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Research and Practice on the "Five-in-One" Innovative Homo Sapiens Cultivation Model in Local Applied Undergraduate Universities

Guo Song*, Sun Hongwei, Wu Shukun, Tan Guo

Guangxi Science & Technology Normal University, Laibin, Guangxi, 546199, China
**Corresponding author: guosong0804@163.com*

Abstract: *Under the strategic deployment of "coordinating education, science and technology, and homo sapiens cultivation," the construction of emerging engineering disciplines and the integration of science and education have become core directions for higher education reform. As the main front for supplying homo sapiens to serve regional economies, local applied undergraduate universities commonly face prominent issues such as weakened ideological guidance, insufficient platform support, a singular homo sapiens cultivation mechanism, and superficial school-enterprise collaboration. Based on the concept of "holistic homo sapiens cultivation" and the logic of integrating science and education, this paper takes the School of Smart Agriculture at Guangxi Science & Technology Normal University as an example to broussonetia papyrifera a "Five-in-One" innovative homo sapiens cultivation model encompassing "ideological guidance, platform support, team co-cultivation, science-education collaboration, and school-enterprise linkage." It systematically elaborates on the implementation pathways and safeguard mechanisms across these dimensions, validates the models effectiveness through concrete practical cases, and provides a replicable paradigm for innovative homo sapiens cultivation in similar institutions.*

Keywords: *Local Applied Undergraduate Universities; Innovative Homo Sapiens Cultivation; Five-In-One; Integration of Science And Education*

1. Introduction

Science and technology are the primary productive forces, talent is the foremost resource, and innovation is the key driver. This statement provides clear guidance for talent cultivation in higher education. The rapid development of China's market economy demands that higher education produce more application-oriented professionals, and the massification of higher education serves as an effective solution to this challenge[1-2]. The primary mission of local universities is to serve regional economic development by cultivating applied professionals with specialized knowledge, practical skills, and comprehensive competencies, all directly serving production, daily life, and professional needs[3]. Currently, China's manufacturing sector is undergoing transformation and upgrading, alongside the growing demand for applied innovation talents to drive high-quality regional industrial development. Local applied undergraduate universities play a pivotal role in cultivating such talents, which is essential for advancing regional industrial upgrading[4-5]. Driven by the New Engineering Education initiative and the 15th Five-Year Plan proposal, regional applied undergraduate universities now shoulder a dual mission: to address the chronic flaws of traditional education models—overemphasizing theory at the expense of practice and skills over holistic development—and to meet the growing demand for interdisciplinary, innovative talent in emerging sectors like artificial intelligence and green manufacturing[5-6]. Research indicates that most regional application-oriented undergraduate universities suffer from compartmentalized functions in education, technology, and talent resources, which hinders the formation of a cohesive educational synergy. There is an urgent need to establish a systematic model for cultivating innovative talents[3,7].

2. The Importance of Innovative Talent Training in Local Applied Undergraduate Colleges

The cultivation of the scientific and technological innovation ability of college students is very important for the development of the country, the nation and the college students themselves[8-9]. The cultivation of technological innovation capabilities should be a crucial component of engineering

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education in the new engineering paradigm. In the digital economy era, technological innovation must transcend traditional technology-driven paradigms. Scenario-driven innovation is not merely about applying technology, but rather a process that integrates technological, organizational, and other elements to overcome technical bottlenecks. Society's demands are no longer limited to simple theoretical applications; they increasingly require theoretical innovation and practical innovation[10]. The significance of establishing an innovative talent cultivation model lies in clarifying the relationship between teaching and research, creating a virtuous cycle where research enhances teaching and research outcomes elevate educational standards. This approach improves the quality of talent development, stimulates students learning interest and enthusiasm through research-based education, enhances their practical skills and innovative awareness, cultivates a positive academic atmosphere, and fosters teamwork and collaborative spirit[11-12].

