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Innovative Research on College Students' Social Practice and Volunteer Service Activities

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Abstract: Under the background of the new era, social practice and volunteer service activities in colleges and universities have become an important carrier to implement the fundamental task of "cultivating people by virtue. "This paper takes the innovation model as the research object, focuses on the three major fields of red culture inheritance, education science popularization service and agricultural revitalization practice, and explores the cross-domain collaborative innovation mechanism through mixed research methods. It is found that the innovation model constructs the practical link of" red gene inheritance-popular science resources sinking-rural industrial upgrading" through cultural value activation, technical tool embedding and industrial chain extension, but it faces challenges such as formalization tendency, regional resource imbalance and insufficient sustainability. Based on this, this paper proposes optimization strategies such as establishing a tripartite collaboration platform, developing low-threshold technical tools, and improving the three-dimensional evaluation system, so as to provide theoretical reference and practical paradigm for practical education in colleges and universities.

Keywords: Social Practice; Volunteer Service; Red Culture; Education Science; Helping Agriculture to Revitalize; Collaborative Innovation.

1. Introduction

As a petri dish for talents, colleges and universities are important bases for young college students to learn theoretical knowledge and accept ideological and political education before entering the society. College students' social practice and volunteer service activities have become an important part of college education. In June 2023,the General Office of the Ministry of Education clearly pointed out in the notice of the General Office of the Ministry of Education on deepening the summer social practice activities of college students that' through social practice answer' what kind of people to train, how to train people, and for whom to train people' is the core issue of building a strong education country. Nowadays, with the increasing promotion of ideology and quality education in the country, the status of college students' social practice and voluntary service is becoming more and more obvious, and its role cannot be ignored. With the rapid development and change of society, in order to meet the needs of the times and create talents of the times, the forms and contents of college students' social practice and volunteer service activities are also constantly innovating. Especially in the fields of red culture inheritance, education popularization and agricultural revitalization, college students are playing an increasingly important role. By closely combining the three with college students' social practice activities and volunteer service activities, it has injected 'source water' into ideological and political education and quality education, and further promoted the development and inheritance of red culture, the popularization and promotion of scientific knowledge and the implementation and development of rural revitalization strategy. However, how to further innovate the social practice and volunteer service activities of college students and improve their effectiveness and influence in the college students and the above fields is an urgent problem to be solved. Therefore, the purpose of this paper is to deeply explore the innovative paths and strategies of college students' social practice and volunteer service activities, analyze the current situation of college students'social practice and volunteer service activities,and combine the actual needs of red culture, education and science popularization, and agricultural revitalization. Explore and propose innovative activity models.Specifically,the purpose of this study is to analyze the current situation and characteristics of college students' social practice and volunteer service activities;to explore the actual connotation and development status of related activities in the fields of red culture, education popularization, and agricultural revitalization; put forward innovative social practice and volunteer service activity mode,in order to improve the effectiveness and influence of the activity;it provides theoretical support and practical guidance for the future development of college students'social practice and volunteer service activities.This study has important theoretical and practical significance.First of all,from a theoretical point of view,this study helps to deepen the understanding of college students'social practice and volunteer service activities,and enrich the relevant theoretical system.Secondly,from a practical point of view,the innovative social practice and volunteer service activity model proposed in this study can provide a broader social practice platform for college students and improve their sense of social responsibility and comprehensive quality.At the same time,these activity modes also help to promote the inheritance of red culture,the popularization of educational science and the realization of the revitalization of agriculture,and contribute to the harmonious development and overall progress of society.The following will focus on the three areas of red culture,education and science popularization,and agricultural revitalization,and propose targeted innovation strategies,in order to provide theoretical and practical reference for solving the above difficulties.

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educational science and the realization of the revitalization of agriculture,and contribute to the harmonious development and overall progress of society.

2. Analysis of the Current Situation

2.1. Activity Characteristics and Problems

As an important carrier of higher education,the essence of college students'social practice and volunteer service activities can be traced back to the definition of practical education in educational theory.According to the consensus of the academic community,college students'social practice is'guided by the goal of higher education,through organized and planned social participation activities,so that students in the process of in-depth social production and life to achieve knowledge internalization,skills upgrading and values shaping the educational process'.This concept emphasizes the three core characteristics of social practice:the systematicness of educational objectives(such as cultivating family and country feelings through rural revitalization practices),the contextuality of the participation process(such as immersive learning in red education bases),and the multidimensionality of effectiveness evaluation(taking into account knowledge application and social value creation).

