas is relatively weak. In the new development stage, we should pay more attention to the education in the northwest minority areas. Further enhance the "soft power" of rural education, Currently, the hardware of education in rural areas has been basically improved, but the "soft power" of rural education is still worrying, such as poor confidence in rural education and low professional identity of rural teachers.

Therefore, we should enhance the "soft power" of rural education, strengthen the confidence of education in rural areas, and enhance the sense of professional identity and acquisition of rural teachers. At the same time, in the process of implementing the rural revitalization strategy, more attention should be paid to the development of small-scale rural schools and left-behind children, so as to improve people's sense of happiness and security.

In terms of value orientation, currently rural education mainly faces the difficult choice of "farming" and "leaving farming". In recent years, many scholars have put forward their own opinions on this issue, but so far they have not been able to solve the value orientation of rural education.From the existing problems, some studies hold that: rural education stratification phenomenon is serious, regional differences are huge;Rural education standardization degree is low, information facilities lag. The loss of students, lack of quality teachers, weak local awareness and lack of local elements. At the same time, it is proposed that the revitalization of rural education should adhere to the strategy of echelon development and solve the stratification difference;Promote the application of modern information technology and support the leapfrog development of rural education;Choose diversified development mode to solve the practical problem of insufficient rural educational resources;To construct the symbiotic mechanism of industrial economy and education development and solve the difficulties of the benefit of rural education. In addition, in view of the problems existing in rural education in school layout,

teachers, student resources and other aspects, some studies put forward feasible suggestions for specific problems.

The integrated development of urban and rural compulsory education is a historical choice. For the development of rural compulsory education, it is necessary to clarify the responsibilities of the government and promote the balanced development of rural compulsory education through the government formulating corresponding policies and the joint development of urban and rural teachers.

Starting from compulsory education in ethnic minority areas, to promote the balanced development of compulsory education in ethnic minority areas, we should strengthen school leadership, effectively do a good job in guaranteeing teachers, actively promote curriculum construction, strive to expand students' learning experience, and effectively increase parents' participation in education. In terms of rural compulsory education funds, scholars generally point out that it is necessary to strengthen the provincial pooling of rural compulsory education funds, improve the supporting mechanism of funds, and improve legislation and supervision. Some studies believe that the balanced development of compulsory education in the new era needs to make full use of the school district system, and the balanced development of education can be effectively promoted through the overall optimization and reasonable allocation of various educational resources in the region.

Rural compulsory education is the focus of rural education research.In recent years, rural compulsory education has been greatly improved. The existing problems are mainly the difficult choice between "farming" and "leaving farming", as well as the layout of rural education schools, teachers, student resources, lagging information construction and poor confidence in rural education.In this regard, different scholars put forward feasible suggestions for specific problems.

The development of rural schools reflects the present situation of our country's rural education to a certain extent.From the keyword of rural school derived rural school layout adjustment, rural small-scale schools and so on.

(1) Study on the Adjustment of the distribution of rural schools In terms of the distribution of rural schools, Zhou Bin et al. believe that rural schools with Chinese characteristics should be built. According to the situation of different regions, rural schools should be abolished and merged, and high-quality teachers, multimedia technology and other teaching facilities should be allocated to maximize the use of high-quality educational resources. Starting from the two types of schools in rural areas, studies have pointed out that in terms of the contradiction between educational equity and educational efficiency, it is necessary to rationally allocate educational resources to balance and adjust the positioning of the two types of schools (rural small-scale schools and rural boarding schools) so as to facilitate the layout of rural schools. Other studies hold that the distribution of rural schools should be considered comprehensively, be realistic and adapt to local conditions, and vigorously promote the integrated and balanced development of urban and rural education.

(2) Research on rural small-scale schools Research on rural small-scale schools can be roughly divided into two categories: one is to analyze the excellent cases of foreign rural small-scale school layout adjustment to provide experience for the construction of domestic small-scale schools;The second is to make recommendations based on the actual situation of small-scale schools in the country.In the United States, the size of primary and secondary schools has always been a hotly debated issue in the field of education policy research, and the prevailing view is that small schools are better. The United Kingdom shows different action trends in the development of small-scale schools. It adopts a cooperative approach to achieve sustainable development of small-scale schools, that is, effectively improve the quality of school education through school alliances and regional schools. Japan has adopted measures such as the formulation of small-scale school standards, the promotion of school vitality, the improvement of compound teaching quality and the strengthening of community cooperation.

At the same time, Japanese governments at all levels have promoted small-scale rural schools in terms of funding and teachers, which is in line with rural

society, economy, culture and school activities in and out of class, and is of practical reference for Chinese rural schools to boost the rural revitalization strategy. The above is based on the analysis of foreign excellent cases, which provides experience and reference for the development of rural small-scale schools. Duan Zhaobing (2020) pointed out that in order to solve the problems such as the continuous loss of students, it is necessary to form a stable and sustainable long-term development strategy, to improve the quality of education, to revive people's minds, to use diversified methods to create characteristics, to promote the integration of urban and rural public education services with urban and rural planning and resource sharing, and to promote the modernization of educational technology and equipment through standardization. Ouyang Xiujun et al. (2019) believed that small-scale rural schools were the "weakest" and "most critical" link in the development of rural education, and proposed that the overall reform of small-scale rural schools should take the integration of rural curriculum as the breakthrough point, strengthen the local cultural leadership of principals, improve teachers' ability of "rural-based teaching and research", and integrate the "rural curriculum" of coexistence between human and nature.The practical path of rural students' learning in action.

Based on the field analysis of Ningqiang County in Shaanxi Province, Zhao Dan et al. (2021) put forward the following suggestions: In the overall planning of urban and rural compulsory education, adhere to the value orientation of giving priority to fairness, taking into account efficiency and quality;Rational closure and retention of small schools through scientific planning procedures and adjustment models;Strengthen policy support to compensate the cost of schooling for children in remote areas;We will build an inter-school cooperation network and encourage small-scale schools to share quality resources.

In addition, some scholars have proposed that rural small-scale schools can unite through alliance development, learn from each other in the process of integrating school resources, and promote the common development of rural small-scale schools. In general, current studies generally point out that the development of rural small-scale schools is a key link in the development of rural

schools and also the development direction of rural schools in the future. To make rural small-scale schools develop in a better direction, it is necessary for the government, schools, parents, teachers and students to work together from multiple perspectives to promote the development of schools. Generally speaking, our country continues to strengthen the investment in rural education, rural schools have basically realized the modernization of the school conditions, the township boarding school gradually pay attention to the students' psychological appeal, the development of relatively significant achievements. However, there are still difficult problems, namely, the continuous loss of rural students, the alienation of rural education and local culture, and the "loss of confidence" caused by the anxiety of education quality.

Rural teachers are the foundation strength of Chinese teachers and an important support for realizing rural revitalization.In recent years, the research of rural teachers has been paid more and more attention by scholars.Through the secondary analysis of relevant literature on rural teachers, the main topics such as rural teacher professional development and rural teacher team construction are derived.

(1) Research on the professional development of Rural teachers In terms of professional development, Li Taohong et al. (2021) pointed out that there are the following problems in the current professional development of teachers: first, rural teachers themselves lack a clear sense of professional development and a strong desire for professional development;Secondly, the atmosphere, system environment, welfare, social environment and cultural resources of rural schools;Finally, the lack of internal and external motivation for the professional development of rural teachers leads to the imbalance of the service support system, which is difficult to provide strong support for the professional development of teachers.

In the path of professional development, some scholars analyze from the macro level and believe that the professional development of rural teachers must be promoted jointly from government policies, social environment and school management. More studies put forward suggestions from the ways of pre-service

training and post-service training of rural teachers. In terms of the professional development system, Wang Xiaoli et al. (2021) believed that the professional development support system for rural teachers should be improved as soon as possible from the following aspects: establishing a guidance and incentive system for the professional development of rural teachers, establishing a support system to promote the initiative of individual professional development of rural teachers, and building a community of professional practice for rural teachers based on the improvement of education and teaching.

Some scholars, through analysis of rural teachers in central and western China, proposed that the current rural teacher professional development in central and western China is in multiple crises. To solve the crisis, we should transform the institutional logic of rural teacher professional development, establish a fair and high-quality rural public service system, promote the modernization of rural education governance system and governance capacity, and construct a local orientation of rural teacher professional development model.

Since the reform and opening up, the Party and the government have attached great importance to the construction of rural primary and secondary school teachers, and have made certain achievements in quantity and quality, greatly improving the overall quality of primary and secondary school teachers.

While achieving results, there are still some problems that have not been solved, such as the loss of rural teachers and low self-identity of rural teachers.In view of the loss of rural teachers, some representative views believe that the salary of rural teachers should be improved, the subsidy policy should be improved, and the reasonable flow of rural teachers should be guided.

On the construction path of rural teachers, Zhou Ye (2019) believes that building high-quality teachers is an inevitable requirement for promoting high-quality development of rural education in the new era, promoting rural revitalization, building a modern socialist country and realizing the great rejuvenation of the Chinese nation.We should focus on four aspects, precise training of local rural teachers, improving the qualification access system of rural teachers,

providing appropriate post-service training for rural teachers and establishing and improving the withdrawal mechanism of rural teachers.