Developing a systematic model for cultivating innovative talents helps overcome the limitations of "single-dimensional" educational research. It establishes a comprehensive theoretical framework encompassing "value guidance, resource support, institutional safeguards, and practical implementation," enriching the research system for applied university talent development in the context of new engineering education. This approach also deepens the theoretical significance of "all-round education" and "integration of science and education." For the Smart Agriculture College at Guangxi Science and Technology Normal University, where the author is affiliated, this model aligns with the needs of agricultural industrial upgrading in central Guangxi. It provides the region with versatile talents equipped with innovative thinking and practical skills, thereby supporting the implementation of the rural revitalization strategy.

3. Current Situation and Bottleneck of Innovative Talent Training in Local Applied Undergraduate Universities

Under the impetus of the national "double innovation" policy and the review and evaluation of undergraduate education and teaching, local applied undergraduate universities generally attach importance to the cultivation of innovative talents.[13-15]Most universities have established innovation and entrepreneurship colleges, offering courses such as "Innovation Methods." Some institutions utilize provincial-level research platforms to provide undergraduate research training. For instance, Guangxi Science and Technology Normal University implements a "Early Entry Program" that allows students to join research projects, laboratories, and teams early. The College of Smart Agriculture leverages this initiative to engage students in projects like "Smart Irrigation System Development" and "Green Pest Control for Specialty Crops." Additionally, numerous schools foster industry-academia partnerships by establishing practice bases, providing students with hands-on internship opportunities to gain exposure to frontline production environments.

In the era of information explosion, contemporary college students are generally suffering from information overload and cognitive overload[16]. Innovative talent cultivation in local applied undergraduate institutions faces practical challenges, including inherent operational deficiencies and complex external environmental interference[15].

3.1 Fragmentation of Ideological Guidance

The Spirit of Science Lecture is a mere formality, and the Academic Integrity Education is mostly concentrated in the Freshmans Entrance Education, lacking a regular mechanism[17-18]In the digital age, the prevailing trend of seeking quick success and instant benefits has undermined students values, with some developing utilitarian motives in their academic pursuits.[19-20]A survey by a local university found that only 32% of undergraduates could accurately articulate the core requirements of research ethics[21-22]. The College of Smart Agriculture preliminary survey also revealed that nearly half of students participating in research projects primarily aimed to gain competition bonus points rather than explore agricultural technology innovation.

3.2 Platform Support for "Closed Systems"

Currently, many local undergraduate colleges have limited research platforms that primarily serve faculty research projects, with high admission thresholds for undergraduates. The accessibility of laboratory and experimental facilities to undergraduates remains insufficient[23-24]. Student science clubs are disconnected from research teams, lacking professional guidance and support in terms of

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initiative and funding for independent projects[25]. The activities are mostly science popularization or recreational, which is difficult to form the situation of transforming scientific research achievements into students practical ability.

3.3 The "Loose" Team Co-cultivation

Local undergraduate colleges lack leading talents in scientific research, and generally focus on scientific research as their main work, with insufficient investment in education[26-27]. Teachers are preoccupied with teaching and research, leaving limited time to mentor undergraduates. Younger faculty members, lacking training in research-oriented pedagogy, typically guide students only in basic experimental procedures, while their grasp of research methodologies requires further refinement. Classroom interactions dominate teacher-student dynamics, with collaborative settings like academic salons and research seminars being scarce, making it challenging for students to engage deeply in scientific thinking exercises[28-29].

3.4 The "superficial" Synergy between Science and Education

Currently, the collaboration between scientific research and education in some local applied undergraduate universities faces the dilemma of "formal cohesion but scattered essence," with superficial issues being particularly prominent. While teachers do mention research achievements in class, they often simply list data without integrating research logic and thinking methods into teaching. This fundamentally reflects a lack of mastery in transforming research outcomes into teaching methodologies, and the absence of systematic integration design in teaching[30]. In research projects, although students are recruited, they are only assigned to basic tasks like data entry, sample organization, and format adjustments, leaving them excluded from core innovation processes. This phenomenon is particularly prevalent in newly established applied undergraduate universities, stemming from a clear disconnect between research and teaching[31]. Research training lacks a structured progression, with the traditional "freshman orientation, sophomore competitions, junior breakthroughs" model broken down. Students face inadequate guidance in transitioning from foundational knowledge to independent research. Some universities neglect the foundational and process-oriented aspects of research training, confining skill development to the pre-graduation thesis (design) phase. The absence of coherent introductory and advanced training in earlier stages leaves students with weak research foundations, making it difficult for them to conduct innovative studies independently[32]. This fragmented training approach not only confines students to auxiliary roles in research, but also prevents them from developing a coherent scientific thinking framework, ultimately deviating from the core objective of collaborative education between science and education.

