Education Insights

Article

The Approach to Constructing "Golden Courses" in Higher Vocational Education within the Context of New Quality Productivity: A Case Study of the Course "Virtual Instrument Technology"

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Abstract: Under the background of new quality productivity, this paper analyzes the coupling logic between the construction of "Golden Courses" in virtual instrument technology and new-quality productivity. Based on the four dimensions of technological foundation, production factors, value creation, and industrial ecology of new-quality productivity, it proposes a systematic reconstruction of the curriculum system with innovation as the guide and technological integration as the cornerstone. Simultaneously, it provides practical paths from four aspects: reconstructing curriculum objectives with technology as the guide and industry demand as the driver; innovating teaching content through curriculum linkage and industry-education integration; dynamically optimizing curriculum resources through school-enterprise collaboration; and innovating teaching models with value as the driving force. It aims to cultivate students' system integration practical skills, engineering thinking, and innovative abilities. While exploring the value-added aspects of the curriculum, it helps students achieve personal value leaps, providing reference ideas and feasible solutions for the construction of "Golden Courses" in higher vocational colleges.

Keywords: new quality productivity; vocational education; "golden course" development; virtual instrument technology; innovation orientation; technology integration

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1. Introduction

In recent years, the concept of "new quality productivity" has increasingly emphasized the integration of industrial development with talent cultivation. Strategic planning in emerging industries and the upgrading of traditional manufacturing sectors has highlighted the need for expanding and optimizing vocational education programs at secondary, higher, and undergraduate levels. This creates both opportunities and challenges for the development of vocational education, particularly in terms of curriculum design, faculty development, and resource allocation.

In this context, the curriculum has become a central element in the cultivation of skilled personnel. The development of vocational college courses must closely align with technological advancements and digital transformation in industry, emphasizing the cultivation of practical skills, problem-solving abilities, and innovative qualities. Curriculum system reform should follow high-quality standards, including the development of model courses, exemplary teaching resources, and well-trained instructors, to effectively meet the demand for skilled technical personnel and promote the formation of new productive capacities in modern industries [1].

2. The Connotation and Characteristics of New Quality Productive Forces

2.1. The Connotation of New Productive Forces

New-quality productive forces are an important development concept proposed by China in the context of the new era. They have profound connotations and strategic significance. From a theoretical perspective, they expand the Marxist theory of productive forces; from a practical perspective, they provide guidance for China's high-quality development process [2]. New-quality productive forces are productive forces driven by technological innovation. They have the characteristics of high efficiency and high quality. They are a form of productive forces that breaks through the traditional growth path and meets the requirements of high-quality development [3]. They represent a qualitative leap in the level of productive forces and give rise to new laborers, new objects of labor and new means of labor in this process [4].

2.2. Core Characteristics of New Productive Forces

New-type productivity, as the core driving force leading high-quality development, essentially lies in reshaping the factors and structure of productivity through technological innovation, achieving a qualitative leap in productivity, and promoting high-quality economic and social development. Its core characteristics can be understood from the following dimensions.

First, technological innovation: disruptive technological breakthroughs. The "new" in new quality productivity is anchored in seizing the new track of strategic emerging industries and future industries with breakthroughs in key disruptive technologies, and getting rid of the "bottleneck" dilemma in key core technology fields, thereby further enhancing China's independent innovation capability in science and technology [5].

Second, key support: deep innovation of production factors. The "quality" of new quality productivity emphasizes the breakthrough of key disruptive technologies under the premise of adhering to the essence of innovation-driven development. Such technological breakthroughs and technological innovations will be applied in production through the combination with laborers, labor objects and labor means, thereby generating a stronger innovation driving force, fully demonstrating the innovation-driven essence of new quality productivity. In short, technological innovation drives production innovation, and the doubling of production efficiency leads to deep innovation of traditional production factors. The core changes of production factors are reflected in: laborers have changed from technical laborers to knowledge-based, skilled and innovative laborers; labor objects have changed from " physical resources " to " virtual + physical integration "; and labor means have changed from "mechanical" to "intelligent" [6].