In terms of the quality of rural teachers, current studies generally point out that the criteria for unqualified teachers should be clarified, the appointment system of teachers should be perfected, and the withdrawal guarantee mechanism for unqualified teachers in rural compulsory education should be established and perfected. Liu Shanhuai (2019) pointed out that the construction of rural teachers, as one of the problems of improving the rural education management system, is the key to improving the overall quality of compulsory education and realizing the modernization of education.

In addition, some scholars proposed that in the era of intelligence, artificial intelligence should be used rationally to boost the construction of rural teachers. Literature analysis shows that in the past twenty years, the quantity and quality of rural teachers have made some achievements, their overall quality has been improved, and the frequency of teacher training has increased. However, the professional development of rural teachers is limited, their sense of self-identity is low, and the psychological problems of rural teachers have not been solved.

3.2. The practical reform of teaching with new technology (simulation teaching, vr) in education

The paper is to explore the application effect and prospect of VR immersion teaching in basic nursing training. By using the method of convenient sampling, 120 full-time four-year nursing undergraduates in the third semester of 2021 / 2022 were selected from a university in China. There were 60 people in the two groups, the control group was treated with traditional courseware and experimental materials, and the experimental group was treated with VR virtual classroom and group discussion. The scores of classroom test, theory test and skill test in the experimental

group were significantly higher than those in the control group (P < 0.05). It turns out that VR immersion teaching in basic nursing skills training can fully mobilize students' enthusiasm, significantly improve students' practical ability, autonomous learning ability and teaching effect, help students to master clinical knowledge, and has a good application prospect.

Nursing is a comprehensive and practical subject. The key to improve the ability of nursing students is clinical professional knowledge and skills [1]. With the deepening development of higher education reform, the growing number of college students has brought various challenges to the traditional teaching model. The traditional teaching mode can not meet the current teaching needs, so a new teaching mode is urgently needed to complete the current educational requirements. The application of virtual reality technology has brought a new revolution to education and changed people's learning style, becoming a beneficial supplement or alternative technology to the traditional teaching model [2].

Visual Reality (VR) simulates human sensory and mechanical feedback through a number of computer technologies, and combines interactive three-dimensional dynamic multi-source information and body behavior to realize real-time interaction between human and machine. Users can experience the virtual situation in its natural state and immerse themselves in the virtual environment. This technology is closely related to clinical medicine, mainly manifested as: molecular structure model of synthetic drugs, operation simulation of diagnosis and treatment, anatomical simulation, surgical training, medical education, etc. [3].

When sophomore undergraduate students learn basic nursing operations, they lack the training of real clinical scenes. VR technology can build a realistic learning environment for students, make teaching more vivid, help students intuitively understand the teaching content, and effectively improve the teaching level [4]. For this reason, a college of nursing in Xinxiang City applied VR technology to basic nursing training teaching, showing the real scenes of static distribution center and clinical nursing in an all-round way, so that students could observe and learn in an

immersive way, improve the interest of classroom teaching and comprehensively improve the quality of teaching and education.

A total of 120 full-time four-year undergraduate nursing students in the third semester of the 2021-2022 academic year from a college of Nursing in Xinxiang City were selected by convenience sampling. According to the normal class grouping, they were divided into two groups, among which class 39 and 40 were the control group, and class 41 and 42 were the experimental group. There were 52 girls and 8 boys in the control group, with an average age of (20.43±0.57) years. There were 53 females and 7 males in the experimental group, with an average age of (21.56±0.61) years (range, 2021-2022 years). There was no significant difference in the gender, age and other general information of the two groups of students, and the teaching background of the two groups of students (such as theoretical course teaching time, teachers, admission results, etc.) (P > 0.05), which was comparable.

In the control group, traditional teaching model + physical model and imaging data were used to teach aseptic operation and liquid aspiration in basic nursing; The experimental group used group discussion system and VR virtual classroom demonstration to teach aseptic operation and drug aspiration theory. The two groups had the same teaching cases and the same teaching time and content. According to the requirements of the undergraduate syllabus of nursing in our school, the sixth edition of Basic Nursing published by Human Health Press is used as the teaching material. The teaching plan is designed for two large classes, divided into 4 periods, each of which lasts 40 minutes. The first lecture lasted 40 minutes for theory teaching, 30 minutes for operation practice, and 10 minutes for class test. The second lecture is the final exam (Theory and practice), which lasts for 80 minutes. The interval between the two lectures is 4 weeks. All are taught by the same senior teachers with rich teaching experience.

The 360° panoramic camera (DJI Osmo Pocket China) was used to record the panoramic video of the on-site environment of the static distribution center and treatment room in the hospital, and the obtained video files were exported. Adobe Premier CC and Kolor Autopano Video software were used to splicing and editing

the recorded panoramic Video for spare use. The full set of VR panoramic video courseware consists of two scenes for the suction of liquid medicine, namely, the static distribution center and the treatment room. The operation techniques of three kinds of liquid medicine suction are demonstrated in the two scenes, namely large ampoule, small ampoule and sealed bottle.

After class teaching, students in the experimental group were uniformly distributed with VR glasses for VR video courseware learning. Each person uses VR equipment (Xiaomi VR glasses, Xiaomi, Beijing) and pre-installed UtoVR panoramic video player APP (mobile phone software, Shanghai Youtu Shizhen Culture Media Co., LTD.) to watch the above VR video courseware. About 20 minutes after each video clip, it covers the main steps such as drug suction and aseptic operation. After watching the video, immediately switch roles and enter the scene. Students act as nurses to perform aseptic operation and drug dispensing on site.

After the completion of the teaching task, the objective test and subjective evaluation survey were conducted for the two groups of students. The objective test content includes theory examination and skill operation. The theory examination is divided into classroom test and final examination. All the papers are designed by the same teacher, and the total score is 100 points in the form of closed book examination. The topic types were single choice and multiple choice, mainly including the principles of aseptic operation (40 points) and the classification of the suction technique of liquid medicine (60 points). Skill operation mainly includes three parts: on-site environment assessment, aseptic operation and drug liquid suction, with 20 points for each part.

The subjective evaluation questionnaire was based on the teaching effect scale, which included 6 aspects of learning initiative, classroom interest, teacher-student interaction, teaching novelty, knowledge mastery and teaching satisfaction, with 10 points for each item.

Lin Yi and Jiang Anli (2021) from the Second Military Medical University were selected to compile the Self-directed Learning Ability Assessment Scale for

nursing undergraduates, which was divided into three dimensions: self-management ability, information ability and learning cooperation ability. This scale has a total of 28 questions, including 10 questions on self-management ability, 11 questions on information ability and 7 questions on learning cooperation ability. Likert5-level scoring method was used, and the answers of each item were assigned as "completely agree", "basically agree", "generally", "basically disagree" and "completely disagree" respectively.

The positive items were "5, 4, 3, 2, 1", and the negative items were assigned as reverse values. The total score of autonomous learning ability should theoretically range from 28 to 140, the score of self-management ability should theoretically range from 10 to 50, the score of information ability should theoretically range from 11 to 55, and the score of learning cooperation should theoretically range from 7 to 35. The scale has good validity after two rounds of expert consultation, with A coefficient of 0.8632 and a split-half reliability of 0.7656.

SPSS 24.0 was used for statistical analysis. Test level $\alpha=0.05$. Quantitative data were expressed as mean ± standard deviation (), and all test data were in line with normal distribution. Comparison between groups was performed by two independent sample t test. $P < 0.05$ was used to indicate statistical significance.

The scores of classroom test, theory test and skill test in the experimental group were significantly higher than those in the control group, and the differences were statistically significant ($P < 0.05$). See Table 2.2.

Table 3.2- Comparison of classroom test, final examination and skill scores between the two groups after the test (points, $\bar{x} \pm s$)

group	Classroom test	Final examination	skill scores
control group （n=60）	76.23±3.44	74.51±3.91	80.65±3.27
experimental group （n=60）	86.56±2.68	84.16±3.25	84.25±3.22

t	18.349	14.702	6.076
P	＜0.001	＜0.001	＜0.001

Source: author`s research

After the experiment in this study, the scores of learning initiative, classroom interest, teacher-student interaction, teaching novelty, knowledge mastery and teaching satisfaction of nursing students in the experimental group were higher than those in the control group, and the differences were statistically significant (P < 0.05), as shown in Table 3.3.

Before experimental teaching (before intervention), there was no significant difference in the total score of self-directed learning ability and scores of each dimension between the two groups (P > 0.05).

Table 3.3. - Comparison of teaching effect scores between the two groups of nursing students after the test (score, $\bar{x} \pm s$)

classification	control group （n=60）	experimental group （n=60）	t	P
learning initiative	6.95±1.03	8.15±0.99	6.506	＜0.001
classroom interest	7.04±0.92	8.21±1.14	6.187	＜0.001
teacher-student interaction	7.15±1.13	8.38±0.96	6.426	＜0.001
teaching novelty	7.04±1.05	8.28±0.95	6.783	＜0.001
knowledge mastery	6.45±1.14	7.86±1.52	5.748	＜0.001
teaching satisfaction	7.78±1.25	9.05±1.03	6.074	＜0.001

Source: author`s research

After experimental teaching (after intervention), there were no significant differences in the total score of self-directed learning ability and scores of each dimension of nursing students in the control group after intervention compared with those before intervention (P > 0.05).