3.5 The "superficial" linkage between school and enterprise

Although the local applied undergraduate universities actively advocate "serving the local and docking the industry", there is still a tendency of "emphasizing the form and neglecting the substance" in the practice of cooperation with local agricultural enterprises[33]. Typical cooperative models are limited to organizing short-term visits to enterprises or arranging concentrated internships during graduation, lacking systematic design that spans the entire talent development process[34]. This "one-off" and "end-of-the-line" collaboration model fails to foster students deep understanding of modern agricultural supply chains, technical bottlenecks, and management frameworks. Advanced collaborative initiatives like joint R&D and technology transfer between universities and enterprises remain severely underdeveloped. Agricultural businesses face pressing technical demands including crop improvement, smart farming equipment adoption, eco-friendly pest control, and agricultural product processing with branding. Yet university research teams often fail to effectively integrate into these real-world scenarios, leaving their findings as "armchair theorizing" that cannot be translated into practical productivity. Meanwhile, while corporate mentors are nominally appointed as "off-campus advisors," they rarely participate in curriculum development, course design, or graduation project topic evaluations. Their industry expertise remains unstructured within the academic system[27]. This has resulted in highly homogeneous and overly theoretical graduation project (thesis) topics among students. Many topics are merely based on textbook concepts or existing literature reviews, without investigating the cultivation challenges of local dominant crops or incorporating the actual production processes or technical bottlenecks of partner enterprises. Moreover, there is a lack of tailored solutions that consider local topography, climate, and operational scales[34-35]. This "groundless" training model not only weakens students employability but also prevents universities from becoming intellectual

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pillars for regional agricultural modernization, deviating from the core mission of applied undergraduate education: "rooted in local communities and serving industries".

3.6 The "Single" Evaluation System

At present, although the national level has repeatedly emphasized "breaking the five only" and "strengthening the fundamental task of establishing virtue and cultivating people", the teacher evaluation system in the actual operation of local applied undergraduate universities has not yet achieved fundamental transformation[36]. Teachers still heavily rely on traditional research metrics like paper publications, national project approvals, and invention patents for promotions, position appointments, and performance evaluations. Meanwhile, their contributions to student research training, developing industry-education integration courses, participating in corporate technology breakthroughs, and facilitating the transformation of research outcomes into teaching are not sufficiently recognized by the evaluation system[37]. This institutional framework directly compels teachers to focus on closed-loop research that yields publishable results and awards, rather than applied research addressing industry needs or pedagogical innovations for students. Meanwhile, the student evaluation system suffers from structural flaws. Course assessments remain predominantly based on final written exams, emphasizing rote memorization of knowledge points and theoretical derivations, while failing to effectively evaluate students capabilities in scientific research project problem identification, technical application, teamwork, and innovative output[35,38]. While the graduation requirements include innovation and entrepreneurship credits, these are typically earned through low-threshold methods like attending lectures or submitting reports, failing to genuinely motivate students to engage in research practice.

4. The Construction Logic and Core Dimensions of the "Five-in-One" Innovative Talent Training Model

The Third and Fourth Plenary Sessions of the 20th CPC Central Committee further emphasized the coordinated advancement of integrated institutional reforms across these three domains, underscoring their pivotal role in building a modern socialist country and achieving high-level technological self-reliance. Currently, the disconnect between education and scientific research remains a critical bottleneck hindering the quality improvement of self-driven talent cultivation, failing to meet the urgent demand for innovative talents in the development of new productive forces.