Thirdly, industrial carriers: the transformation and upgrading of a modern industrial system. New-quality productivity emphasizes the active cultivation of "strategic emerging industries" and "future industries," indicating a close connection between new-quality productivity and industrial structure upgrading. New-quality productivity focuses on tracks such as next-generation information technology, biotechnology, new materials, and high-end equipment to create future growth engines; it also transforms and upgrades traditional industries through digitalization and green technologies, laying the groundwork for future industries.

Fourth, the development logic: the systematic reconstruction of the innovation ecosystem. The essence of new quality productivity is innovation-driven, which is to give full play to the first factor of science and technology, the first resource of talent, and the first driving force of innovation. Compared with traditional productivity, new quality productivity has key characteristics such as new fields involved, high technology content, excellent factor allocation, and environmental friendliness [7].

3. The Connotation and Essential Characteristics of "Golden Courses" in Vocational Education

In order to adapt to the new quality of productivity and meet the connotation requirements of deepening the high-quality development of vocational education, the curriculum, as the basic unit of the teaching system, solves the fundamental problems in the field of education and teaching from the micro dimension and is the key support for talent cultivation [8]. In November 2018, the leaders of the Higher Education Department of the Ministry of Education summarized the standards of " Golden Courses " as " two characteristics and one degree " at the 11th China University Teaching Forum, namely , high level, innovation and challenge [9]. It was summarized that the "golden course" classroom mainly consists of five elements: advanced classroom, dialogue classroom, open classroom, integration of knowledge and action, and integration of learning and thinking [10].

By deeply analyzing the core connotations and essential characteristics of "Golden Courses" , and considering the training characteristics of vocational education aimed at cultivating high-quality technical and skilled personnel, this paper proposes that the construction of "Golden Courses" in vocational education can be promoted from three dimensions: First, teaching objectives should align with industry needs, emphasizing the cultivation of practical skills and job competence, and possessing a high level of sophistication. Second, teaching content and resources should reflect industry-education integration, focusing on the advanced and cutting-edge nature of technical skills, and possessing a challenging level of difficulty. Third, the teaching model should be "student-centered," respecting individual differences, and employing diversified methods to present advanced and interactive content, possessing innovation. This will create high-level classrooms, dialogue classrooms, and open classrooms, achieving the integration of knowledge and practice, and the combination of learning and thinking throughout the entire teaching process.

4. A Coupled Logic Analysis of New Productivity and the Construction of "Golden Courses" in Virtual Instruments

4.1. The "Demand-Driven" Effect of New-Quality Productivity on the Development of "Golden Courses"

Education, science and technology, and talent are important structural elements of the social system. The cross-integration of the three is the key path to cultivate and develop new productive forces. As the demand for technological innovation from new productive forces continues to increase, the boundaries of future industrial structure will become more flexible [11]. This poses new requirements for the quality and standards of talent cultivation in higher vocational education.

Specifically, the development of new-type productivity urgently requires highly skilled technical personnel with a forward-looking vision, interdisciplinary thinking, and original innovation capabilities. This directly necessitates that the construction of "Golden Courses" in higher vocational colleges must highlight the characteristics of "advanced level" and "innovation." "Advanced level" is reflected in the need for higher vocational courses to transcend traditional knowledge transmission, focusing on cultivating complex problem-solving, critical thinking, and systematic decision-making abilities. "Innovation" requires that curriculum systems, teaching methods, and evaluation mechanisms break away from path dependence, integrating cutting-edge scientific and technological achievements and industry practice cases to stimulate students' innovative potential. At the same time, the pace of technological iteration on which new-type productivity depends is constantly accelerating, with emerging industries and business models constantly emerging. This requires higher vocational "Golden Courses" to set reasonable levels of challenge. By introducing real-world engineering problems or research topics with exploratory and uncertain aspects, students are guided to actively adapt, iterate their learning, and reconstruct their knowledge system in a dynamically changing learning environment. This cultivates their ability to respond quickly to technological changes and market demands, ensuring a dynamic match between talent supply and industrial development.

4.2. The "Talent Support" for New Productivity from the Development of Virtual Instrument "Golden Courses"

Virtual instrument technology, with its software-defined core characteristics, is expanding from traditional testing and measurement fields to a wider range of areas during the current industrial upgrading and technological transformation, encompassing high-end manufacturing and metrology, communication and information technology, industrial automation and digital transformation, and energy and power systems. The development of "Golden Courses" in virtual instrumentation precisely addresses the development needs of key areas of new quality productivity, cultivating students' mastery of measurement techniques based on advanced instrument platforms, data acquisition and analysis methods, and cross-domain system integration and optimization capabilities. These core capabilities directly match the talent needs of key areas of new quality productivity, such as quality inspection and process control in intelligent manufacturing; virtual production line debugging, equipment condition monitoring and data analysis in industrial automation; and power system testing and energy efficiency optimization in new energy vehicles.