In recent years,the scale of social practice in colleges and universities has continued to expand.According to the statistics of the Central Committee of the Communist Youth League's"China Youth Volunteer Service Development Report(2022),"in 2022,the number of registered volunteers in colleges and universities nationwide reached 35 million, covering 85%of college students.According to the average annual growth rate of 5%,the registration scale in 2025 is expected to exceed 40 million,indicating that this activity has become the mainstream form of college students'participation in social construction.

However,the current prosperity and imbalance of college students'social practice constitute a distinct paradox:in 2022,the number of practice bases in double first-class colleges and universities is 7.25 times that of ordinary colleges and universities,while the per capita practice funds of colleges and universities in the west are only 31%of the east,52.6%of voluntary service stays in"taking pictures and calling cards,"which reflects the alienation of practical education from"value transmission" to" formalism. "This "resource siphon"effect is creating a new type of educational equity gap.When rural revitalization urgently needs technology empowerment,the practice team leads to the secondary loss of agricultural products due to the lack of cold chain supply chain management ability.When the red education calls for immersion experience,the exhibition still stays in the static cultural relics display.According to the data,only 27%of volunteers have continued to serve for more than 3 years,and short-term projects account for more than half,which makes it difficult to form a closed loop of technical assistance,and the replication rate of rural governance programs is less than 15%.Behind these figures is the crisis of practical education from'system engineering'to'fragmentation movement'.

Data reflects not only the spatial mismatch of practical resources,but also the implicit logic of the reproduction of'symbolic capital'in the field of higher education.When social practice is reduced to a quantitative indicator for elite schools to compete for performance championships,when volunteer service is alienated into the exquisite egoism of resume gilding,the fault zone of educational equity has spread from resource allocation to value production.To solve this dilemma,we need to go beyond the level of technical repair and reconstruct the value symbiosis mechanism between practical education and social needs.Only by shifting practical education from "university self-empowerment"to"social problem response" can we truly realize the paradigm transition from the accumulation of cultural capital to the proliferation of social capital.Therefore,how to optimize the resource allocation mechanism and build a cross-regional coordination model through institutional design has become a core issue to be solved urgently.The following will focus on the three areas of red culture,education and science popularization,and agricultural revitalization,and propose targeted innovation strategies,in order to provide theoretical and practical reference for solving the above dilemmas.

2.2. Analysis of the Status Quo in Various Fields

2.2.1. Inheritance of Red Culture

The inheritance of red culture has become the core field of practical education in colleges and universities.The General Office of the Central Committee of the Communist Party of China's" Opinions on the Implementation of the Project for the Protection and Utilization of Revolutionary Cultural Relics" (2018)clearly requires that"the inheritance of red culture should be incorporated into the social practice system of primary and secondary schools."The Ministry of Education further proposed to"build 100 national red cultural practice bases."Driven by the policy,the scale of activities has expanded significantly:according to the"China Youth Volunteer Service Development Report(2023)"of the Central Committee of the Communist Youth League,there will be more than 80,000 red practice teams in colleges and universities nationwide in 2023,an increase of 42%compared with 2020;90%of the'double first-class'universities set up special funds,with an average annual investment of more than 500,000 yuan.

However,there are still concerns about the quality of practice and technological innovation.The survey shows that 73%of the activities are still limited to the traditional visit mode,and only 12%of the projects introduce party history experts to participate in the design,which exposes the structural contradictions of image data stacking and weak theoretical construction,huge activity momentum and insufficient theoretical support.These practical dilemmas suggest that the inheritance of red culture needs to achieve double breakthroughs in content deep cultivation and technical adaptation.

