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Article

Research on Two-Way Empowerment Mechanism between Higher Vocational Art and Design Professional Teaching and Enterprise Digital Content Operation Enabled by AIGC Technology

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Abstract: The collaboration between vocational colleges and enterprises in teaching art design and digital content operations, as well as mutual empowerment, is key to promoting the deep integration of vocational art design education and industrial development. This paper adopts a systems dynamics perspective to analyze the interactive development mechanisms between vocational college art design education and corporate digital content operations. An evolutionary game model is constructed to analyze the game evolution issues between vocational colleges and enterprises, providing a more intuitive illustration of the dynamic process of school-enterprise collaboration in the mutual empowerment between art design education and corporate digital content operations. Numerical simulation analysis of the game evolution model reveals that the revenue distribution and cost-sharing mechanisms of school-enterprise cooperation directly influence the willingness of both parties to participate actively. Government support and its underlying policies are more conducive to deep school-enterprise cooperation.

Keywords: school-enterprise cooperation; vocational education; evolutionary game; system dynamics

1. Introduction

With the continuous development of the socio-economic landscape, the demand for the art and design industry has been steadily increasing, particularly in the realm of corporate digital content operations. This has led to growing attention being directed toward art and design programs at vocational colleges and universities from both society and students [1-3]. To better align with the needs of corporate digital content operations and enhance employment quality, many vocational colleges and universities have actively partnered with businesses to establish a mutually beneficial collaboration mechanism, thereby fostering a more comprehensive talent development framework [4-6].

With the continuous development and popularization of information technology, corporate digital content operations have become an inevitable trend in corporate development [7-8]. Digital content operations not only improve corporate efficiency and productivity but also bring more customer resources and business opportunities to enterprises [9-10]. In today's highly competitive market environment, how to expand customer resources and achieve business growth through digital content operations has become an urgent issue for enterprises to address [11-12]. Under the two-way empowerment mechanism, the talent cultivation of higher vocational art design programs provides the necessary human resources to address this issue. Meanwhile, enterprises support the teaching of higher vocational art design programs by providing industry expert lectures, technology, and financial resources to ensure high-quality teaching outcomes [13-16]. Both parties strengthen communication and interaction, abandoning one-way instruction, to explore a new, comprehensive educational system. This enables two-way talent mobility and mutual benefit in funding, fostering a positive cooperative atmosphere. It lays a more solid foundation for higher education reform and provides a steady stream of professional talent for corporate digital content operations [17-18].

To investigate the dynamic interactive development mechanism between vocational college art design education and corporate digital content operations, this paper provides an overview of system dynamics and proposes causal relationship diagrams as a research tool for analyzing dynamic mechanisms. It constructs the logical relationships between the intrinsic elements of vocational college art design education and corporate digital content operations. Based on this, an evolutionary game model for school-enterprise cooperation between vocational colleges and enterprises is constructed, and the replicating dynamic equations for the evolutionary game of school-enterprise cooperation are determined. Using system dynamics principles, the dynamic mechanisms of vocational art design education and corporate digital content operations are analyzed, exploring the mutually promoting yet mutually constraining interactive relationships between the two in areas such as talent cultivation, scientific research innovation, and financial support. Using MATLAB software for numerical simulation of the evolutionary game model, we conduct simulation analysis of system instability. From factors such as cost-benefit analysis and government support, we explore the evolutionary process and outcomes of school-enterprise cooperation in the bidirectional empowerment process between vocational college art design education and corporate digital content operations.

2. Dynamics Mechanism of School-Enterprise Cooperation in Higher Vocational Art Design Majors

In the current context of the integration of vocational education and industrial development, the collaboration between higher vocational art design programs and corporate digital content operations has become a key pathway for enhancing the quality of higher vocational art design education and meeting societal needs. This paper will employ system dynamics causal analysis to examine the interactive development mechanisms between higher vocational art design programs and corporate digital content operations from a system dynamics perspective.