After intervention, the total score of autonomous learning ability, self-management ability, information score and learning cooperation ability of nursing students in the experimental group were higher than those before intervention, and the differences were statistically significant (P < 0.05).

Moreover, the total score of autonomous learning ability and scores of each dimension of the experimental group after intervention were higher than those of the control group after intervention, and the differences were statistically significant (P < 0.05), as shown in Table 3.4.

Table 3.4-Comparison of scores of autonomous learning ability before and after experimental teaching between two groups of nursing students (scores, $\bar{x}\pm s$)

classification	control group （n=60）				experimental group （n=60）				
	before	after	t	P	before	after	t	P	P_1
autonomous learning ability	32.8± 4.4	31.6± 3.9	0.581	0.116	32.7± 4.9	36.2± 3.4	4.456	＜0.001	
Information ability	31.7± 4.2	30.5± 4.5	1.510	0.133	31.8± 4.7	39.1± 5.3	7.982	＜0.001	＜0.001
ability to cooperate	20.3± 2.3	21.1± 2.2	1.947	0.053	21.4± 2.6	27.8± 2.8	12.974	＜0.001	＜0.001
total	83.5± 8.7	82.6± 8.8	0.564	0.574	82.7± 8.3	98.7± 8.2	10.622	＜0.001	＜0.001

Note: P1 value refers to the comparison between the experimental group and the control group after the intervention

Source: author`s research

This study recreates the real scene inside the hospital through VR technology, allowing students to enter the operation site personally. Through scene simulation, students can feel the serious and tense working atmosphere of the hospital, and also have an in-depth understanding of the advanced static distribution center. The results of the experimental group were significantly higher than those of the control group. This result is basically consistent with previous research results. VR scenario simulation is used as a transitional way to cultivate nursing talents, on the one hand, to cultivate students' on-site coping ability, avoid being confused because of lack of experience, increase professional rigor, so as to avoid further harm to patients and lead to serious consequences.

On the other hand, VR technology is multi-sensory, immersive, interactive and convenient, which gets rid of the restrictions of traditional mode in space, time and region.

The teaching courseware is presented in the form of video and can be distributed to all students. Students can play it at any time through their mobile phones. No matter in the classroom or in the dormitory, they only need to wear a pair of VR glasses to watch and learn. At the same time, through VR scene reproduction, students will learn and use knowledge now. The sense of reality and visual impact brought by VR technology significantly deepen students' memory and impression, and then consolidate knowledge points.

With the help of virtual reality technology, according to different accident scene recording, through the computer design and rendering of the corresponding virtual scene, customized set of VR video courseware. At the same time, supplemented with tools such as tracker and touch gloves, students can directly conduct human-computer interaction in the immersive scene, which can make learners understand and feel more intuitively. The immersive and interactive nature

of virtual classroom makes the class more vivid and interesting, attracts students' attention, stimulates students' learning initiative and improves students' learning efficiency.

The scores of learning initiative, classroom interest, teacher-student interaction, teaching novelty, knowledge mastery and teaching satisfaction of nursing students in the experimental group were higher than those in the control group. This result is basically consistent with previous research results. Through VR virtual class, students learn and apply professional knowledge to cope with the problems in the scene, and deepen their understanding and memory of the learning content. The scene rendering function of holographic imaging technology can provide teachers with image expression tools, which makes many abstract teaching problems become concrete. Because of its unique visual characteristics, virtual classroom can present the real aseptic room working environment and drug logistics system in front of students, which is conducive to students' memory and understanding, and improve the acceptance of knowledge.

Moreover, students who adopt VR virtual classroom teaching generally think that virtual classroom is more novel. In this study, VR technology is used to make video courseware, establish virtual classroom and simulate teaching in real combat environment, which is an important means to make teaching close to real combat. Virtual classroom can effectively improve the students' understanding of the real hospital nursing operation environment, enhance their understanding of the aseptic environment, so as to more clearly master the classification and skills of drug aspiration under aseptic operation, and effectively improve the level of nursing operation technology of students. Studies have confirmed that compared with students in traditional mode, students who use VR technology for operation training have better performance, while students trained under other conditions have greater volatility.

For a long time, the traditional teaching method is based on teachers' teaching and indoctrinating knowledge, and students have formed the habit of over-relying on teachers, which affects the development of their autonomous

learning ability. The results showed that the total score of self-directed learning ability and the scores of each dimension of the experimental group were higher than those of the control group after the intervention, and the differences were statistically significant (P<0.05). It indicated that the application of VR technology in basic nursing teaching can improve the autonomous learning ability of nursing students. At the same time, the teacher sets aside 20 to 30 minutes for nursing students to independently explore the autonomous learning content in the virtual software. The teacher makes the rounds, timely prompts, urges and guides the students to learn, find and solve problems, timely exchanges and answers the students' problems, and improves their autonomous learning ability.

The strength of autonomous learning ability depends on nursing students' perception of learning in the teaching environment. The environment may be due to the fact that the VR simulation system is based on mechanical feedback and visual feedback for human-computer interaction, which plays an important role in virtual operation training. In these virtual environments, students can repeatedly use different accident scenes to improve their psychological endurance, emergency response ability and autonomous learning ability.

This study through static distribution center and the therapy of panoramic video recording hospital, using VR technology comprehensive rendered sterile environment liquid suction under the perspective of dynamic process, and stripping, design, copy the various steps of the nursing operation, can in a short period of time special intense training, make the students efficiently, firmly grasp the main technical points of the basic nursing procedures.

The advantages of VR technology can promote the learning of basic nursing operation, but it cannot completely replace the physical operation. The accumulation of clinical skills and clinical experience still needs to be devoted to traditional teaching. VR technology itself has shortcomings such as dizziness, nausea and discomfort after wearing, which may be related to the insufficient response speed of the hardware and the preparation process. Due to the limited research funds, this study was unable to purchase a large number of VR equipment, resulting in a small

number of selected samples. Whether the results of this study are applicable to all students needs to be further expanded.

VR immersion teaching effectively make up for the deficiency of the traditional teaching mode, dynamic present asepsis operation and the drug pump and the details of the process, fully arouse the enthusiasm of the students' classroom, apparently active classroom learning atmosphere, improve education quality of teaching and students' autonomous learning ability, VR immersion teaching mode, on the basis of nursing education provides a new way of thinking, new patterns are built.

3.3. The benefits and barriers of holistic nursing training by high-fidelity simulation

The rapid changes occurring in health care and clinical nursing education have led to the rise of simulation as a teaching tool. To keep nurses abreast of new technology, innovative methods are necessary to prepare nurses for modern clinical practice. Simulation is widely used in the United States in several disciplines, including not only health care but also aviation and the military, to train and educate personnel. In the nursing context, simulation is a strategy used to mirror real situations with guided interactive experiences.

Holistic nursing simulation is a two-component strategy used in nursing programs that combines simulation as a technology and holistic nursing care as a philosophy—the two components that have merged during the process of knowledge and skill acquisition in the care of patients as whole beings. Simulation provides opportunities to practice knowledge and skills using simulators, standardized patients, and virtual settings. Holistic nursing, meanwhile, refers to patient-centered care in which the nursing focus is on the patient as a unified whole being.

Simulation was first introduced into Chinese nursing education around the beginning of the 1990s. In China, nursing simulation is practiced at various levels of fidelity: human patient simulators (nursing classmates), computer-assisted simulation (Simamn), standardized patients(SP), and partial simulation (bottoms,arms,etc.). The Sim-man 3G is an example of a high-fidelity simulator, which presents a heartbeat, palpable carotid pulse, blood pressure, spontaneous breathing, and appropriate physiological responses to medications and other treatments.

A holistic nursing approach to simulation-based learning (SBL) may facilitate improvement in the quality and safety of patient-centered care. Simulation started as a novel supplement to traditional clinical experience integrated into curricula in the 1960s in U.S.

It has recently been cited by American National Council of State Boards of Nursing (NCSBN) as an effective replacement for up to half of the recommended clinical hours in pre-licensure nursing education if quality simulation is used. With the conclusions of this NCSBN's landmark simulation study, there is reason to believe many nursing programs will increase their use of simulation. With this anticipated change in practical learning, clear definitions and understanding of simulation are needed.

In a literature search for studies that focused on "holistic nursing simulation," this search term resulted in zero citations. However, in 2018, Walker and Avant promoted the development of a model case, which included the defining attributes of holistic nursing and simulation, as well as exemplars that represented differing degrees of the concept: related, borderline, illegitimate, and contrary. Careful scrutiny of reported case studies is vital to differentiate between the proper and improper uses of the term "holistic nursing simulation." There is a tendency in nursing to label everything as holistic and many ideas as simulation, but the analysis of cases using the concepts of Walker and Avant will help clarify the appropriate use of the concept of holistic nursing simulation.