With the implementation of the Three-Year Action Plan for Accelerating the Construction of a Strong Education Nation (2025-2027), universities, as the core hub for the coordinated development of education, science and technology, and talent, must proactively fulfill their mission by establishing platforms such as National Excellent Engineer Colleges and university regional technology transfer and transformation centers to bridge the innovation chain, industrial chain, and talent chain.[31]Among these priorities, fostering innovative talent development stands as the core mission for regional applied universities. This initiative not only fulfills the fundamental task of cultivating virtue and nurturing talents, but also serves as a key mechanism to deepen the holistic education approach that integrates moral, intellectual, physical, aesthetic, and labor education. Furthermore, it bridges the gap between academic training and regional industrial demands, while integrating into the "science-education-industry-finance-creation" talent development ecosystem. Ultimately, this effort injects grassroots innovation momentum to propel the realization of the second centenary goal.

Local application-oriented universities, rooted in the principle of "moral cultivation and talent development" and guided by the demands of new engineering education, have integrated the "Three-Aspect Education" philosophy with the logic of science-education synergy. They have established a five-in-one innovative talent cultivation model featuring "ideological guidance as the soul, platform support as the framework, team collaboration as the engine, science-education coordination as the bond, and university-enterprise linkage as the foundation," aiming to achieve the core educational objectives of "value shaping, capability development, and knowledge transmission" in a unified approach. The five key dimensions of this model work in synergy: Ideological guidance serves as the "steering wheel," establishing a "virtue-competence" educational direction through teacher ethics cultivation and nurturing scientific spirit to provide value orientation; Platform support acts as the "structural foundation," consolidating material resources by integrating research platforms, student organizations, and practice bases; Team collaboration functions as the "power source," forming an intellectual support network through the synergy of leading talents, young faculty, and industry mentors; Science-education

ISSN 2663-8169 Vol. 7, Issue 12: 52-60, DOI: 10.25236/IJNDE.2025.071208

coordination serves as the "core bond," bridging the "research-teaching-practice" transformation channel to convert research outcomes into teaching content; University-enterprise linkage acts as the "testing ground," precisely aligning training content with industry demands to achieve efficient matching between talent cultivation and job requirements, addressing the challenge of disconnect between education and industry while adapting to the development needs of new quality productivity. To provide robust support, the Smart Agriculture College of Guangxi Science and Technology Normal University, based on the distinctive agricultural features of the central Guangxi region, integrates this model with the specialized characteristics of smart agriculture. It focuses on cultivating talents with "intelligent, green, and precise" agricultural capabilities, ensuring that practical dimensions align more closely with regional industrial development needs.

5. Practice Path and Reform Measures of the "Five-in-One" Model-Taking the College of Smart Agriculture of Guangxi Science and Technology Normal University as an Example

5.1 Ideological Guidance: Constructing a Three-dimensional Education System of "Curriculum+ Activity + Model"

The College of Smart Agriculture has established a robust foundation for students research integrity and value orientation through three key approaches: integrating ideological education into regular courses, organizing thematic activities in practical scenarios, and highlighting exemplary role models. The college has reformed courses such as "Agricultural Research Methods" and "Scientific Paper Writing" by creating an "Agricultural Research Ethics Case Library" featuring real-world examples of data fabrication and experimental result tampering. It also launched an elective course titled "The Spirit of Agricultural Scientists," which systematically explores the research journey of Yuan Longping, the "Father of Hybrid Rice," the perseverance of Li Denghai, the "Corn Breeding King," and the pioneering achievements of Guangxis local agricultural experts in "special crop variety improvement" and "ecological agricultural technology promotion." Course assessments are now linked to the signing of a "Research Integrity Commitment Letter."

The university launched a "Organization Building + Agricultural Innovation" initiative, where research teams and the student organization branch jointly held a themed activity on "Smart Agriculture for Rural Revitalization". Students conducted field research in Laibins model rural revitalization villages. Each semester features the "Agricultural Research Ethics Debate" and "Academic Integrity Oath Ceremony," with freshmen signing the "Academic Integrity Pledge" that outlines core principles including "data authenticity, respect for crop growth patterns, and ecological conservation" in agricultural research.