2.1. Principles of System Dynamics

2.1.1. Overview of System Dynamics

System dynamics is a comprehensive interdisciplinary concept applicable to both natural sciences and social sciences. Its core principle involves studying the behavior of an entire system through information feedback to identify or resolve systemic issues [19]. System dynamics can establish multiple levels and feedback loops within systemic models, analyzing the system's dynamic characteristics by examining the patterns of change across various variables. Therefore, based on its emphasis on information feedback, system dynamics excels at addressing systems with hysteresis phenomena by coordinating various subsystems or sub-systems from a holistic perspective. It is particularly well-suited for complex systems with time delays, real-time dynamic changes, incomplete data, and difficult-to-quantify relationships between parameters or variables, especially nonlinear systems. The development process of interdisciplinary teams in higher education institutions, which is the subject of this study, meets the above requirements. Interdisciplinary teams in higher education institutions have complex internal structures, and their development processes undergo dynamic changes over time. Many relationships between variables are difficult to quantify, and various influencing factors interact with each other, while also being influenced by feedback from the final development outcomes. Therefore, system dynamics methods are suitable for conducting a comprehensive analysis of such systems.

2.1.2. Concepts Related to Causal Diagrams

Causal relationship diagrams are also known as system cycle diagrams [20]. They use the causal relationships between various factors or variables within a system as their logical foundation, employing causal links to describe the causal relationships between each set of factors. These simple causal relationships ultimately outline the data transmission and feedback structure of the entire system. In complex systems, the relationships between variables are typically not simple linear interactions or unidirectional influences, but rather a combination of feedback, linear, and nonlinear relationships.

1) Causal chain A→+B: Connecting variables A and B with a positive sign indicates that A and B change in the same direction, and A's change is the cause of B's change.

2) Causal chain A→-B: Connecting A and B with a negative sign indicates that A and B change in opposite directions, but A's change is still the cause of B's change. Thus, the causal links between multiple variables collectively form the causal polarity relationships of the entire system.

2.2.3. System Dynamics Modeling Steps

The research approach for system dynamics is illustrated in Figure 1. First, the system is analyzed by summarizing literature and conducting task surveys to clarify the research questions and define the scope of the study. Second, a structural analysis is conducted by constructing causal relationship diagrams to establish the logical relationships between internal elements, followed by defining variables and constructing system flow diagrams. Third, mathematical equations are established, and the model is validated using actual data. If the model is ineffective, it is modified and adjusted; if it is effective, simulation and modeling are conducted, and conclusions and recommendations are drawn from the simulation results.

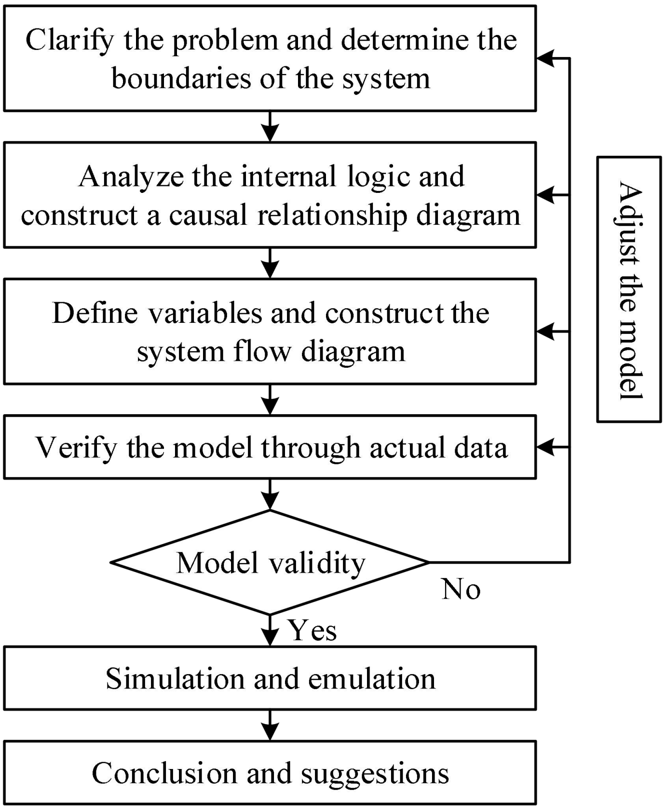


Figure 1. Research ideas of system dynamics.

