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Research on the "Involution" Mechanism of Industry-Education Integration in China's Vocational Education

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Abstract: *The industry-education integration(IEI) is an ideal goal for vocational education to develop high-quality technical and skilled personnel. At present, IEI in China's vocational education has fallen into a development pattern of "involution" with "growth without development". This paper focused on the "involution" mechanism of IEI to promote the sustainable development of IEI in China's vocational education.For this purpose, We introduced the instrumental analytical value of "involution" and incorporated the "involution" into the scope of cross-organizational knowledge management of Industry-Education Integration; and we constructed the Cross-organizational Learning Cycle Model (COLCM) of IEI, which is a combination of the SECI model and the OLC model, and developed a quantitative model of enterprise input-output ratio of IEI based on the knowledge spillover effect. Through our research, we found that IEI is falling into an "involution" development pattern of "growth without development" in China's vocational education. The reason for this "involution" is that the current pathways of IEI are challenging to effectively establish a positive ratio of enterprise input-output mechanisms. This challenge is manifested in the most significant development dilemma faced by IEI in China's vocational education—referred to as "positive schools and negative enterprises." This dilemma is characterized by a development pattern where "external conditions" are limited, and the "internal process" is locked into current pathways. To promote the sustainable development of IEI, it is necessary to build new pathways that can effectively establish a positive ratio of enterprise input-output mechanisms.*

Keywords: *Vocational Education, Industry-Education Integration, Involution, Knowledge Management, Organizational Learning*

1. Introduction

"Involution" is a concept used more frequently in the cognition of culture, economy, politics, education and other social activities, which is mainly used to characterize the development phenomenon that "when something has reached a certain development pattern, it neither stabilizes nor develops into a newer form, but is replaced by a continuous refinement and complication of internal process"[1], which is mainly used to express a point of view that "existing efforts or reforms do not lead to actual effective development"[2].

The industry-education integration(IEI) has become the ideal goal of China's vocational education for the development of high-quality technical and skilled personnel because it better interprets the "cross-border" attribute characteristics of vocational education. In order to deepen IEI, China's vocational education is carrying out multi-channel pathways exploration and practice. However, due to the superimposed influence of internal and external factors, the pathways of IEI in China's vocational education has created different degrees of development difficulties, which restricts the re-enhancement of the quality of China's vocational education in the development of high-quality technical and skilled personnel. IEI in China's vocational education is falling into an "involution" development pattern of "growth without development".

Based on the research logic of posing problems, analyzing problems and solving problems, we want to explore the mechanism of the current "involution" development pattern of IEI in China's vocational education by introducing the instrumental analytical value of the "involution", in order to provide help for the strategies construction of the current pathways optimization and the future pathways

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Exploration. It aims to explore the mechanism of "involution" development in China's vocational education IEI, so as to help optimize the current pathways and construct strategies for subsequent pathway exploration.

2. Theoretical Traceability of "Involution"

Regarding the "involution", Kant first distinguished between the concepts of "involution" and "evolution"[3], and Gordon Weiser used the term "involution" to refer to the concept of "evolution". The "involution" is used by Gordon Wiese to describe a phenomenon of human cultural development in which external changes are fixed while internal refinement and complexity are constantly taking place[4], and Gertz first applied the "involution" to the economic field of agricultural development by using the "involution" to describe a phenomenon of human cultural development in which external changes are fixed while internal refinement and complexity are continuously taking place. The "involution" describes a form of agricultural development in the Kwajalega region of Indonesia in which agricultural production "acquires a certain rigidity due to the excessive refinement of internal details caused by the inability to extend outward"[5].

As the scope of the study of"involution" continues to expand, the "involution" is constantly being redefined and expanded. North(1981) used cultural "involution" to illustrate the gradual and pathway-dependent nature of institutional change[6]. Prasenjit Duara(1991) used "involution" to describe the development process of Chinese state power in the first half of the 20th century[7]. Fan Zhihai(2004) used "involution" to describe the reform and innovation of China's system in the past two decades[8]. Guo Ji-Qiang(2007) argues that "involution" is a generalization of the mechanism of self-conquest and self-locking of economic agents, especially family farms (farmers), and that small and dispersed small farms can easily fall into the pathway dependence of fine farming and be locked in, and also argues that the introduction of the "involution" has a positive analytical value in terms of instrumental analysis[9].