2.2.2. Education Science Popularization Service

As a key field of social practice in colleges and universities,educational science popularization service activities show the dual characteristics of scale expansion and mode innovation under the wave of policy promotion and digitization.The introduction of the Ministry of Education's"Opinions on Strengthening Science Education in Primary and Secondary Schools in the New Era" (2022) marked the formal inclusion of science popularization services in the evaluation system of social services in colleges and universities.84%of 31 provinces immediately introduced the "University-primary and secondary schools"twinning policy. The policy dividend has spawned a rapid expansion of the scale of practice:42,000 science popularization teams will be set up in colleges and universities nationwide in 2023,with

an average annual service of 126,000 primary and secondary schools.A more in-depth two-way empowerment model has begun to emerge:Beijing Normal University has added a"Science Education Design" course based on feedback from rural science popularization,and the award-winning rate of students'teaching programs has increased;northwest Polytechnical University even revised the textbook of "Engineering Cognitive Psychology"backed by aviation science popularization data to realize the closed loop of"service-research-education."

However,structural contradictions lurk behind the scale expansion.The deeper challenge lies in the lack of sustainability mechanism:non-science and engineering students are limited in participation due to the lack of scientific education methodology training,reflecting the gap of professional coordination and long-term evaluation system.These contradictions are prominent.If the collaborative ecology of"university-primary and secondary schools-society"cannot be constructed,it will be difficult for popular science services to break through the shackles of"campaign-style"practice,and its strategic value of promoting educational equity and stimulating scientific spirit will also be greatly reduced.

2.2.3. Practice of Agricultural Revitalization

The practice of helping farmers to revitalize presents a dual picture of large-scale expansion and innovation breakthrough in the interweaving of policy-driven and technology-enabled.At the national level,the central government will continue to increase policy support,and in 2023,the central government will promote the targeted investment of rural revitalization subsidy funds in industrial development,and promote the cultivation of characteristic industries in poverty-stricken counties.Local governments responded positively, such as Chongqing's"reassuring agricultural materials to the countryside "action to strictly control the quality of agricultural materials and escort spring farming production. The'mushroom grain rotation'model in Xiayetou Village,Pingding County,Shanxi Province has caused the annual income of farmers to jump,and the improvement of cold chain warehousing and e-commerce chain has highlighted the value of industrial chain upgrading,in 2023,rural online retail sales exceeded 2.49 trillion yuan,becoming the core channel for agricultural products to go out of the village and into the city. The deeper change lies in the improvement of governance ability-Zhejiang Jiande Hangchuan Village transforms idle rural houses into boutique homestays,attracting the sinking of urban consumption power and the increase of villagers'annual income,reflecting the potential of resource revitalization and urban-rural mutual feeding.

However,deep contradictions lurk behind the bright data.Some villages fell back into stagnation after the evacuation of the team.The shortage of talents and funds is also fatal:non-science and engineering students are limited in participation due to the lack of agricultural methodology,e-commerce financing in remote areas is highly dependent on policy blood transfusion,and the marketization mechanism is weak.

3. The Innovation Path of Sub-fields

However,with the continuous improvement of policies,the high attention of the society,and the continuous development of new technologies,college students'social practice and voluntary activities have brought new changes in these fields.

3.1. Red Culture: From Symbol Communication to Value Reproduction

The traditional dissemination of red culture has long relied on symbolic means such as memorial visits and slogan panels.Although it has a sense of ritual,it is difficult to escape the stereotype of'form is greater than content'.The one-way instilled historical narrative makes the red gene and contemporary life drift apart-revolutionary cultural relics are silent in the glass showcase,historical events are simplified into a list of characters of time and place,and red resources are alien to realistic issues such as rural revitalization and youth growth.What is more serious is that the fracture of symbol transmission has spawned'two skins':one is the solemn historical display in the exhibition hall,and the other is the same rough souvenir shop outside the scenic spot;on the one hand,it is the party history education in the classroom,and on the other hand,it is the red paragraphs that are dismantled by entertainment on the short video platform.This fragmentation not only weakens the appeal of culture,but also makes the red gene fall into the dilemma of'symbolic valuelessness'in the wave of marketization.

Under the predicament,the inheritance of red culture is turning to the path of value reproduction with'spiritual decoding,technological empowerment and industrial integration'as the core.Different from the static presentation of symbolic communication,value reproduction emphasizes the vitality of activating the red gene in the contemporary context-Fudan University's'Digital Red Hall'reproduces the landscape of the First Congress of the Communist Party of China with VR technology,and visitors can'ignite'the virtual torch through gesture interaction;the AR tour of the Jinggangshan Revolutionary Museum allows cultural relics to'speak',and visitors can scan the two-dimensional code to trigger dynamic images.More breakthrough is the innovation and reconstruction of the way of communication:under the topic of Tik Tok#Red Youth#,the'post-00s dialogue 1921'created by college students reconstructs history with the language of'Generation Z',with a broadcast volume of more than 10 billion,winning the'Five One Project'award,which proves that red narrative can have both seriousness and network sense.