In this study, a case from Walker and Avant's 2018 publication was used to train Chinese nursing students, focusing on the teaching outcome of the simulation. The study results will be helpful to understand the holistic nursing simulation process from students' perspective, and thus to design improved simulation training.

We provided a questionnaire to the participants to generate research data and specify the questions in Chinese.The quantitative data were entered into the Statistical Package for the Social Sciences (SPSS) version 24 for analysis. The reliability of the questionnaire was evaluated with Chronbachs alpha. Findings from the closed Likert-style questions are reported first and this is followed with a discussion of the responses to the questions posed in the open responses section of the questionnaire. In the various tables, the highest percentage response for each question is highlighted in bold.

During this study, all participating students used the same following model case as Jill (below) in the holistic nursing simulation. This case, which consisted of nine steps, is illustrated in Figure 3.4

STEP 1:

A junior-level nursing student, Jill, participates in a holistic nursing simulation. A set of measurable objectives for the simulation was given to the class a month ahead of time to allow for preparation. The objectives for the holistic nursing simulation address physical, psycho-social, spiritual, and cognitive care. However, the details of the situation were not shared with the students, to simulate real-life nursing experiences.

STEP 2:

On Jill's arrival at the simulation center, the night nurse, a faculty member from the center, provides Jill with a sign-off report, before Jill enters the simulation lab. "Harvey" (a Sim-man 3G) is on a nitroglycerin drip for acute coronary syndrome and complains of a headache, nausea, and increased financial stress because of this hospitalization. He is also in tears because he has just learned that his partner was in a car accident on the way to visit him.

STEP 3:

Jill implements the nursing process with Harvey by first performing a thorough assessment, then sets measurable goals, implements interventions aimed at Harvey's physical and emotional distress, and evaluates all aspects of the implemented plan.

STEP 4:

Jill prioritizes the nursing case based on Maslow's hierarchy of needs, knowledge of the patho-physiology and psychology of Harvey's condition, and Harvey's previous medical history. Based on his educational background, Jill first ensures that the patient is not exhibiting any signs of decreased cardiac perfusion or other complications of acute coronary syndrome.

STEP 5:

Next, Jill assesses and manages Harvey's headache and nausea using pharmacological and non-pharmacological interventions. Once Harvey reports a tolerable level of pain and absence of nausea, Jill sits at the bedside to fully assess the emotional and spiritual distress reported and demonstrated by the SP.

STEP 6:

Throughout the experience, Jill educates the patient about his condition based on her knowledge of Harvey's reported and learning style preferences from his initial assessment. Harvey expresses appreciation for the thoughtful education related to cardiovascular health, pain control, and additional resources available for Harvey and his partner following the recent accident. Additionally, Jill consults the hospital chaplain and social worker to follow up with the patient.

STEP 7:

Following the simulation, Jill joins the other students, who cared for an SP with exactly the same situation, for debriefing led by fully trained simulation faculty members. Jill and her classmates express the feeling that they were required to synthesize what they have learned in all of their courses over the past 3 years.

STEP 8:

Finally, the students are each required to watch a video recording of their encounter and write a reflection with a holistic focus on their performance related to each of the assignment objectives.

STEP 9:

The following month, in clinical practice, Jill reports a change in her approach to holistic care for her patients. She attributes this to her learning experiences and written reflection on the holistic nursing simulation event.

At the end of the questionnaire, the participants were invited to add comments about the simulation session as a whole as well as about this lesson. The participants commented on several aspects of the simulation. Some stated that it was "very realistic" and reported that "it was helpful to learn while using my own initiative." Others opined that "it was a very good way to study, especially combined with traditional teaching."

The questionnaire was designed to examine the participants' views of the simulation lesson and whether they found it beneficial. Cronbach's alpha was 0.924, representing a high level of internal consistency. From the total of 147 participating students, 124 responses were collected. The students agreed that the holistic nursing simulation cultivated humanistic care literacy, clinical practice ability, and clinical thinking ability; enhanced teamwork ability; and reinforced professional knowledge. The breakdown of the responses is given in Tables 3.5–3.9.
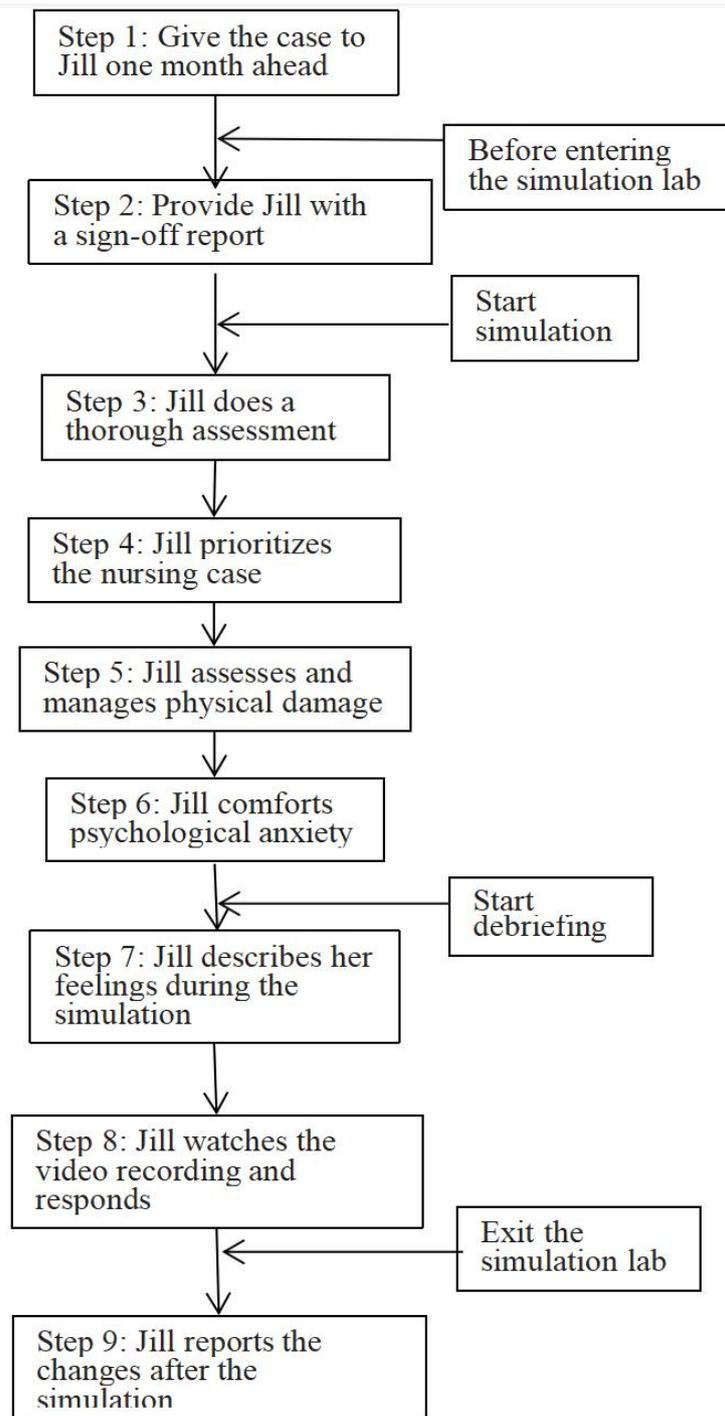
Figure 3.4 - Step-by-step process of Model Case

Source: author`s research

Many participants enjoyed the experience of "learning about critical care in a practical environment," which was "hands on."

Professional knowledge and skills	SA	A	U	D	SD
I took the initiative to make a patient nursing assessment	52.42%	29.84%	16.13%	1.61%	0%
I promptly checked for changes in the patient's condition and made appropriate nursing interventions	43.55%	36.29%	18.55%	1.61%	0%
I applied basic nursing care proficiently	37.1%	42.74%	15.32%	4.84%	0%
I comprehensively applied various specialist nursing interventions	36.29%	41.94%	16.13%	5.65%	0%

Table 3.5- Professional knowledge and skills

Key: SA strongly agree, A agree, U unsure, D disagree, SD strongly disagree

Source: author`s research

One participant responded that "teachers had rich clinical experience and offered a lot of experience for us." Some reported negative feedback on the simulation session, stating that "it needs to be improved to make it more realistic," and "we should have more simulation lessons and longer time in each lesson."

Clinical strategy	SA	A	N	D	SD
The simulation process was helpful to demonstrate clinical decision-making skills	61.29%	22.58%	15.32%	0.81%	0%
The simulation could help me avoid the mistakes of others	38.71%	43.55%	13.71%	4.03%	0%
I had a sense of accomplishment when the patient got better in the simulation session	74.19%	12.9%	12.1%	0.81%	0%
I gained self-confidence in the decision-making of clinical practice	45.16%	40.32%	13.71%	0.81%	0%
I realized the importance of theoretical learning in the simulation process	55.65%	22.58%	20.16%	1.61%	0%
I responded quickly when the patient's situation changed	38.71%	37.9%	17.74%	5.65%	0%

Table 3.6 - Clinical strategy

Key: SA strongly agree, A agree, U unsure, D disagree, SD strongly disagree

The main issue that the respondents raised regarding ways to improve the simulation session was related to the size of the participant groups during the simulation activity. Many respondents requested that for future sessions they would prefer fewer students in the group around the bed working with the manikin so they could "get more hands on experience." Other respondents reported that "if there were more simulators in the simulation lab, it would solve this problem."