In the field of education, Pang Shouxing and Li Shuxiao(2010) used the "involution" to describe the development bottleneck of China's basic education[10]; Xia Jun(2012) used "involution" to describe the lack of "qualitative development" of China's higher education system[11]; DAI Xiangzhi(2017) used "involution" to describe the lack of attraction, lack of motivation, and lack of power behind the rapid development of China's higher vocational education system[12]; Zhang Xiaoyu(2019) used "involution" for the first time to describe the development status quo of school-enterprise cooperation in China's higher vocational colleges and universities, and constructed a pathway optimization strategy corresponding to it based on the analysis of the causes of the development status quo of school-enterprise cooperation in higher vocational colleges and universities[13].

In the light of above studies, "involution" has gradually been used to refer to a development pattern of "internal processes are currently locked in as a result of the restricted extension of external conditions" for the development of a particular subject, and is a figurative analogy for the developmental pattern of "growth without development" for the development pattern of a certain thing, which has remarkable application universality.

3. Development status of IEI

Based on the Theoretical traceability of "involution", in order to explore the "involution" mechanism of IEI in China's vocational education, it is necessary to sort out and analyze the "external Condition" and "internal Process" of IEI.

3.1. "Internal Processes" of IEI

The purpose of IEI is mainly to develop high-quality technical and skilled personnel, which determines that the "internal process" of IEI is a knowledge management process oriented to the development of high-quality technical and skilled personnel. Regarding on the relationships between IEI and knowledge management, Tang Jiazhou(2012) believes that IEI is to promote the sharing, transformation and absorption of knowledge between schools and enterprises[14]; Wu Yanming (2013) believes that IEI is a process of knowledge management of the tacit knowledge and explicit knowledge between schools and enterprises, which is essentially the integration of knowledge between enterprises and schools[15]; WANG Yanan and LIU Yi(2014) believes that IEI is a process of transformation of the

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tacit knowledge and explicit knowledge between schools and enterprises and a process of constructing a knowledge base for technical skill development[16].

In describing the "internal process" of IEI, scholars mostly cite the SECI model. For example, Sun Xiaoli(2020) cited the "SECI" model to study the process of IEI in the development of new financial personnel in the era of intelligence[17]; Meng Renzhen, et al (2023) studied the personnel development pathway and strategy of modern apprenticeship under the progressive goal from the perspective of SECI model[18]. The "SECI" model is mainly used to describe the organizational learning process in which tacit and explicit knowledge are transformed into each other and in which the individual learning is the main target within an organization[19]. However, IEI is both a cross-organizational learning process and a parallel process of individual and organizational learning, both has the individual learning process within the organization and the parallel process of individual and organizational learning between organizations. Therefore, it is obvious that the existing researches only adopted the "SECI" model is insufficient to comprehensively describe the whole process of knowledge sharing, transformation and absorption in IEI of vocational education.

Based on this, we introduce the Organizational Learning Cycle (OLC) model[20] and incorporate the concept of "meaning structures" into the SECI model to comprehensively describe the knowledge management process of IEI. Based on the overall logical transformation relationships, we constructed a cross-organizational learning cycle model(COLCM) of IEI, which is shown in Figure 1.