High-quality technical and skilled personnel cultivated through "Golden Courses" can quickly integrate into industrial practice and become the core human resource carrier for the development of new productive forces, thereby achieving deep coupling between the education chain, talent chain, industrial chain, and innovation chain.

5. The Concept of Building "Golden Courses" for Virtual Instruments under the Background of New Quality Productivity

Against the backdrop of new-type productivity, the development of virtual instrument "Golden Courses" starts from the technological foundation of the electronic information industry, guided by innovation and based on technological integration, deeply promoting industry-education integration and systematically reconstructing the curriculum system. From the perspective of industrial production factors, it connects the industrial production data chain, focusing on cultivating students' system integration capabilities and data literacy. It transforms the teaching model based on the value creation of new-type workers, exploring the added value of individual and course value. From the perspective of the industrial ecosystem, it uses integrated hardware and software solutions as a breakthrough point for skills training, focusing on cultivating students' knowledge integration and application abilities and problem-solving skills. Through this multi-dimensional collaborative approach, the development of "Golden Courses" is propelled to new heights.

5.1. Technological Foundation Dimension: Deep Integration of Intelligence and Digitalization

New quality productivity is generated by technological revolutionary breakthroughs, innovative allocation of production factors, and deep transformation and upgrading of industries. Its technological foundation is manifested in the deep integration of artificial intelligence, digital technology and the real economy. In order to adapt to the new quality relationship of productivity, taking technological integration as the starting point, in the process of building virtual instrument "Golden Courses", we should deepen the integration of industry and education, based on the technological foundation and industrial upgrading and transformation, systematically reconstruct the curriculum system, dynamically adjust the curriculum objectives and teaching content, update digital resources, introduce artificial intelligence technology to innovate the curriculum teaching mode, evaluation system, etc., so that the curriculum reform is synchronized with the industry technology iteration, thereby improving the adaptability of new quality workers to new technologies and new industries.

5.2. Production Factor Dimension: Core Resource Requirements for Data-Driven Development

In the digital economy era, data is the most core factor of production. New quality productivity mainly takes information and data resources that can be infinitely recycled as new objects of labor. Information and data not only inject new objects of labor that can be infinitely recycled into the factor system of new quality productivity, but also inject new production tools. The value creation capability of data resources far exceeds that of traditional factors of production. Therefore, in the process of building "Golden Courses", we should emphasize the connection of the data chain in the production process and attach importance to the cultivation of students' data literacy and system integration ability, in combination with the production process of intelligent manufacturing and information technology industry.

5.3. Value Creation Dimension: Innovation-Driven Value Leap

The essence of new-quality productivity is innovation-driven, following the logical main line of productivity development: "technological innovation - structural change - efficiency transformation". In the process of realizing the value leap of productivity driven by innovation, high-quality technical and skilled personnel, as innovative human capital, are the key elements of productivity innovation-driven development. Coupling productivity value creation with the personal value creation of workers is an issue that vocational education talent training needs to consider.

With the upgrading of labor objects, tools, and factors of production in the new productive forces, and the acceleration of scientific and technological innovation and industry iteration, the new workers trained by vocational education should not only remain at the operator level, but should also master various intelligent and digital tools and play the role of system optimizer or decision-maker. While serving the value creation of new productive forces, they should realize the leap of personal value from "operator → tool user → system decision-maker ". This idea provides a clear logic for talent cultivation in creating professional "Golden Courses".

Therefore, in the process of building innovation-oriented "Golden Courses", while emphasizing technological and content innovation, we should also explore the leap of students' personal value and the enhancement of course value through innovative teaching models.