This is the first study focusing on holistic nursing simulation. The results show that the students strongly agreed that the simulation greatly promoted their personal ability and were positive about participating in the new learning approach.

Team work	SA	A	N	D	SD
I understood the work assigned to my team	62.1%	18.55%	16.13%	3.23%	0%
I tried to encourage cooperation among team members in the simulation session	66.13%	16.94%	16.94%	0%	0%
The team members helped and supported each other	68.55%	13.71%	16.94%	0.81%	0%
I tried my best to achieve the goals	68.55%	15.32%	14.52%	0.81%	0.81%

Table 3.7. - Team work

Key: SA strongly agree, A agree, U unsure, D disagree, SD strongly disagree

Simulation was also conducive for students to acquire an in-depth understanding of the nursing care process through assessment, implementation, and evaluation. As an innovative learning approach, holistic simulation allows repeated opportunities for students to practice both integrated nursing skills and individual skills. According to experiential learning theory, students' learning benefits most when they learn on their own.

Communication	SA	A	N	D	SD
1. Spontaneously inquiring about psychological health of the patient	50.81%	31.45%	16.94%	0.81%	0%
2. Communicating with team members frankly	66.13%	13.71%	20.16%	0%	0%
3. Asking for teachers' help proactively	54.84%	25.81%	16.94%	2.42%	0%

Table 3.8 - Communication

Key: SA strongly agree, A agree, U unsure, D disagree, SD strongly disagree
Source: author`s research

During this model case simulation, the students strongly agreed with most of the questions regarding improvements to their ability. This shows the benefits of

Development of professional and critical thinking	SA	A	N	D	SD
Gradually adapt to the clinical role through the guidance of the teacher	51.61%	32.26%	13.71%	2.42%	0%
Conduct self-criticism and self-assessment frequently	58.87%	23.39%	13.71%	3.23%	0.81%
Can find and solve problems continuously	55.65%	28.23%	15.32%	0.81%	0%
Think positively when encountering problems	54.84%	25.81%	17.74%	1.61%	0%
Proactively offer constructive opinions	39.52%	40.32%	16.13%	3.23%	0.81%
Improve self-ability though simulation practice	53.23%	29.03%	14.52%	3.23%	0%

holistic nursing simulation.

Table 3.9 - Development of professional and critical thinking

Key: SA strongly agree, A agree, U unsure, D disagree, SD strongly disagree

Source: author`s research

However, the technique has several limitations that we need to discuss and revise in the future. In the section on professional knowledge and skills, 20.16% of students responded that they could not apply basic nursing care proficiently, and 21.78% expressed inability to comprehensively apply various specialist nursing interventions. Holistic nursing simulation tests students' skill development in every professional aspect. Therefore, many students felt that their nursing interventions were poor during those parts of the demonstration in which they were less proficient.

Clinical strategy is very important for mature clinical nurses. According to Table 3.6, approximately 4% of students thought that this simulation would not help them avoid the mistakes of others, and 5.56% were unable to respond quickly when the patient's situation changed. Unlike a previous study that involved simulation training,our questionnaire obtained individualized responses from each student. Most students responded that they could recognize their own mistakes and react quickly. As simulation is a new learning approach, students need adequate orientation on the use of different simulation equipment prior to the class itself. Simulation-assisted nursing experience may not exactly replicate real clinical settings.

The learning experience of the students is contingent on many factors, such as how well the simulation is organized and how typical is the simulation scenario. Faculty's teaching style also affects the learning perception and outcomes. In the section on development of professional and critical thinking (Table 3.5), a single student responded that he or she was unable to conduct self-criticism and self-assessment frequently or to proactively offer constructive opinions. This student may have had low self-esteem or encountered an unexpected event during the simulation.

In most cases, simulation-assisted learning provides an ideal learning context and highly realistic patients, but it is still far less complex than real clinical settings. Therefore, where possible, students still need to practice their skills in real clinical settings as well: simulation cannot totally replace clinical practice. However, for some specific elements of practice content that are rarely encountered in real clinical

settings, simulation is an ideal alternative. Unlike traditional teaching approaches, simulation places a high demand on students' self-directed learning. The bulk of the results of this study confirm the effectiveness of holistic simulation.

The simulation teaching method helps to cultivate students' enthusiasm and initiative and promotes self-learning ability. This paper is expected to provide nurse educators with guidance to aid future development of innovative and interactive teaching and learning strategies.

The official launch of this platform is a milestone achievement of the Education Digitalization Strategy Action launched by the Ministry of Education, and an important step towards building a networked, digital, personalized, and lifelong education system through practical actions. At the same time, the situation of the COVID-19 across the country has been very serious recently. The launch of the national smart education platform is also a need to coordinate the prevention and control of the epidemic and the reform and development of education. By providing high-quality digital education resources, efforts have been made to create an online classroom that is always online, so as to better serve teachers and students and show the educational role in the fight against the epidemic.

The National Smart Education Platform is a comprehensive and integrated platform. The first phase of the project includes four sub platforms: the National Smart Education Platform for Primary and Secondary Schools, the National Vocational Education Smart Education Platform, the National Higher Education Smart Education Platform, and the National 24365 College Student Employment Service Platform. In the future, it will be gradually increased in stages and batches. The National Smart Education Public Service Platform was officially launched on March 28, 2022. Since the launch of the National Smart Education Public Service Platform, it has built the world's largest education and teaching resource library. As of June 2023, the platform has accumulated a total of 26 billion views, with over 1.92 billion visitors, covering over 200 countries and regions.

The national higher education smart education platform includes four aspects of content. The first is the background of platform construction, the second is the

design concept of the platform, the third is the main innovation of the platform, and the fourth is the consideration of future work,see the detail in Figure 3.5.
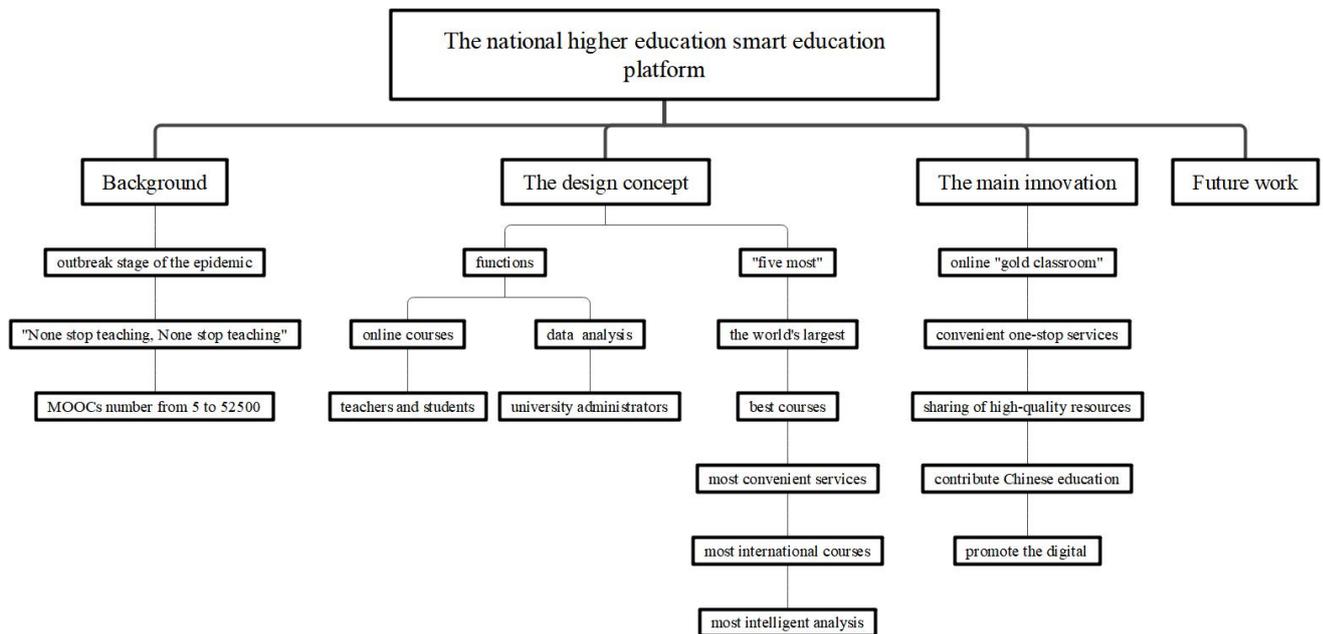
Figure 3.5-The four aspects of the national higher education smart education platform

Source: author`s research

1. Background of platform construction. You can take a look at the roadmap for the development of digital action in higher education. The first year of MOOC in China was 2013, when we established the Online Education Research Center of the Ministry of Education. In 2017, we launched the first batch of national high-quality online open courses. In 2019, we held the China MOOC Conference and launched the National First Class Curriculum Double 10000 Program, which includes online first-class courses. In 2020, during the outbreak stage of the epidemic, we proposed to carry out online teaching in all universities across the country on the second day of the Chinese New Year, proposing the concept of "None stop teaching, None stop teaching". Then, in April of that year, we launched two international platforms for online teaching in universities, and at the end of the year, we also held the World MOOC Conference. In 2021, in order to promote the high-quality development of higher education in the central and western regions, we launched the "Muke Western

Tour". On March 28th of this year, we officially launched the Smart Higher Education Platform.