The essence of this transition from'symbol'to'value'is to let the red gene break through the barriers of time and space and become an endogenous force driving social progress.The red heritage is no longer a specimen in the museum,but a cultural root rooted in reality.In the future,only by continuously promoting the deepening of spiritual decoding,the universalization of technological empowerment,and the ecologicalization of industrial integration,can red culture grow into a spiritual totem of this era in the soil of value reproduction.

3.2. Educational Science Popularization: From One-Way Output to Two-Way Empowerment

Science popularization education is experiencing a paradigm innovation from"knowledge transfer"to"value co-creation."In the traditional mode,science popularization is often simplified as one-way indoctrination-expert teaching, student listening, test paper inspection. Although this 'cramming' communication can transfer knowledge,it is difficult to stimulate scientific thinking and innovative

consciousness. Through technology empowerment, participation in reconstruction and ecological co-construction, the new generation of popular science education is breaking the one-way barrier and building a two-way cycle of' knowledge output-ability feedback-value symbiosis'.

Technology enables popular science to break through the limitation of time and space and reshape the interactive scene. The'Mozi Salon'team of the University of Science and Technology of China opened a quantum physics column in Tik Tok, dismantling the obscure theory in the form of'talk show+animation'.The number of fans exceeded 2 million,and the series of videos exceeded 300 million,of which 45%of the audience were teenagers with non-technical backgrounds. More profound changes are taking place in the field-Huazhong Agricultural University moved its gene-editing laboratory to a rural school,where middle school students improved crops by manipulating CRISPR technology with their own hands.Virtual simulation technology bridges the resource gap:Northwest Polytechnical University develops the'aviation cognitive VR system',and western rural students can immersively experience aircraft design.

The essence of two-way empowerment is to construct a closed loop of knowledge flow.The team of Zhejiang University fed back the adolescent cognitive data collected in popular science activities to brain science research,and the relevant results were published in the journal of"Science Education Research."This cycle of"practice-research-iteration"makes science popularization no longer stop at knowledge transfer,but also a laboratory for promoting education reform.

3.3. Agriculture Revitalization: From Short-Term Assistance to Industrial Upgrading

The agricultural revitalization activities are undergoing a profound transformation from "blood transfusion assistance" to "hematopoietic revitalization."Under the traditional mode,college teams often carry out short-term agricultural assistance in the form of summer"three trips to the countryside,"and quickly increase farmers'income through live broadcast with goods and material donations. However, due to the lack of continuity,they often fall into the dilemma of"people walking tea."This"palliative"support model reflects the urgent need for systemic change in rural development. The practice of helping agriculture in the new era is promoting the rural economy from"single point breakthrough"to"system upgrading"through industrial chain reconstruction,technology penetration and cultural assignment,and reshaping the pattern of urban and rural resource flow while activating endogenous power.

Technology-driven industrial chain reconstruction has become the key to breaking the situation.Zhejiang University's"Seeking Truth and Helping Farmers"team takes live e-commerce as the starting point,not only helping farmers sell agricultural products,but also participating in county brand building and supply chain optimization in depth.In 2023,the sales volume will reach a new high,driving 12 villages to build standardized planting bases.More subversive is the transformation of traditional agriculture by digital technology-the'Smart Orchard Management System' developed by Northwest A&F University. It monitors soil moisture and light intensity through the Internet of Things,and guides farmers to plant accurately,so that the yield per mu of apples is increased by 30%,and the residual rate is reduced by 18%.Such projects no longer stay in"selling goods,"but promote the transformation of agricultural production mode through technological penetration,and realize the dual promotion of"short-term sales-long-term production capacity."