2.2.4. Research Adaptability Analysis

The development of vocational art design education and corporate digital content operations is influenced and constrained by various factors. The process of mutual empowerment itself is one in which various elements interact and internal and external driving mechanisms continuously couple. These elements are not static but change over time. This complex relationship can be visualized through causal diagrams and quantified to achieve the effect of simulating a dynamic system.

Whether from the perspective of the application of system dynamics itself or from the angle of this paper's research on the relationship between vocational college art design education and corporate digital content operations, the use of system dynamics methods is more conducive to studying the internal and external development mechanisms and the interactive relationships among these factors.

2.2. Analysis of Kinetic Mechanisms

This section will analyze the dynamic mechanisms between vocational art design education and corporate digital content operations based on system dynamics principles.

1) The objective demand for vocational art design education in corporate digital content operations

Based on the theoretical, technical, and talent demands generated by corporate digital content operations, a causal relationship diagram of these demands is presented in Figure 2. The diagram shows three negative feedback loops:

(1) Industry service level → - Industry cost → - Industry profit → + Industry value added → +

Industry scale expansion demand → + Industry theoretical demand → + Industry theoretical shortage → - Industry service level.

(2) Industry service level → - Industry cost → - Industry profit → + Industry value added → + Industry scale expansion demand → + Industry technical demand → + Industry technical shortage → - Industry service level.

(3) Industry service level → - Industry cost → - Industry profit → + Industry value added → + Industry scale expansion demand → + Talent demand → + Industry talent shortage → - Industry service level.

Improving industry service levels helps reduce costs, increase industry profits, and thereby enhance industry value-added. This leads to industry demand for scale expansion, which in turn generates new demands in theory, technology, and talent. There is a mismatch between enterprises' actual demand for vocational art professionals and the supply of such talent, resulting in enterprises struggling to find suitable employees, while vocational art design graduates struggle to find suitable job positions. These issues constrain enterprise economic development and thereby create an objective demand for advancing vocational art design education.

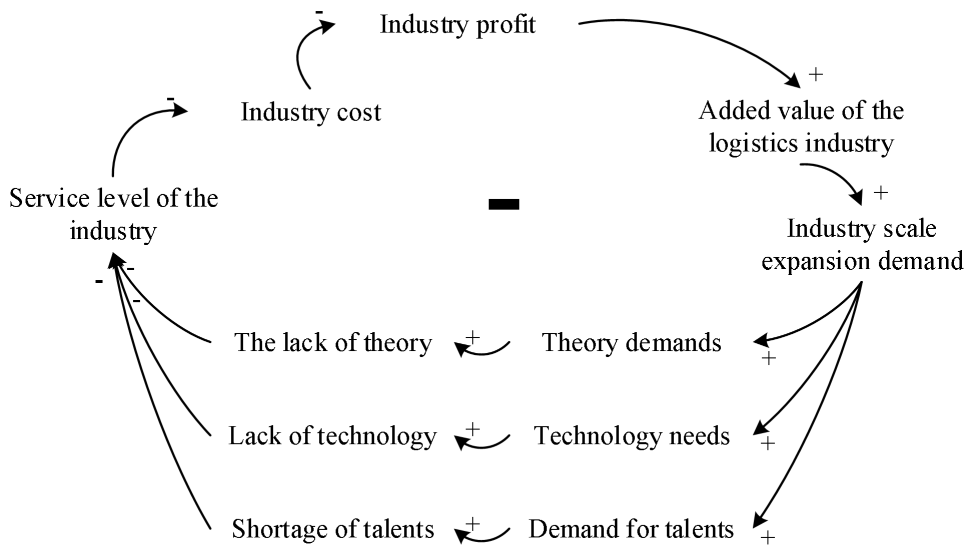


Figure 2. Theory, technology and talent demand of enterprise digital content operation.