The construction of online courses includes two stages. One is to lead from following to running. We only had five MOOCs in 2013, and now the number of MOOCs has exceeded 52500. In 2013, we only had over a hundred registered users, and now we have over 370 million users. The number of MOOCs and learners in China ranks first in the world and is still growing rapidly. Secondly, we have been tested for the epidemic. In 2020, in the face of the sudden outbreak of the epidemic, we proposed the concept of "no stop teaching, no stop learning". After large-scale online education in the spring, we achieved "three stability" and "four changes". We stabilized universities in Wuhan, Hubei, and the whole country.

We changed the teaching of teachers, the learning of students, the management of schools, and the form of education. Faced with the serious situation of the epidemic again this year, teachers and students in colleges and universities across the country have changed from the original sense of freshness to the current New normal. National universities are "one click in hand, instant switching, and calmly responding". As you can see, in Jilin, where the epidemic is concentrated, Jilin University has opened more than 2200 courses a week, with a class opening rate of 100%. In Shanghai Jiaotong University, online courses+cloud homework, teachers+online teaching assistants have been implemented. All universities across the country have now implemented a one click switch between online and offline teaching, ensuring a calm, orderly, and calm response.

2. The design concept of the platform. This idea has one goal, two functions, and five major characteristics. One goal, expressed as the "six most", is to build a global higher education smart open course platform with the largest scale, most comprehensive categories, and the most users. We aim to gather the best universities, teachers, and courses both domestically and internationally, and become a national level comprehensive higher education course platform.

Two functions, one is to provide various high-quality course resources and teaching services for all university teachers and students and social learners. The

second is to provide Big data monitoring, analysis and research services for education departments and university administrators.

The five major characteristics are to become the "five most": the first characteristic is the world's largest, most comprehensive, and most user oriented higher education platform. Our first launch was to select the best among over 52000 high-quality courses, selecting 20000 courses covering 13 subject categories and 92 professional categories, allowing all university teachers, students, and social learners to enter the university's online classroom.

The second characteristic is a comprehensive platform that brings together the best universities, teachers, and courses. The first batch of online courses have gathered high-quality courses of many famous teachers, academicians and scholars, such as the course of economist Justin Yifu Lin, the course of medical expert Zhang Wenhong, the course of Dunhuang scholar Fan Jinshi, and the course of Turing Award winner and international higher education master John Hopcroft. All these courses are open on this platform.

The third characteristic is that we are a resource platform that provides efficient and convenient teaching and learning services. The higher education smart platform provides multiple search methods such as course names, subject majors, universities, platforms, popular courses, first-class courses, etc. It can be said that the one-stop search for excellent courses on the entire network is in front of us, providing learners with friendly and convenient personalized services.

Fourth, we are a Open platform providing multilingual and international courses. The intelligent platform of higher education links two international online teaching platforms of colleges and universities, namely "Love Course" and "XuetangX", to provide thousands of multi language courses and supporting learning guidance services for all college students and global learners at home and abroad.

Fifth, we are a management platform that provides intelligent analysis services for teaching and learning. We provide Big data analysis and research services for the Ministry of Education, local education administrative departments, and schools. In the New normal of online teaching construction, use, learning, and

management, we implement intelligent governance throughout the process to improve the level of decision-making and management.

3. Main innovations of the platform. This platform has three modules, one is the course service platform, one is the course data service center, and one is the credit course data monitoring center. It provides full chain management for teachers and students' learning, education department management, and data decision-making analysis.

Firstly, it is necessary to gather national and even global gold teachers' gold courses, becoming an always online "gold classroom". In terms of the core curriculum system, core textbook system, core teacher team, and core experimental training system, it is necessary to establish good courses, textbooks, teachers, and experiments that cover all disciplines and majors in higher education.

The second is to provide convenient one-stop services for millions of university teachers, tens of millions of college students, and billions of social learners. College students can break through the physics fence, have a platform in hand, and gather good lessons from all over the world. Social learners can achieve the dream of being accessible to everyone at all times and everywhere. University teachers can use the platform to manage and capture students' learning progress, learning status, and learning outcomes in a full process, all-round, and panoramic manner, allowing teachers to have "thousand mile eyes" and "smooth ears".

Thirdly, in promoting fairness and improving quality, we aim to maximize the openness and sharing of high-quality resources. One is to "build good schools and courses", where various high-level universities jointly build high-quality courses to achieve mutual recognition of credit courses. The second is to "strengthen schools and guide weak ones", implement the MOOCE Western Travel Plan, improve the quality of teaching and learning in western higher education institutions, and ensure the overall improvement of students' learning and teaching quality.

The fourth is to set sail and contribute Chinese strength to world higher education. We have signed a high-quality online course agreement with Indonesia. There are over 3000 higher education institutions in Indonesia, and we provide 60

high-quality online course resources to provide teaching services to these 3000 universities. The Director of the Education Innovation and Skills Development Department of the UNESCO Asia Pacific Regional Bureau of Education wrote specifically on University World News, stating that "this collaboration is an important achievement in the international flow of high-quality educational content and teaching methods, contributing to the access to high-quality resources, high-quality and equitable development of higher education in the Asian region

We have initiated and established the World MOOC and Online Education Alliance in China, implementing mutual credit recognition and offering 168 integrated courses at 13 world-renowned universities in 11 countries. Peking University, Tsinghua University, and Shanghai Jiao Tong University provide the best quality schools, teachers, and courses in China.

The fifth is to fully bloom and deeply promote the digital strategic action of higher education. We need to accelerate the promotion and application of the platform, making it an important carrier for innovation in China's higher education learning and teaching paradigms. We need to use informatization, digitization, and intelligence to force higher education reform.

4. There is an understanding of the digitization of higher education that digitization is a new and significant event. Now we are going to turn this sense of freshness into a New normal, turn this important event into a great event, and strive to build a new form of higher education characterized by digitalization.

The development of artificial intelligence is related to the future trend of the world. As an important part of the new round of scientific and technological revolution, artificial intelligence has brought new challenges and new opportunities for the Artificial intelligence technology can fully empower smart education, including the following six examples:

Figure 3.6 - Future development trend of China's school education industry

Source: author`s research

1. In terms of reshaping the role of education. The official launch of the open-source artificial intelligence system represented by ChatGPT has opened up new systems, multiple modes, new forms, and new elements in education, including people-oriented learning in the new system, active personalized learning in the new mode, ultra remote teachers in the new form, and teaching robots in the new element, ultimately achieving personalized education, that is, "tailor-made" education.

2. In terms of knowledge space innovation. Including expanding knowledge space, multimodal knowledge representation, and diversified knowledge analysis and dissemination. Among them, expanding the knowledge space includes deep knowledge mining, knowledge cross fusion, and knowledge space innovation, thereby strengthening goal oriented attention, improving cognitive ability of generalization recognition, and achieving educational extension and knowledge innovation.

3. In terms of the synergy of educational resources. Since its launch more than a year ago, the "National Smart Education Public Service Platform" has received over 6.7 billion visits and has become the world's largest education resource library, with over ten thousand classrooms and courses of renowned higher education teachers,

achieving educational integration.

4. In terms of authoritative immersion space. Taking Beijing Institute of Technology as an example, Beijing Institute of Technology has initiated a smart ideological and political, immersive teaching platform in colleges and universities across the country. Through virtual reality, simulation technology, including the on-site technology of the surrounding environment, students can take the Long March again and have a personal experience of climbing snow mountains and grasslands; By utilizing technologies such as online cloud experiments and pocket laboratories, immersive education can be achieved.

5. In terms of full chain depth perception. It can track the learning process, form student profiles, conduct intelligent teaching evaluations, customize personal plans, achieve personalization, precision, high efficiency, and full chain, and achieve "individualized teaching" through precise education.

6. In terms of full-time intelligent management. Full time health monitoring, full context data collection, full process auxiliary management, full coverage equipment management, and campus wide security monitoring can be constructed, achieving "transparent control" through controllable education.development of higher education.

AI enabling education has both opportunities and challenges. Its challenges include privacy disclosure, false information, Internet fraud, bad guidance, online growth and algorithm deviation. Therefore, the comprehensive application of artificial intelligence will also bring hidden dangers to educational security. To this end, the following three aspects of work need to be done well: first, to build an ethical system for new technologies in the era of artificial intelligence.

Technology ethics is the first layer of constraint framework for smart education. The openness and intelligence of artificial intelligence have broken down cultural barriers in various countries, and at the same time, it will generate new thinking on technology ethics. Therefore, it is urgent to improve the new system of technological ethics in the era of artificial intelligence. Secondly, build a secure platform for intelligent algorithms. Algorithm security is the second layer constraint

framework of smart education, which includes detection of algorithm bias and discrimination, as well as evaluation of algorithm bias, in order to maintain sensitivity to algorithm bias and ensure educational fairness. Finally, protect educational privacy. Privacy protection is the third layer constraint framework of smart education, which includes personal privacy, illegal disclosure of personal privacy, illegal transactions of personal privacy, and the large amount of private data generated during the process of AI empowerment education, all of which need to be carefully managed.