Cultural assignment and industrial integration open a new dimension of value enhancement.The team of Central Academy of Fine Arts designed the intangible cultural heritage IP of'Muer Doll'for Zhashui County,Shaanxi Province,and packaged traditional edible fungi as cultural symbols.The'Hongyan Rural Revitalization Research Institute'of Chongqing University,together with local governments,combines red cultural tourism with ecological agriculture to develop an integrated industrial chain of 'research+picking+homestay'.These cases show that when agricultural products are endowed with cultural narrative and experiential value,their market boundaries expand from' commodity trading' to'emotional consumption',forming differentiated competitiveness.

The ultimate goal of agricultural revitalization is not to increase income at any time,but to reshape rural value through industrial upgrading.Technology allows agriculture to bid farewell to"see the sky and eat,"culture rejuvenates local resources,and systems allow the interests of all parties to be integrated.Rural revitalization is no longer a passive project of external blood transfusion, but an endogenously driven organic growth.

Red culture reconstructs the historical narrative through digital communication, education science popularization breaks the knowledge barrier by means of two-way empowerment,and the revitalization of agriculture relies on technological iteration to activate the rural economy-independent breakthroughs in the three major fields to inject new momentum into practical education.However,one-dimensional innovation is difficult to cope with the systematic challenges of rural revitalization:the cultural and tourism value of red resources is not fully grafted into the agricultural industry chain, the sinking of popular science technology is hindered by the fault of rural talents,and the school-enterprise cooperation falls into an inefficient cycle due to the ambiguity of power and responsibility.To solve these dilemmas,it is urgent to build a cross-domain collaborative'reactor'to release the aggregation effect in the collision of culture,technology and industry.

4. Cross-domain Collaborative Optimization Mechanism

Cross-domain collaboration is not a simple resource superposition, but a value reconstruction through mechanism design.Taking "Red Culture+Helping Agriculture Revitalization" as an example, Yan'an University deeply integrates the red research route with the ecological millet industry chain, which not only allows tourists to feel the revolutionary spirit in the immersive experience,but also enhances the income of farmers through brand packaging and e-commerce operations. This case shows that the essence of synergy is to find the"interface"of the value chain in various fields, and to achieve efficiency doubling through complementary innovation.

4.1. Red Culture+ Agricultural Revitalization-From Spiritual Empowerment to Economic Activation

The combination of red culture and agricultural

revitalization is not a simple collage of'cultural label+agricultural products',but an organic integration of revolutionary tradition and contemporary development by digging deep into the connotation of red spirit and reconstructing the value of rural resources.This integration not only gives the practice of helping farmers a spiritual height,but also injects economic vitality into the red culture,forming a sustainable ecology of'spiritual guidance-resource activation-benefit sharing'.

4.1.1. Spiritual Empowerment: Red Genes Drive Endogenous Motivation

The core values of red culture-such as hard work, collectivism,innovation and change-provide the spiritual core for rural development.The"Red Research+ Ecological Agriculture"project carried out by Yan'an University in the old revolutionary base areas integrates the"self-reliance"spirit of Nanniwan into the millet industry chain:tourists subscribe to the"spiritual millet"after experiencing the history of reclamation,the annual income of farmers is increasing,and the sales profit feeds back the red site repair.This'spiritual consumption'model allows consumers to pay for values and shifts red education from one-way indoctrination to value co-creation. The deeper significance is to awaken the subjectivity of farmers.By sorting out the story of the Red Army's grain collection in a village in Jinggangshan,the villagers spontaneously formed a'red cooperative',re-engraved the 'spirit of the shoulders'with the collective labor model, improved the efficiency of rice planting,and reshaped the villagers'sense of identity and action of local culture.

4.1.2. Resource Activation: Creative Transformation of Red Heritage

Red cultural resources are transformed into economic capital through creative design,forming unique competitiveness. The 'Red Star Tea Set'designed by the Tsinghua University team for the Zunyi Conference Memorial Hall symbolizes the'spark of stars'with the hollowing out of the five-pointed star.The pot handle is integrated into the ripple elements of the Chishui River,and the profit is used to maintain the old revolutionary site, forming a closed loop of'cultural protection-commercial development-fund feedback'.More breakthrough is the application of digital technology:Chongqing Hongyan Village uses blockchain technology to cast revolutionary stories into NFT digital collections,and sales revenue is injected into rural education funds.At the same time,AR technology is used to allow tourists to scan code in the field to trigger'red farming'interactive games,such as virtual participation in'mass production movement'to unlock agricultural coupons,so that red cultural tourism and agricultural consumption can be naturally linked.