2) Cultivating talent to provide qualified labor and high-end talent

Based on the objective needs of economic development, graduates of vocational colleges majoring in art design are divided into ordinary labor and high-end talent. The causal relationship between vocational art design education and the provision of qualified labor and high-end talent to enterprises is shown in Figure 3. There are four positive feedback loops in the figure:

(1) Educational level → + Talent cultivation capacity → + Number of professional admissions → + Number of graduates → + Number of qualified labor → + Industry service level → - Industry costs → - Industry profits → + Industry value added → + Regional GDP → + Regional fiscal revenue → + Educational expenditure → + Educational investment → + Educational level.

(2) Educational level → + Talent cultivation capacity → + Number of specialized admissions → + Number of graduates → + Number of qualified labor → + Industry service level → - Industry costs → - Industry profits → + Industry value added → + Corporate donations → + Educational investment → + Educational level.

(3) Educational level → + Talent cultivation capacity → + Graduate quality → + Number of high-end talents in the industry → + Industry service level → - Industry costs → - Industry profits → + Industry added value → + Regional GDP → + Regional fiscal revenue → + Educational expenditure → + Educational investment → + Educational level.

(4) Educational level → + Talent cultivation capacity → + Graduate quality → + Number of high-end talents in the industry → + Number of qualified laborers → + Industry service level → - Industry costs → - Industry profits → + Industry added value → + Regional GDP → + Corporate donations → +

Education investment → + Educational level.

As vocational colleges across the country increasingly establish art design programs, the demand for labor quantity is gradually being met, but the demand for quality is increasingly rising. The pressure on vocational art design programs to cultivate talent will gradually increase, but the direction is clear.

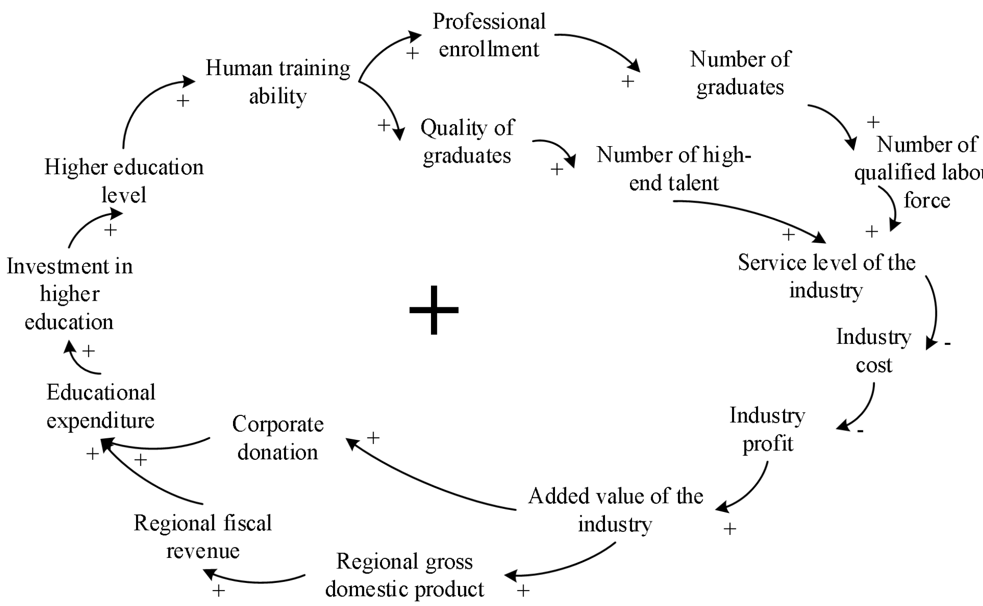


Figure 3. Education to provide qualified labor force and high-quality talents.

3) School-enterprise cooperation to enhance enterprise management levels

The teaching of higher vocational art design majors can enhance enterprise management levels through student internships in enterprises and teacher exchanges with enterprises. These two methods are summarized as school-enterprise cooperation capabilities. The causal relationship between school-enterprise cooperation and the enhancement of enterprise management levels is shown in Figure 4. There are four positive feedback loops in the figure:

(1) Higher education level → + school-enterprise cooperation capabilities → + number of students participating in internships at enterprises → + practical skills of graduates → + industry service levels → - industry costs → - industry profits → + industry value added → + regional GDP → + regional fiscal revenue → + educational expenditures → + higher education investment → + higher education level.