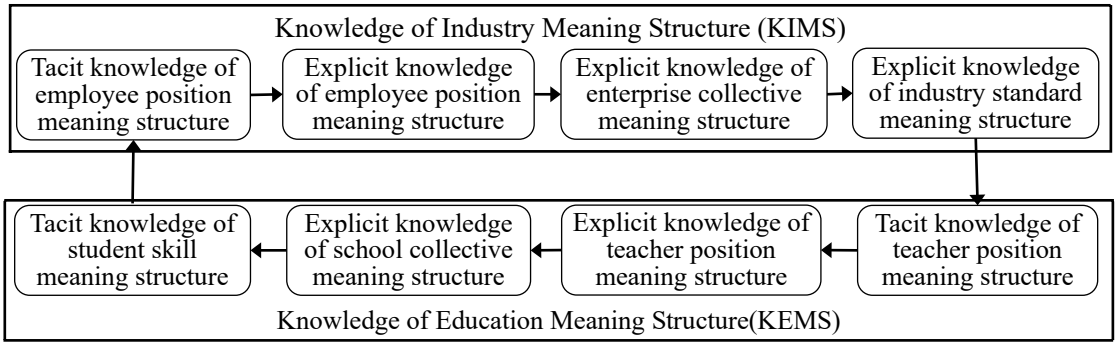

Figure 1: Cross-organizational Learning Cycle Model(COLCM) of IEI.

As shown in Figure 1, COLCM described the subject knowledge transformation and construction process of IEI in a more comprehensive way. However, due to the different "external conditions" , the "internal processes" are different in different IEI pathways.

3.2. "External Conditions" of IEI

The "external conditions" of IEI are specifically characterized by the operation mode and resource collection constructed under the pathways of IEI. At present, IEI in China's vocational education has mainly explored in the pathways of on-off-campus skilled personnel training, building "Double-quality Teacher" teams, constructing shared professional teaching resources platforms, formatting vocational education group, order-type personnel development, modern apprenticeship personnel development.

The pathway of on-off-campus personnel training is mainly based on the construction of on-off-campus training bases, which established an "internal process" of transforming the explicit knowledge of enterprise collective meaning structure, industry standard meaning structure and teacher position meaning structure to the tacit knowledge of student skill meaning structure; the pathway of building "Double-quality Teacher" teams is mainly based on the on-the-job development in enterprises and on-off-campus development and further education for teachers, which established an "internal process" of transforming KIMS to the tacit knowledge of teacher position meaning structure; the pathway of constructing the "shared teaching resource platforms" is mainly based on the construction of national, provincial and school-level vocational education professional teaching resources databases, which established an "internal process" of transforming the tacit knowledge and the explicit knowledge of teacher position meaning structure to the explicit knowledge of school collective meaning structure or the tacit knowledge of student skill meaning structure; the pathway of formatting vocational education groups is mainly based on the community formation of school-enterprise interest, which established an "internal process" of transforming KIMS to KEMS comprehensively under the framework of contract; the pathway of order-based personnel development and the pathway of modern apprenticeship personnel development is mainly based on the two-way development of students by

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school teachers and business mentors under the framework of contract, which established a parallel "internal process" of transforming the KIMS to the tacit knowledge of student skill meaning structure and transforming the KEMS to the tacit knowledge of student skill meaning structure, their difference is that the former is based on the "internal process" of transforming KEMS into the tacit knowledge of student skill meaning structure, while the latter is based on the "internal process" of transforming KIMS to the tacit knowledge of student skill meaning structure.

3.3. Pathway Dilemmas of IEI

Synthesizing the above "external conditions" and "internal processes" of IEI pathways, we could see that although the "external conditions" and "internal processes" of different pathways are different in the transformation process and construction focus of subject knowledge categories, IEI pathways in China's vocational education covers almost all the transformation process and construction focus of knowledge categories of IEI. However, each of IEI pathways in China's vocational education has different development dilemmas, which constrains the development of high-quality technical and skilled personnel.

Chinese scholars have conducted a large number of studies on the current pathway dilemma of vocational education IEI. Comprehensive research results, most of the researches on the causes of the pathways dilemma focused on the different willingness of schools and enterprises to develop personnel, which is specifically manifested in the "positive schools and negative enterprises" willingness to develop personnel[21]. At present, the dilemma of "positive schools and negative enterprises" has become the most important dilemma of IEI pathways in China's vocational education[22]. The cause of the "positive schools and negative enterprises" dilemma lies in the imbalance between input and output of enterprises participating in IEI of vocational education[23] .