In summary, it is achieved through technological ethics, intelligent algorithms, and educational privacy protection to achieve the intelligent use, application, governance, and control of artificial intelligence technology. Intelligent use refers to the intelligent application of artificial intelligence technology to improve educational efficiency; 'Zhi' is the effective use of artificial intelligence technology to solve pain points; 'Governance' refers to the application of artificial intelligence technology to govern the entire process of education and teaching; 'Regulation' refers to the application of artificial intelligence technology to regulate ethical risks in education. In summary, the goal of artificial intelligence empowerment education is to promote the development of smart education in the digital age, enhance the humanized training efficiency of artificial intelligence technology empowerment education, and cultivate top-notch innovative talents that meet the development needs of the new era.

Conclusion to the Chapter 3

During this model case simulation, the students strongly agreed with most of the questions regarding improvements to their ability. This shows the benefits of holistic nursing simulation. However, the technique has several limitations that we need to discuss and revise in the future. In the section on professional knowledge and skills, 20.16% of students responded that they could not apply basic nursing care proficiently, and 21.78% expressed inability to comprehensively apply various specialist nursing interventions. Holistic nursing simulation tests students' skill

development in every professional aspect. Therefore, many students felt that their nursing interventions were poor during those parts of the demonstration in which they were less proficient.

The teaching courseware is presented in the form of video and can be distributed to all students. Students can play it at any time through their mobile phones. No matter in the classroom or in the dormitory, they only need to wear a pair of VR glasses to watch and learn. At the same time, through VR scene reproduction, students will learn and use knowledge now. The sense of reality and visual impact brought by VR technology significantly deepen students' memory and impression, and then consolidate knowledge points.

With the help of virtual reality technology, according to different accident scene recording, through the computer design and rendering of the corresponding virtual scene, customized set of VR video courseware. At the same time, supplemented with tools such as tracker and touch gloves, students can directly conduct human-computer interaction in the immersive scene, which can make learners understand and feel more intuitively. The immersive and interactive nature of virtual classroom makes the class more vivid and interesting, attracts students' attention, stimulates students' learning initiative and improves students' learning efficiency.

The scores of learning initiative, classroom interest, teacher-student interaction, teaching novelty, knowledge mastery and teaching satisfaction of nursing students in the experimental group were higher than those in the control group. This result is basically consistent with previous research results. Through VR virtual class, students learn and apply professional knowledge to cope with the problems in the scene, and deepen their understanding and memory of the learning content. The scene rendering function of holographic imaging technology can provide teachers with image expression tools, which makes many abstract teaching problems become concrete. Because of its unique visual characteristics, virtual classroom can present the real aseptic room working environment and drug logistics

system in front of students, which is conducive to students' memory and understanding, and improve the acceptance of knowledge.

For a long time, the traditional teaching method is based on teachers' teaching and indoctrinating knowledge, and students have formed the habit of over-relying on teachers, which affects the development of their autonomous learning ability. The results showed that the total score of self-directed learning ability and the scores of each dimension of the experimental group were higher than those of the control group after the intervention, and the differences were statistically significant ($P<0.05$). It indicated that the application of VR technology in basic nursing teaching can improve the autonomous learning ability of nursing students. At the same time, the teacher sets aside 20 to 30 minutes for nursing students to independently explore the autonomous learning content in the virtual software. The teacher makes the rounds, timely prompts, urges and guides the students to learn, find and solve problems, timely exchanges and answers the students' problems, and improves their autonomous learning ability.

The strength of autonomous learning ability depends on nursing students' perception of learning in the teaching environment. The environment may be due to the fact that the VR simulation system is based on mechanical feedback and visual feedback for human-computer interaction, which plays an important role in virtual operation training. In these virtual environments, students can repeatedly use different accident scenes to improve their psychological endurance, emergency response ability and autonomous learning ability.

This is the first study focusing on holistic nursing simulation. The results show that the students strongly agreed that the simulation greatly promoted their personal ability and were positive about participating in the new learning approach. Simulation was also conducive for students to acquire an in-depth understanding of the nursing care process through assessment, implementation, and evaluation. As an innovative learning approach, holistic simulation allows repeated opportunities for students to practice both integrated nursing skills and individual skills. According to

experiential learning theory, students' learning benefits most when they learn on their own.

During this model case simulation, the students strongly agreed with most of the questions regarding improvements to their ability. This shows the benefits of holistic nursing simulation. However, the technique has several limitations that we need to discuss and revise in the future. In the section on professional knowledge and skills, 20.16% of students responded that they could not apply basic nursing care proficiently, and 21.78% expressed inability to comprehensively apply various specialist nursing interventions. Holistic nursing simulation tests students' skill development in every professional aspect. Therefore, many students felt that their nursing interventions were poor during those parts of the demonstration in which they were less proficient.

Clinical strategy is very important for mature clinical nurses. According to Table 3.6, approximately 4% of students thought that this simulation would not help them avoid the mistakes of others, and 5.56% were unable to respond quickly when the patient's situation changed. Unlike a previous study that involved simulation training,our questionnaire obtained individualized responses from each student. Most students responded that they could recognize their own mistakes and react quickly. As simulation is a new learning approach, students need adequate orientation on the use of different simulation equipment prior to the class itself. Simulation-assisted nursing experience may not exactly replicate real clinical settings.

The learning experience of the students is contingent on many factors, such as how well the simulation is organized and how typical is the simulation scenario. Faculty's teaching style also affects the learning perception and outcomes. In the section on development of professional and critical thinking, a single student responded that he or she was unable to conduct self-criticism and self-assessment frequently or to proactively offer constructive opinions. This student may have had low self-esteem or encountered an unexpected event during the simulation.

In most cases, simulation-assisted learning provides an ideal learning context and highly realistic patients, but it is still far less complex than real clinical settings. Therefore, where possible, students still need to practice their skills in real clinical settings as well: simulation cannot totally replace clinical practice. However, for some specific elements of practice content that are rarely encountered in real clinical settings, simulation is an ideal alternative. Unlike traditional teaching approaches, simulation places a high demand on students' self-directed learning. The bulk of the results of this study confirm the effectiveness of holistic simulation.

The simulation teaching method helps to cultivate students' enthusiasm and initiative and promotes self-learning ability. This paper is expected to provide nurse educators with guidance to aid future development of innovative and interactive teaching and learning strategies.

CONCLUSIONS

This research try to use the latest industry research data, to conduct empirical research on the online education market's educators, educates, education impact, combined with a qualitative way to derive conclusions, and scientific induction and summary, so as to draw arguments. In order to reach a scientific and reasonable conclusion, this research will combine the theories and viewpoints of multiple disciplines, and from the perspective of economics, study the supply and demand relationship between educators and educates in each market segment of online education, integrate the corresponding theories of education and market, and conduct a comprehensive analysis across disciplines, so as to derive a scientific and reasonable conclusion.

1. China's higher education has significantly improved its ability to serve the country. Higher education has taken the initiative to subordinate the "small logic" service of its own development to the "big logic" of the country's economic and social development. The capacity of higher education institutions to serve the country's major strategies has been continuously enhanced, and they have won more than 60% of the three national science and technology awards. More than 60% of the country's basic research and more than 80% of the National Natural Science Foundation projects are undertaken by higher education institutions. Universities and colleges have provided key technologies for high-speed rail, nuclear power, biological breeding, vaccine research and development, national defense and military industries, participated in the development of supercomputers, Beidou navigation satellite system, Shenzhou series and other national weapons, and supported and led the construction of a strong culture, a strong talent, a strong sports, a healthy China, a beautiful China, and a safe China.

2. "People-oriented" and "four returns" are deeply rooted in the hearts of the people, and "students are busy, teachers are strong, the system is hard, and the quality is high" has become the general consensus and direction of efforts on the front. It will promote the construction of the "Four new", and carry out all-round reforms in

personnel training paradigms such as education ideas, development concepts, quality standards, technology methods, and quality evaluation.

3. To deepen the construction of new engineering projects, comprehensively promote innovation in organizational models, theoretical research, content and methods, and practical systems, implement the innovation of the organizational model of colleges and departments as the starting point, we will promote the construction of 28 first 12 future technology colleges, so as to promote the deep-seated reform of VR education.

4. The construction of new medical science, positioning "big country plan", "big people's livelihood", "big discipline" and "big specialty", strengthening the cultivation of Taoist, humane, academic, technical and artistic skills of medical students, leading the innovation and development of medical education. Medical and educational cooperation to build a "5+3" as the main body of clinical medical personnel training national system. Accelerate the training of high-level innovative talents in composite medicine, hold 10 consecutive sessions of the Chinese College Students Medical Technology and Skills Competition, support 11 universities to carry out eight-year clinical medical education, and promote the pilot reform of "Medicine +X" composite talent training. It will integrate mentoring education into the whole process of training talents, and basically establish a talent training system. Recognized by the World Federation of Medical Education, a medical education professional certification system with Chinese characteristics and international substantive equivalence has been established.