(2) Higher education level → + Talent cultivation capacity → + Number of professional admissions → + Number of graduates → + Number of qualified laborers → + Industry service level → - Industry costs → - Industry profits → + Industry value added → + Corporate donations → + Higher education investment → + Higher education level.

(3) Higher education level → + school-enterprise cooperation capacity → + number of teachers participating in enterprise exchanges → + operational management efficiency → + industry service level → - industry costs → - industry profits → + industry value added → + regional GDP → + regional fiscal revenue → + educational expenditure → + higher education investment → + higher education level.

(4) Higher education level → + school-enterprise cooperation capacity → + number of teachers participating in enterprise internships → + operational management efficiency → + industry service level → - industry costs → - industry profits → + industry value added → + corporate donations → + higher education investment → + higher education level.

Improvements in the teaching quality of higher vocational art design programs enhance the ability of universities to collaborate with enterprises, leading to an increase in the number of students participating in internships and faculty members engaging in exchanges. Through internships, students gain hands-on experience in enterprise operations, enhancing their practical skills. Upon graduation, this enables them to reduce the adaptation period and quickly acclimate to their work positions. Faculty members from higher vocational colleges who engage in exchanges with enterprises can learn practical experience while also assisting enterprises in improving operational management efficiency.

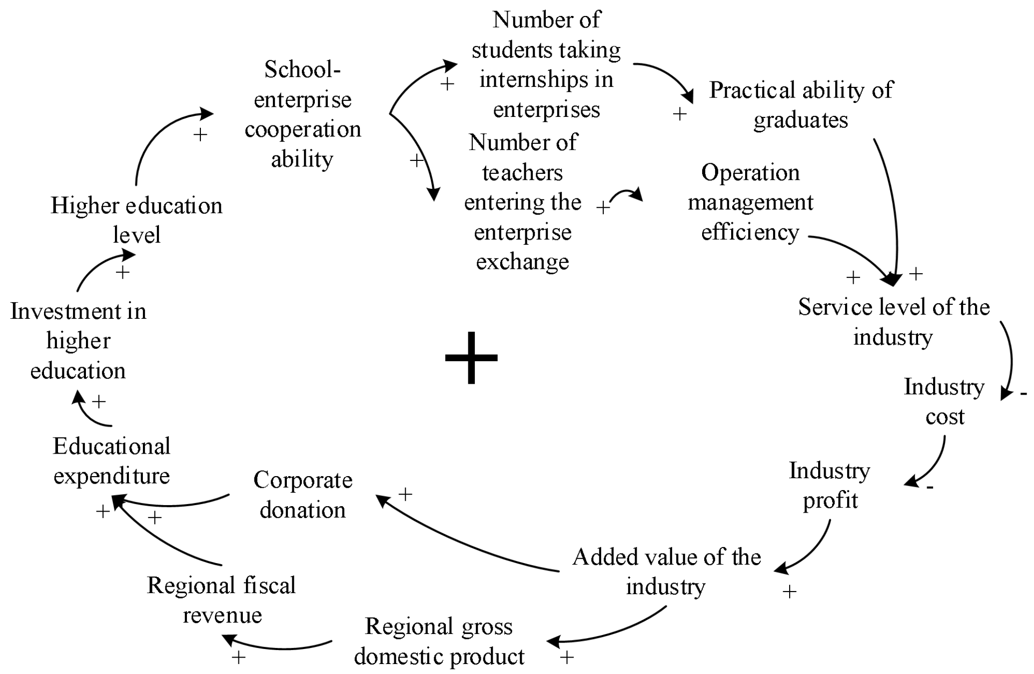


Figure 4. School-enterprise cooperation to enhance the level of enterprise management.

3. Evolutionary Game Theory in School-Enterprise Cooperation in Higher Vocational Art Design Programs

The school-enterprise cooperation between higher vocational art design majors and enterprise digital content, which enables mutual empowerment, is an effective way for higher vocational colleges and enterprises to jointly cultivate high-tech, specialized, senior professionals for society. Considering factors such as the benefits and costs of both schools and enterprises and government support, this chapter will analyze the evolution process and results of school-enterprise cooperation in the mutual empowerment process based on an evolutionary game model [21].