IEI is a cross-organizational learning process, and it is the process of transforming and constructing the multiple subjects knowledge between different organizations. Although IEI pathways in China's vocational education has built up a more comprehensive "external conditions" and "internal process", it has gradually fallen into an "involution" development pattern which is characterized by the expansion limitation of "external conditions" and the developmental lock-in of "internal processes" under the constraints of "positive schools and negative enterprises".

4. "Involution" Mechanisms of IEI

Although the "involution" has been introduced into the field of IEI, the existing researches have only used the "involution" to characterize the development status of IEI in vocational education, without clearly defining its concept and exploring its mechanism in depth, which will inevitably reduce the instrumental analytical value of the "involution" and restrict the effective construction of optimization strategies.

At present, the reason why IEI has fallen into a "involution" development pattern is due to the "positive schools and negative enterprises" pathways dilemma of IEI in China's vocational education. The "positive schools and negative enterprises" pathway dilemma is rooted in the fact that IEI in China's vocational education has failed to effectively establish a positive ratio of enterprise input-output mechanism for personnel development[24].

In order to explore the "involution" mechanism of IEI in China's vocational education, we developed a quantitative model of the input-output ratio based on the "internal process" of knowledge transformation. In the "internal process" of IEI, due to the different "external conditions", there are two kinds of knowledge transformation processes, spillover and non-spillover, from the KIMS to the KEMS. According to the two knowledge transformation scenarios of spillover and non-spillover, IEI pathways can be divided into contractual pathways and non-contractual pathways, and we also established two kinds of enterprises input-output ratio quantitative models for the contractual pathways and non-contractual pathways. Among IEI pathways, the pathways of on-off-campus personnel training, building "Double-quality Teacher" teams and constructing the "shared professional teaching resource platforms" are more affiliated with the non-contractual pathway type, while the pathways of formatting the vocational education groups, order-oriented personnel development and modern apprenticeship personnel development are more affiliated with the contractual pathways.

In the non-contractual pathways, assuming enterprises fully participated in IEI, the enterprises input-output ratio of IEI can be quantified as shown in equation (1).

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$$N_{Kn}=\frac{\sum_{n=1}\left[(R_{Kn}-W_{Kn})\times Q_{Kn}-(R'_{(Kn-K1)}\times Q'_{Kn})\right]}{\sum_{n=1}C_{Kn}},\quad (n=\{1,2,3\}) \tag{1}$$

In the contractual pathways, assuming enterprises fully participated in IEI, the enterprises input-output ratio of IEI can be quantified as shown in equation (2).

$$N_{Kn}=\frac{\sum_{n=1}\left[(R_{Kn}-W_{Kn})\times Q_{Kn}\right]}{\sum_{n=1}C_{Kn}},\quad (n=\{1,2,3\}) \tag{2}$$

In equation (1) and (2), N_{Kn} represents the firm's input-output ratio, R_{Kn} represents the output of potential personnel positions, W_{Kn} represents the cost of hiring personnel, Q_{Kn} represents the number of personnel hires, Q'_{Kn} represents the number of personnel turnovers and C_{Kn} represents the cost of personnel development. n and Kn represent the knowledge categories of industry meaning structure and its knowledge stock, and the value range of n is $n=\{1,2,3\}$. $K1$, $K2$ and $K3$ represent the explicit knowledge stock of industry standard meaning structure, enterprise collective meaning structure, employee position meaning structure respectively; since vocational colleges are more willing to cooperate with the leading enterprises, the relationships of knowledge stock between $K1$, $K2$ and $K3$ is $K3>K2>K1$. $R'_{(Kn-K1)}$ represents the value added of positions output of potential personnel .

By analyzing the quantitative relationship between enterprises' inputs and outputs in equation (1), we can see that enterprises have access to personnel that acquires $K1$, $K2$ and $K3$ knowledge stocks, but also produces knowledge spillovers from $(K2-K1)$ and $(K3-K1)$. We assume that the firm has a certain number Q_{Kn} of personnel to recruit each year, and although the greater the amount of knowledge transferred by the firm, the greater the firm's output, it also brings about an increase in the enterprises' inputs and the enterprises' relative losses. Therefore, the non-contractual pathways are difficult to construct a positive ratio of enterprises' inputs and outputs.