4.1.3. Industrial Synergy: Building an Ecological Chain of 'integration of Red and Green'

Red culture injects differentiated genes into rural industries and solves the dilemma of homogeneous competition.Based on the ruins of the Shaanxi-Gansu border revolutionary base area, Zhaojin Town in Shaanxi Province has built a three-in-one industrial chain of'red research+ecological orchard+non-heritage workshop':tourists visit the revolutionary memorial hall in the morning,pick apples on the reclaimed land of the Red Army in the afternoon,and experience the production of'Red Star Paper Cutting'in the evening.The integration of"red scene+green industry"makes local apple premium, paper-cut sales increase year by year,and farmers become"red guiders"and"non-heritage craftsmen," realizing the dual upgrading of identity and income.

The essence of the combination of red culture and the revitalization of agriculture is to achieve three breakthroughs through the collaborative innovation of spiritual decoding-technical empowerment-system design:

The value dimension: transforming the revolutionary spirit into consumer identity, and solving the dilemma of'low price competition'of agricultural products;

resource regeneration:activating the sleeping red heritage through digital technology to build a cultural and economic dual cycle;

governance reconstruction:reshape the interest distribution mechanism with red ethics to ensure the dominant position of farmers.

This innovation is not a simple consumption of history,but to make the red gene rejuvenate in the rural revitalization.When the millet in Nanniwan carries the spiritual premium of"self-reliance,"when the revolutionary story on the blockchain is transformed into the rural education fund,the red culture has truly completed the creative transformation from"historical memory"to"development kinetic energy,"and injected lasting spiritual strength into common prosperity.

4.2. Educational Science Popularization+Rural Revitalization: From Knowledge Sinking to Two-Way Empowerment

The combination of education popularization and rural revitalization goes beyond the traditional one-way mode of"sending knowledge to the countryside."By constructing a collaborative ecology of"knowledge sharing-technology transformation-talent cultivation,"it not only solves the shortage of rural education resources,but also feeds back the teaching and research of colleges and universities, forming a closed loop of sustainable development of urban and rural mutual feeding.

4.2.1. Model Innovation: A Practical Framework of Two-Way Empowerment

The rural revitalization practice of educational science popularization needs to break the rigid paradigm of"exper t lectures+experimental demonstrations"and turn to the thr ee-dimensional innovation of"demand orientation-local par ticipation-achievement transformation":

Demand orientation:accurately identify rural needs through field investigation,and develop science popularization courses in a targeted manner;

local participation:farmers are no longer passive listeners,but work with university teams to develop solutions,such as Yunnan farmers and agricultural college students to improve the coffee fermentation process,the acidity of the product is significantly reduced,and the sales price is effectively increased;

achievement transformation: The data and experience accumulated in the practice of popular science are fed back to the teaching of colleges and universities. For example, Huazhong Agricultural University reconstructs the course of "Agricultural Extension"according to the case of rural technology promotion, and the students'practice score is greatly improved.

4.2.2. Typical Case: The Closed-Loop Construction of Knowledge Flow

The 'field laboratory' model (Nanjing Agricultural

University) set up a'farming and reading school'in Sihong County, Jiangsu Province,and moved the ecological agriculture class to the wheat field:

Farmers' classroom: teaching water-saving irrigation, organic composting and other technologies, supporting the development of dialect version operation video;

student project: collecting soil microbial data for scientific research,publishing 4 SCI papers;

product upgrade:to assist in the registration of'Daoxiang Commune'brand, rice premium,driving farmers to increase their income.

Results:Successful training of professional farmers, technology promotion of agricultural use area,and student innovation and entrepreneurship projects won 8 national awards.

The activation mode of'popular science+intangible cultural heritage'(Central Academy of Fine Arts) is to carry out the project of'scientific decoding of Dong brocade'in Dongzhai, southeastern Guizhou:

Technical science popularization:the traditional plant dye process is optimized by chemical dyeing principle,and the color fastness is effectively improved.

Design empowerment:students and embroiderers create modern patterns,and products land in Paris home exhibition;

education feedback:the establishment of'intangible cultural heritage digital gene bank'has become the core case of' traditional craft innovation' course in colleges and universities.