3.1. Evolutionary Game Model Construction

Suppose there is a group of vocational colleges (V) and a group of enterprises (E) engaged in strategic game theory, and there is no organization to design or arrange cooperation between the two parties. Both the colleges and enterprises adjust their optimal strategies dynamically based on the strategies of other members under conditions of bounded rationality.

Assumption 1: Limited rationality assumption. When decision-makers or game participants face a choice (decision) regarding an issue, they do not possess complete knowledge (full awareness) of the information structure and preference structure (range of decision possibilities and preference relationships) of the decision problem they face.

Assumption 2: Strategy selection. The strategy selection sets for both colleges and enterprises are either cooperation or non-cooperation. The probabilities of universities and enterprises choosing to cooperate at the beginning of cooperation are α and β , respectively, where $\alpha, \beta \in [0,1]$.

Assumption 3: Cooperative excess returns. Assume that the normal returns when both parties adopt a “non-cooperative” strategy are denoted by R_U and R_E , respectively. Let ΔV denote the excess returns generated when both parties adopt the cooperation strategy, and $\Delta V > 0$. Let γ denote the university's share of the excess returns, i.e., the university receives $\gamma\Delta V$ and the enterprise receives $(1-\gamma)\Delta V$, where $\gamma \in [0,1]$.

Assumption 4: Cooperation costs. The total cost of cooperation between the university and the enterprise is C . ε denotes the university's cost-sharing ratio, i.e., the university bears εC of the costs, and the enterprise bears $(1-\varepsilon)C$ of the costs, where $\varepsilon \in [0,1]$.

Assumption 5: Fraudulent gains W . When one party chooses to cooperate and the other party chooses not to cooperate, the non-cooperating party gains fraudulent gains W , while the cooperating party loses W .

Let $\xi_{11} = R_U + \gamma\Delta V - \varepsilon C$, $\xi_{12} = R_U - W - \varepsilon C$, $\eta_{11} = R_E + (1-\gamma)\Delta V - (1-\varepsilon)C$, $\eta_{21} = R_E - W - (1-\varepsilon)C$. When only the university and the enterprise are involved, the payoff matrix for the university-enterprise cooperation evolutionary game is shown in Figure 1.

Let the average payoffs for the enterprise choosing to cooperate and not to cooperate be E_1 and E_2, respectively, and the average payoffs for the university choosing to cooperate and not to cooperate be U_1 and U_2 , respectively. $E_1 = \alpha\eta_{11} + (1-\alpha)\eta_{21}$ $U_1 = \beta\xi_{11} + (1-\beta)\xi_{12}$, $E_2 = \alpha(R_E + W) + (1-\alpha)R_E$, and $U_2 = \beta(R_U + W) + (1-\beta)R_U$. The replicator dynamics equation for the evolution of industry-academia collaboration games is:

$$\begin{aligned}
\alpha^* &= \alpha(1-\alpha)(U_1 - U_2) \\
&= \alpha(1-\alpha)(\beta\gamma\Delta V - W - \varepsilon C) \\
\beta^* &= \beta(1-\beta)(E_1 - E_2) \\
&= \beta(1-\beta)(\alpha\Delta V - \alpha\gamma\Delta V - W - C + \varepsilon C)
\end{aligned} \tag{1}$$

3.2. Numerical Simulation Analysis of the Model

This paper uses Matlab software for numerical simulation and simulation calculations. When conducting model stability analysis, the assignment principle is to ensure that each condition (1) to (4) is satisfied within its respective value range. When analyzing the impact of the initial intentions of the game participants on system evolution and the influence of various sensitivity factors, the values must comply with the conditions of Scenario 1, i.e. The trend of the curves in the simulation diagram reflects the dynamic evolution process of school-enterprise cooperation between higher vocational colleges and enterprises in combining art design professional teaching with enterprise digital content operations. The horizontal axis of the diagram represents the time axis, i.e., the evolutionary sequence of the game, while the vertical axis represents the evolutionary trend of higher vocational colleges, enterprises, or the system as a whole.