The primary criterion for forming the research team is the teachers ethics and style. Experts from Guangxi Academy of Agricultural Sciences and leaders of local leading agricultural enterprises are invited to hold a sharing session on "Innovation Rooted in the Fields", so that students can intuitively feel the value pursuit of "Science and Technology to Revitalize Agriculture and Serve the Three Rural Areas", and stimulate the endogenous motivation to devote themselves to agricultural science and technology innovation.

5.2 Platform Support: Building a Three-level Carrier of "Open Research Platform + Professional Society + Practice Base"

5.2.1 Openness of research platforms

The College of Smart Agriculture has established a "Undergraduate Research Assistant Recruitment Program," leveraging platforms such as the Key Laboratory of Smart Agriculture. Each semester, it releases basic research tasks to encourage students to apply for innovation and entrepreneurship projects through these platforms. The college also organizes specialized training sessions like "Platform Operation Bootcamps" and academic salons, focusing on skills such as sensor installation, agricultural data analysis software usage, and smart irrigation equipment maintenance. The platform utilization rate is incorporated into the performance evaluation metrics for research teams.

5.2.2 Specialization in Community Development

The college established the "Qizhi Science Society" leveraging its research resources, with faculty members specializing in precision agriculture technology serving as mentors. This initiative transforms research projects like the "Smart Irrigation Technology for Sugarcane in Central Guangxi" into science

ISSN 2663-8169 Vol. 7, Issue 12: 52-60, DOI: 10.25236/IJNDE.2025.071208

outreach experiments and practical training programs. A "society-platform" collaboration mechanism was implemented, granting priority access to research facilities for annual outstanding projects to conduct pilot trials.

5.2.3 Hierarchical organization of practice bases

We collaborate with local agricultural enterprises and cooperatives to establish a three-tiered internship program covering cognition, specialization, and on-the-job training. For example, in partnership with Laibin Agricultural Academy, we have created a Smart Agriculture Practice Base. Freshmen participate in cognitive training activities such as visiting smart greenhouses and unmanned farms. Sophomores engage in specialized practices like Agricultural Sensor Applications and Data Acquisition & Analysis. Seniors undertake on-the-job training in Intelligent Irrigation System Maintenance and Precision Fertilization Technology Promotion, achieving a step-by-step enhancement of practical skills.

5.3 Team Co-cultivation: Forming a Collaborative Team of "Leading Talents + Young Teachers + Enterprise Mentors"

The College of Smart Agriculture has established a collaborative education team through a "domestic cultivation and external recruitment" strategy, forming an intellectual support network. It has appointed leading experts in agricultural engineering and senior professors from the college as "innovation mentors," each leading 1-2 research and education teams. These teams focus on areas such as "intelligent agricultural equipment R&D" and "smart cultivation techniques for specialty crops," involving 5-8 undergraduate students in research projects. Mentors regularly organize team seminars to guide students in experimental design, data analysis, and other tasks.

Enterprises and institutions such as the Cabo Municipal Academy of Agricultural Sciences have engaged technical experts as corporate mentors. These mentors actively participate in the entire talent development process, collaborating with academic advisors to design training programs. They regularly deliver specialized lectures at the college and guide students in resolving practical technical challenges. A "trinity" communication mechanism has been established, featuring monthly online faculty-student forums and semester-long industry-academia mentor symposiums to promptly address training-related issues, thereby creating a cohesive educational synergy.