By analyzing the quantitative relationship between firms' inputs and outputs in Equation (2), we can see that enterprises can acquire personnel that acquire $K1$, $K2$ and $K3$ knowledge stocks, and have not produced knowledge spillovers of $(K2-K1)$ and $(K3-K1)$. We also assume that the number of personnel Q_{Kn} that enterprises have to recruit each year is certain, due to the contractual restrictions on the flow of personnel, the greater the amount of knowledge transfer, the greater the output of the enterprise, and it is easy to establish a positive mechanism for the input-output of the enterprise's knowledge transfer. However, the establishment of this positive ratio mechanism also brings two restrictions to the contract-pathways. First, the contractual pathways for establishing a positive ratio of enterprises' input-output mechanism require two constraints. These constraints are designed to prevent the loss of the enterprise personnel development pathway and also to prevent the inflow of personnel development pathways from other enterprises. If there is a failure in the contractual force in either direction, it becomes challenging to establish a positive ratio of enterprises' input-output mechanism. Second, the contractual pathways impose specific requirements on the knowledge stock and personnel recruitment scale of the enterprise to establish a positive enterprises' input-output mechanism. This is because IEI demands a substantial investment of resources and an extended period of cooperation and bonding. If the enterprise is small or the investment is insufficient, short, or unstable, it becomes impossible to establish a positive enterprises' input-output mechanism. Therefore, the contractual pathways are more suitable for the long-term cooperation between industry-head enterprises and vocational schools, but not for the cooperation between SMEs and vocational schools.

Therefore, whether non-contractual pathways or contractual pathways of IEI, it is difficult to establish a positive input-output mechanism for IEI by simply relying on the cooperation between enterprises and vocational colleges and universities, which has led to the pathway dilemma of "positive schools and negative enterprises" for IEI in China's vocational education. If the positive ratio of input and output mechanism of enterprises is difficult to establish, no matter how the "external conditions" of IEI are extended, it is difficult to establish an efficient knowledge transformation cycle of "internal process" for IEI, which makes IEI stay in a development pattern of "growth without development" in the long term, which affects the development of high-quality technical and skilled personnel in China's

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vocational education .

5. Conclusions and Recommendations

Although the "involution" has been introduced into the field of IEI, the existing researches have only used the "involution" to characterize the development status of IEI, without clearly defining its concept and exploring its mechanism in depth, which will inevitably reduce the instrumental analytical value of the "involution" and restrict the effective construction of optimization strategies.

At present, the development status of IEI in China's vocational education is very much in line with the characteristics of "involution", which is specifically characterized in that the extension of "external conditions" is limited and the development of "internal processes" is locked into existing paths, resulting in that IEI in China's vocational education felled into a development pattern of "growth without development".

In order to promote the sustainable development of IEI, first, we have clarified the instrumental analytical value of the "involution" through the theoretical traceability; second, we constructed the COLCM of IEI (IEI) by integrating the SECI model and the OLC model, and clarified the "internal process" of IEI by sorting out the different pathways of IEI and the "internal process" of IEI by combing the different types of pathways of IEI; third, by combing through the literature, we explored the causes of the current pathways dilemma of IEI in China's vocational education-"positive schools and negative enterprises" triggered by the imbalance of enterprises' input and output; forth, by categorizing the types of pathways of IEI, we constructed a quantitative model of enterprise input-output ratio for contractual and non-contractual pathways of IEI based on the knowledge spillover effect, and then explored the formation mechanism of "involution" of IEI in China's vocational education, which provides valuable reference for promoting the development of industry-industry integration in China's vocational education.

There are also shortcomings in this study. We have only explored the enterprise input-output mechanism of IEI between vocational colleges and enterprises, and the government plays an important role in IEI as a multi-body collaborative education system. This study has not yet explored the role of the Government in the construction of the enterprise head-output mechanism, which is also a future research direction.

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