Results:Dong brocade practitioners are younger and attract young people to return home.

The essence of the combination of education populariza tion and rural revitalization is to realize three major transi tions through knowledge reconstruction-technology penetr ation-system innovation: from'giving'to'co-creation':farmers become participants in knowledge production,and univers ity research obtains real scenes;from'blood transfusion'to 'hematopoiesis':the achievements of science popularization are transformed into industrial competitiveness; from'activ ity'to'ecology': building a sustainable urban-rural knowled ge community through digital platform and system design.

When the field becomes an open laboratory,when the embroider patterns board the international booth,when college students and farmers write technical manuals together,education science popularization is no longer a one-dimensional knowledge charity,but a catalyst for the development of urban and rural symbiosis-not only let science take root in the countryside,but also let the countryside feed back education,and write a modern chapter of rural revitalization in a two-way rush.

4.3. Collaborative Innovation of Red Culture+ Popular Science Education+ Agricultural Revitalization: From Spiritual Guidance to Ecological Reconstruction

The deep integration of red culture, popular science education and rural revitalization is creating a new paradigm of rural revitalization-taking the red spirit as the value core,science and technology as the practical tool,and industrial development as the landing carrier to build a'spiritual empowerment-knowledge sharing-economic activation'Trinity of sustainable ecology.This collaborative innovation not only breaks through the limitations of a single field,but also activates the multiplier effect of rural development through cross-dimensional integration.

The deep interweaving of red culture,popular science education and agricultural revitalization marks that rural revitalization has entered a new stage driven by"spirit-knowledge-industry."The value of this model lies in:

Cultural dimension:let the revolutionary spirit rejuvenate in science and technology to help farmers,and solve the dilemma of"museumization"of historical heritage;

the educational dimension:constructing a scene-based learning ecology,so that science popularization can be sublimated from"knowledge transfer"to"value shaping";

economic dimension:through differentiated IP building, break through the homogenization competition of agricultural products,and realize the double value-added of'spiritual premium+ technology premium'.

Visitors learn fluid mechanics by the Chishui River restored by AR.Xiaomi in northern Shaanxi sells best all over the country because of'Nanniwan Spiritual Certification'. Farmers share scientific and technological achievements through blockchain dividends.Rural revitalization is no longer an isolated economic proposition,but a resonance of spiritual rejuvenation, knowledge revolution and industrial transformation-on this land that has been infiltrated by blood,scientific rationality and red faith grow together,writing an idyllic epic belonging to the new era.

5. Conclusion

This study takes the innovative three-dimensional collaborative model as the innovation path, and constructs a practical ecosystem of cultural activation-technology sinking-industry extension'. Through empirical research,it is found that the model has achieved three breakthroughs: in the value dimension, the red gene is decoded into an experiential cultural IP, so that the field of ideological and political education is expanded from the memorial hall to the digital twin space,and the participation is improved.In the technical dimension,a three-level technology transmission system of'university laboratory-county service center-rural service station'was built,and the deployment of agricultural Internet of Things equipment increased,helping the e-commerce sales of agricultural products to make a significant breakthrough;in the industrial dimension,the two-wheel drive mechanism of "voluntary service credit system+entrepreneurial incubation fund"is innovated to cultivate a number of sustainable local brand projects.

The research reveals the deep logic of higher education empowering rural revitalization:the spiritual leading role of cultural elements,the leverage effect of technological resources and the transformation efficiency of industrial carriers form a closed-loop resonance.The data analysis shows that compared with the traditional team,the project survival rate of the university practice team implementing this model is improved,and the coverage of the beneficiary population is expanded,which confirms the exponential improvement effect of'institutional transformation'on the practical efficiency.

However,empirical research also warns of potential risks:in some cases,there is an imbalance between'heavy technology investment and light cultural connotation',and some projects encounter the dilemma of'mismatch of school and land resources'.This requires the establishment of a dynamic monitoring index system and the construction of a three-dimensional evaluation model of'cultural value evaluation-technical adaptation detection-industrial benefit audit'.It is suggested that future research should focus on the development of digital governance platform,the use of

blockchain technology to achieve transparent management and control of resource circulation, and the cultivation of a symbiotic practice community of' college tutors+ local talents+ young makers'.

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