5.4. Industrial Ecosystem Dimension: Cross-border Integration and Networked Collaboration

New quality productivity is the fundamental result of the cross-integration breakthrough of scientific and technological innovation. With the rapid development of information technology and modern high-tech industries represented by it, the boundaries of industries have gradually become blurred, and promoting industrial integration has become an inevitable choice to lead a new round of industrial transformation. In the process of upgrading the intelligent manufacturing and information technology industries, the characteristics of multi-technology integration, networked collaboration, and knowledge intensity have been presented, forming an ecosystem of "hardware + software + service". Therefore, in the process of building virtual instrument "Golden Courses", in combination with the characteristics of the courses, the software and hardware integrated solution is used as the breakthrough point for ability training, and cross-disciplinary and cross-course comprehensive projects are developed to cultivate students' ability to integrate and apply knowledge and their ability to solve problems.

6. Practice in Building a "Golden Course" for "Application of Virtual Instrument Technology"

6.1. Technology-Led, Reshaping Curriculum Objectives

The Virtual Instrument Technology course aims to align with the development of intelligent detection systems and intelligent system integration positions in the electronics and information technology industry. Guided by industry technological development and driven by industry needs, it emphasizes the technological integration during the industry's digital transformation, focusing on the electronics and information industry's demand for new types of workers capable of integrating multiple technologies to solve system problems, as well as cultivating students' data literacy and engineering thinking. Therefore, the course objectives are designed with the concept of "combining technological dynamism with the cultivation of multifaceted abilities," constructing a three-tiered objective chain of "basic operation→system integration→innovative application." The specific objectives of the course are shown in Table 1.

Table 1. Course Objectives for "Application of Virtual Instrument Technology".

Overall goals	This program aims to cultivate high-quality technical and skilled personnel who can skillfully use virtual instrument technology to build data acquisition systems, combine embedded technology and network technology to achieve intelligent terminal system integration, possess multi-technology integration capabilities from basic operation to system integration to innovative applications, and meet the job requirements of intelligent detection system development and intelligent system integration .	
Knowledge Objectives	**Skill Objectives**	**competency goals**
1. Understand the cutting-edge developments in virtual instrument technology and master the composition and characteristics of virtual instrument systems. 2. Master LabVIEW programming methods and the use of classic program architectures. 3. Master the usage of common sensors, as well as the functions and interface specifications of virtual instrument hardware boards. 4. Master the basic architecture of virtual instruments and the construction methods of data acquisition systems. 5. the usage of common communication protocols (serial communication, Modbus TCP).	6. **Basic operational skills**: Proficient in operating NI myDAQ/CompactRIO to complete signal acquisition, conditioning and analysis. 7. **System integration skills: Able to** use LabVIEW to develop host computer systems by combining embedded technology; able to independently deploy data link channels from data acquisition to data upload to the cloud, and realize data visualization and analysis on the cloud platform. 8. **Innovative application skills** : Able to optimize the data processing chain for specific scenarios; capable of knowledge transfer, and able to apply the experience of developing intelligent detection systems to cross-domain scenarios such as agriculture and medicine .	1. Able to establish modular programming concepts, possess basic data literacy, engineering systems thinking, and critical thinking skills. 2. Possesses excellent communication and teamwork skills.

6.2. Integrating Courses to Innovate Teaching Content

Adhering to the concept of technology integration and aligning with job competency maps, the curriculum innovatively proposes the idea of "course linkage based on a professional course cluster system." This involves using integrated hardware and software solutions as a breakthrough point for competency training, constructing a multi-course collaborative teaching design, and breaking down barriers between professional courses. A comprehensive project is jointly developed with the professional course "Embedded Measurement and Control Product Design," integrating knowledge points related to communication and network technologies. The course content is redesigned with a design logic of "software programming→hardware understanding→system integration→industry application," focusing on cultivating students' knowledge integration and problem-solving abilities.

Based on real-world enterprise engineering cases, the course organizes its content into three modules according to three typical application scenarios: temperature acquisition system design, smart home environmental monitoring system design, and smart workshop equipment monitoring system design. The course content progresses step-by-step, closely revolving around data acquisition, processing, and analysis. Leveraging the technical integration between intelligent detection system development and intelligent system integration roles, a complete data chain is constructed: data acquisition→front-end preprocessing→data transmission→cloud storage→data visualization and analysis . The course effectively cultivates students' data literacy and system integration capabilities, enabling them to progress from front-end hardware data acquisition to terminal cloud platform visualization and analysis.