5. Further progress was made in revitalizing and developing higher education in the central and western regions. Centering on the strategic layout of "four points, one front and one side", revitalize higher education in the central and western regions, jointly with relevant ministries and commissions, launch basic capacity building projects for universities in the central and western regions, and consolidate the foundation for running schools. During the 13th Five-Year Plan period, a total of 10.7 billion yuan was allocated from the central budget to implement the "One province, one school" and "one school, one plan". Each school

receives about 100 million yuan of financial support from the central government every year. In addition, 119 subordinate universities and high-level universities in the east participated in supporting 103 universities in the central and western regions, covering all 12 western provinces (autonomous regions and municipalities directly under the central government) and the Xinjiang Production and Construction Corps.

The joint construction of colleges and universities has achieved remarkable results. An additional 151 colleges and universities were jointly built with relevant ministries and commissions, large enterprises and local governments. Relying on the co-construction mechanism, the first batch of "double first-class" co-construction of local governments invested a total of more than 66 billion yuan in construction funds, and provincial and ministry co-construction of local colleges and universities received a total of more than 100 billion yuan during the "13th Five-Year Plan" period, effectively improving the overall level of co-construction of colleges and universities and serving national and regional major strategic capabilities.

6. The conducted methodological analysis of the investigated problem in the context of the implementation of innovative technologies in the modern educational space of China made it possible to find out that the level of the contribution of higher education to economic growth in the provinces of the Silk Road Economic Belt over the past 16 years (determined using the Dennison growth factor analysis method) insignificant (k=0.013), significantly lower than the national average (k=0.037). The main reasons are insufficient investment in higher education, the lack of high-level universities in this part of the country, and a serious brain drain. The results show that it is possible to increase the level of the contribution of higher education to economic growth in the Silk Road Economic Belt thanks to the growth of investments in higher education, the optimization of the distribution of higher education resources, the improvement of social conditions in the places of residence of students, the improvement of the quality of training and the motivation of education seekers, and the strengthening of the formation system personnel potential of higher education, improve the mechanism of attraction and retention of employees and create a favorable environment for their development.

7. For a long time, the traditional teaching method was based on the authority of teachers, and students formed the habit of excessively relying on teachers, which affects the development of their independent ability to learn. The results showed that the overall score of independent learning ability and the score of each parameter of the experimental group were higher than those of the control group after the intervention, and the differences were statistically significant ($P<0.05$). It has been stated that the application of virtual reality technology in basic teaching for medical college students can improve the self-learning ability of future nurses.

8. By studying the impact and trend of big data and artificial intelligence on the online education industry, this paper, on the one hand, can provide relatively professional insights on the new technologies and trends of the online education market to institutions that are ready to enter or have implemented online education and training, and help them deeply understand the status quo and bottlenecks of the online education and training industry. So targeted research and development and breakthrough, to achieve new growth points; On the other hand, it can help consumers in the online education industry objectively understand the new technologies and trends of the online education industry, so as to shorten the exploration time of selecting training courses, teachers or education training solutions suitable for their own development, and learn and improve more efficiently.

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APPENDIX A

Intelligent Teaching Technology Reform (high simulation & VR devices) Feedback Questionnaire
(Student version)

Dear students：

Hello! In order to further understand the current situation of students' practical behavior performance in high simulation/VR teaching of students and provide a basis for the reform of practice teaching, we have designed this questionnaire, and sincerely invite you to actively participate in this survey of self-evaluation of high simulation/VR teaching behavior performance of undergraduates. The questionnaire is filled in anonymously, the answer is no right or wrong, the survey results are only for research use, will not have any impact on your academic performance, you do not have any concerns when answering, please fill in seriously and honestly, thank you for your support to our work!

1. Personal information (please tick the corresponding column)

Gender:	Male ( )	Female ( )		
Age:	19 ( )	20 ( )	21 ( )	22 ( )
Study Time:	Within 10 hours ( )	10-20 hours ( )	20-30 hours ( )	30+ hours ( )

2. Questionnaire instructions

The questionnaire was designed to examine the participants' views on whether they found it a beneficial and effective lesson. Cronbach's alpha was 0.924, representing a high level of internal consistency. The students will give the feedback

in the teaching reform about humanistic care literacy, clinical practice ability, and clinical thinking ability; enhanced teamwork ability; and reinforced professional knowledge.

Please choose the choices according to your own experience in classes.

3.1　Communication

1. Pay attention to patients' psychological problems and actively communicate [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

2. Frank discussion with group members [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3. Actively seek support and guidance from teachers [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3.2　Division of labor and cooperation

4. Define your division of labor [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

5. Solidarity with group members [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

6. Group members ask each other to help and support [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

7. Do your best to achieve your goals [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3.3   Clinical decision-making

8. Patient responds quickly to changes in condition [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

9. Good theoretical knowledge is the basis for good clinical decision-making [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

10. Make sure the clinical decision is correct [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

11. The patient has a sense of achievement when his condition improves [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

12. Can well avoid the mistakes that other students have made [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

13. High simulation teaching contributes to the formation of clinical thinking [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3.4　Professional knowledge and skills

14. Take the initiative to evaluate the patient's care [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

15. Timely detection of disease changes and appropriate nursing measures [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

16. Can freely apply basic nursing operations [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

17. Can comprehensively apply various specialized nursing operations [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

18. Be able to identify flaws in your own knowledge [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3.5 Professional development and critical thinking

19. Gradually adapt to the clinical role through the teacher's guidance [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

20. Frequent self-review and self-judgment [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

21. Ability to constantly identify and solve problems [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

22. Think positively when confronted with problems [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

23. Offer some constructive suggestions [multiple choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

24. Continuous improvement of self-ability after learning [single choice]

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

25. Do you have any other comments or suggestions on intelligent teaching reform?

_____

_____

APPENDIX B

Intelligent Teaching Technology Reform(high simulation & VR devices)
Feedback Questionnaire
(Teacher version)

Dear teachers：

Hello! In order to further understand the current situation of students' practical behavior performance in high simulation/VR teaching of students and provide a basis for the reform of practice teaching, we have designed this questionnaire, and sincerely invite you to actively participate in this survey of self-evaluation of high simulation teaching behavior performance of undergraduates. The questionnaire is filled in anonymously, the answer is no right or wrong, the survey results are only for research use, will not have any impact on your academic performance, you do not have any concerns when answering, please fill in seriously and honestly, thank you for your support to our work!

1. Personal information (please tick the corresponding column)

Gender:	Male ( )	Female ( )		
Degree:	PhD ( )	Master's Degree ( )	Bachlor's Degree ( )	Other ( )
Title:	Professor ( )	Associate Professor ( )	Lecturer ( )	Other ( )
Working Years:	Within 10 Years （)	10-20 Years （)	20-30 Years （)	30+ Years （)
Working Postion	Instructor （)	Lecturer ( )	Teaching aid （)	Other ( )
Teaching Hours:	Within 10 hours （)	10-20 hours （)	20-30 hours （)	30+ hours ( )

2. Questionnaire instructions

The questionnaire was designed to examine the participants' views on whether they found it a beneficial and effective lesson.The teachers will give the feedback in the teaching reform about

Please choose the choices according to your own experience in classes.

3.1 Professional teaching effect

1. The content of this course is helpful to my teaching.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

2. I am able to understand and master the key concepts of the course in intelligent teaching.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3. Intelligent teaching has a positive impact on improving my teaching performance.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

4. I can apply theoretical knowledge to the practical situation of intelligent teaching.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

5. Intelligent teaching helps cultivate my problem-solving ability and creative thinking.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3.2 Teaching quality

6. I can explain the course content clearly in an intelligent teaching environment.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

7. I am able to provide timely and effective feedback and guidance.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

8. My classes are well organized and arranged in an intelligent teaching environment.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

9. I encourage student interaction and collaboration to promote learning outcomes.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

10. I track and evaluate students' progress.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3.3   Teachers self-learning experience

11. I find it interesting to study with smart devices.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

12. Smart device learning makes me have a positive attitude towards learning.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

13. I have the opportunity to interact and discuss with students in smart learning.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

14. Smart device learning learning resources are rich and diverse.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

15. I can choose my own teaching time and place.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3.4   Teaching adaptability

16. Intelligent teaching can meet the learning needs of different students.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

17. Intelligent teaching takes full account of students' learning styles and individual differences.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

18. The content and learning activities of intelligent teaching are relevant to real

life and professional needs.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

19. Learning with smart devices can provide personalized learning support and guidance.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

20. I am able to adjust and improve intelligent teaching according to students' feedback and needs.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

3.5 Technical support for smart devices

21. The technical tools used by intelligent learning are easy to operate and use.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

22. Technical support personnel can solve technical problems and failures in a timely manner.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

23. Intelligent learning technology equipment and platform are stable and reliable.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

24. Technical support can provide clear guidance on the operation and use of technology.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

25. My students and I are satisfied with the technical tools and platforms used in learning.

○ SA: strongly agree

○ A: agree

○ U: unsure

○ D: disagree

○ SD: strongly disagree

26. Do you have any other comments or suggestions on intelligent teaching reform?

_____

_____