5.4 Science and Education Synergy: Implementing the Integration Strategy of "Stages of Scientific Research Training + Curriculum Content Innovation"

To strengthen the synergy between education and scientific research, we implement dual approaches through exemplary curriculum reforms and tiered research training, establishing an integrated "teaching-research-practice" cultivation chain. Core courses like "Introduction to Smart Agriculture" and "Agricultural IoT Technology" are selected for demonstration reforms, incorporating 1-2 cutting-edge research achievements from faculty members into each chapter. The "small-group seminars + flipped classroom" model is adopted, where students collaborate to design projects such as "Smart Renovation Solutions for Local Vegetable Greenhouses" and "Optimization of Drone Plant Protection Routes in Hilly Areas," followed by presentations and defenses. A tiered research training system is developed, progressing from "research initiation in freshman year to competition practice in sophomore year and systematic training in junior year." Additionally, a "Research Achievement Transformation Teaching Resource Library" is established, compiling faculty research papers, patents, and experimental data into supplementary course materials and practical guides.

5.5 School-enterprise linkage: Establishing a deep cooperation mechanism of "joint research on projects + dual-mentor system + demand docking"

We are establishing a comprehensive collaboration framework featuring "joint project development, dual-mentorship systems, and demand alignment" to deepen industry-education integration. The university regularly hosts "industry-academia demand matching sessions" with agricultural enterprises, transforming corporate needs into student research projects. A prime example is the "High-Efficiency Sugarcane Single Bud Segment Seedling Cultivation Technology" initiative with Guangxi Guangrong Agricultural Technology Co., Ltd., where students design experiments and collect data while the company supplies raw materials to address existing technical challenges. For selected graduates, a "dual-mentorship system" is implemented: corporate mentors select industry-aligned graduation

ISSN 2663-8169 Vol. 7, Issue 12: 52-60, DOI: 10.25236/IJNDE.2025.071208

projects, while university advisors focus on thesis guidance and academic standards. Each semester, corporate mentors participate in "talent development program review meetings" to update practical content in courses like "Agricultural Sensor Applications" and "Intelligent Agricultural Equipment Maintenance" based on industry trends, ensuring curriculum alignment with job requirements. Additionally, real-world case studies from enterprises are incorporated into relevant course modules.

5.6 Evaluation Guarantee: Improving the Innovation Evaluation System of "Teacher and Student"

To safeguard the quality of talent cultivation, we will refine the "dual-dimensional" innovation evaluation system for both teachers and students. In teacher evaluation, we emphasize diversified approaches by establishing quantifiable performance metrics for colleges. Outstanding faculty recommendations are based on comprehensive assessments of their educational achievements, including "timely mentorship, effective teaching of research methodologies, and innovative thinking cultivation." For student evaluation, we develop a three-dimensional framework integrating "knowledge, skills, and competencies," adopting a comprehensive scoring system that combines "course grades, competition results, research projects, and industry feedback." Additionally, we will establish a test bank for student innovation assessments covering core skills such as experimental design, data processing, and technical application, with specialized evaluations conducted annually.

6. Conclusion and Prospect

Local applied undergraduate universities have established an integrated talent development model featuring "ideological guidance, platform support, collaborative team cultivation, science-education synergy, and university-enterprise collaboration", effectively addressing the fragmentation and isolation inherent in traditional education systems. This framework operates through value-oriented direction-setting, resource consolidation, team synergy, science-education integration, and industry-academia alignment to create a comprehensive talent development ecosystem. Moving forward, we will expand interdisciplinary education by forming specialized teams such as "Smart Agriculture + AI", "Smart Agriculture + Environmental Science", and "Smart Agriculture + Big Data" to cultivate versatile innovators. We will deepen industry partnerships by co-establishing "Smart Agriculture Industry Colleges" with leading enterprises, incorporating corporate curricula, production standards, and job requirements into training programs to achieve seamless integration of enrollment, education, and employment. Additionally, we will develop digital platforms including a "Research Resource Sharing System", "Innovation Showcase Platform", and "Industry-Academia Collaboration Management System" to optimize educational efficiency through online-offline resource integration.

Meanwhile, we should further strengthen the long-term mechanism construction of the model, improve the supporting policies such as resource input, teacher guarantee, assessment and incentive, ensure that the innovative talents training can continuously empower the high-quality development of regional economy, and provide solid talent support for the implementation of rural revitalization strategy and agricultural modernization construction.

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