Through the above teaching project design, the course can realize a value advancement capability framework of "dynamic technological adaptation, hierarchical and progressive ability development, and deep integration of industry and education," and help students gradually achieve the personal value leap from "operator→tool user→system decision-maker ." It comprehensively cultivates students' ability to apply virtual instrument technology to solve engineering problems, thereby supplying the electronics and information industry with a new type of workforce that "understands principles, knows how to integrate, and can innovate." The value advancement capability framework constructed based on the course content is shown in Figure 1.

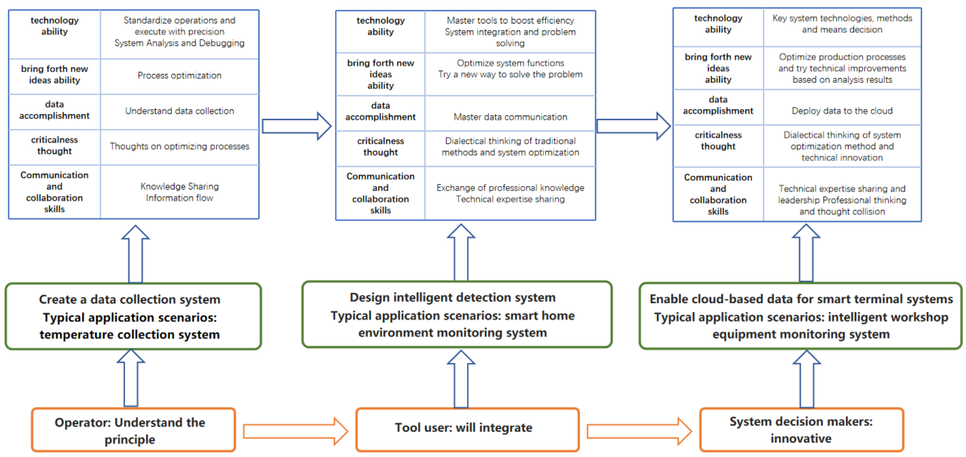

Figure 1. Value Advancement Competency Framework for Course Construction.

6.3. University-Enterprise Collaboration for Dynamic Resource Optimization

By expanding and deepening cooperation with enterprises in the electronic information industry through university-enterprise collaboration, resources are shared and information is exchanged, and teaching resources are continuously updated and optimized to ensure the cutting-edge nature and practicality of courses. The specific process of dynamically optimizing resources through university-enterprise collaboration is implemented through resource co-construction mechanisms, dynamic adjustment mechanisms, collaborative development mechanisms, effect evaluation mechanisms, and long-term cooperation mechanisms, as shown in Figure 2.

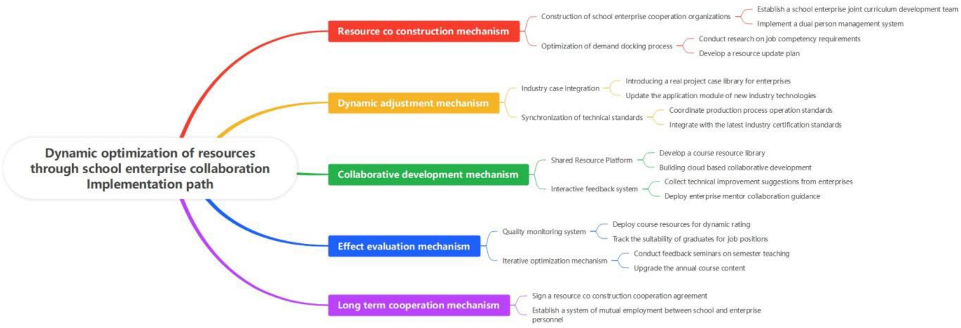

Figure 2. Schematic diagram of the dynamic resource update mechanism for school-enterprise collaboration.

6.4. Value-Driven, Innovative Teaching Models

To adapt to the new productivity's demands on the skills of new workers, the course is driven by the discovery of student value. It breaks away from traditional standardized teaching and adopts diversified teaching models, including blended online and offline teaching, modular teaching, and tiered teaching. It implements the "student-centered" educational philosophy and explores ways to enhance the value of the course while enabling students to leapfrog their personal value.

1) Blended learning

The teaching process relies on the national online open course platform and the NI virtual instrument joint training room, and carries out in-depth online and offline blended teaching in three stages: before class, during class, and after class.

2) Modular teaching

Modular teaching is implemented based on three typical industrial application scenarios. Module 1 is completed under the guidance of the course instructor and mainly adopts online and offline teaching methods. Module 2 adopts a collaborative teaching approach with the embedded systems course, with "course linkage and teacher collaboration." The implementation process is jointly guided by the instructors of the two courses, each with its own focus, and they collaborate throughout the process. This breaks down the barriers between courses and helps students initially establish engineering thinking for system integration, realizing the transformation from fragmented knowledge to systematic capabilities. Module 3 adopts a "school-enterprise co-education and professional and part-time collaboration" teaching method, with professional teachers and enterprise teachers participating throughout the process. Students ultimately go to the enterprise to accept and evaluate the project results, ensuring seamless integration of industrial field system integration during the project implementation process.

3) Differentiated instruction

The course adheres to a student-centered approach and implements differentiated instruction. It accurately assesses student learning through pre-class tests and big data analysis, sets individualized goals based on student needs, and implements goal-based differentiation. Based on these goals, pre- and post-class learning content is delivered through the online course platform, implementing content-based differentiation. The practical tasks across the three modules are also differentiated, implementing task-based differentiation. Furthermore, differentiated assessment methods are designed to ensure accurate evaluation of learning outcomes at each level, protect student self-esteem and enthusiasm, and respect individualized development, implementing differentiated assessment. Simultaneously, the course continuously and flexibly adjusts goals, content, and methods based on students' learning progress, helping students improve their abilities while meeting their emotional needs and achieving personal value enhancement. This value-driven, diversified teaching model is shown in Figure 3.

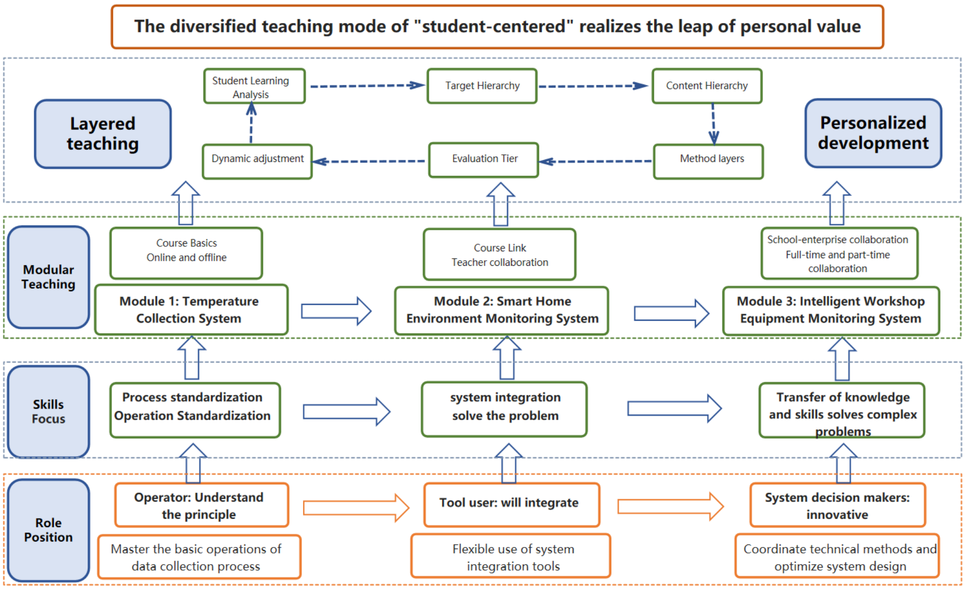

Figure 3. Schematic diagram of value-driven diversified teaching model.

7. Conclusion

Through theoretical research on the connotation and core characteristics of new quality productivity, combined with the current theoretical achievements and experiences in the construction of "Golden Courses" in vocational education, this paper deeply analyzes the coupling logic between the construction of " Golden Courses " in virtual instrument technology and new quality productivity , and summarizes the practical path of the construction of " Golden Courses " in virtual instrument technology. The aim is to provide a systematic construction concept and ideas for the continuous improvement and optimization of the course in the future, so as to promote the close link between the construction of "Golden Courses" in vocational education and industrial transformation.

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