3.2.1. Simulation Analysis of Local System Stability

First, simulate the stability of the game model. Based on the assignment principle, the parameter settings are shown in Table 1. As can be seen from the table, there are four conditions (1) to (4). The specific meanings of each indicator in the table are as follows:

R —Additional benefits of active participation in school-enterprise cooperation by higher vocational colleges and enterprises;

T —Additional benefit distribution coefficient of higher vocational colleges;

C_1 — the additional costs incurred by higher vocational colleges for actively participating in school-enterprise cooperation;

C_2 — the additional costs incurred by enterprises for actively participating in school-enterprise cooperation;

G_1 — the additional benefits for higher vocational colleges when they actively participate in school-enterprise cooperation;

G_2 — the additional benefits for enterprises when they actively participate in school-enterprise cooperation;

L_1 — Coefficient of vocational colleges' ability to utilize enterprise resources;

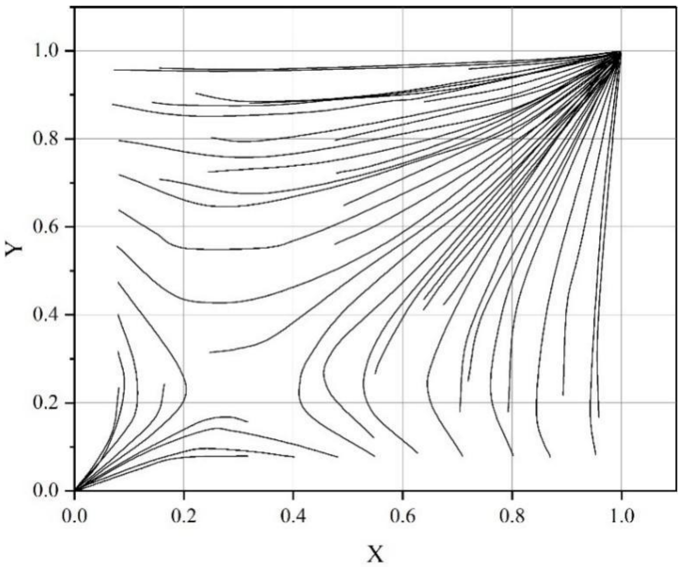
L_2 — Coefficient of enterprises' ability to utilize vocational college resources;

P — Penalty paid by the party that passively participates in school-enterprise cooperation when only one party passively participates.

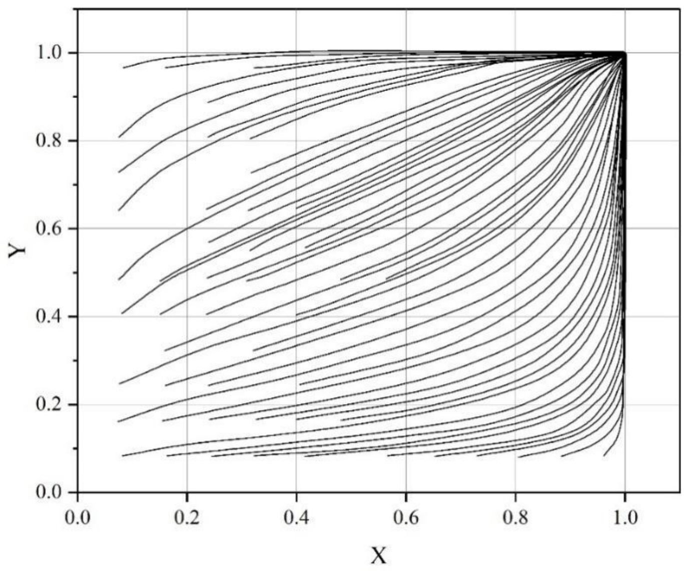
Table 1. System local stability parameters.

Condition setting	R	T	C_1	C_2	G_1	G_2	L_1	L_2	P
Conditions (1)	18	0.6	6	5	2.5	2.5	0.1	0.1	1
Conditions (2)	18	0.6	5	4	3	2.5	0.1	0.1	2
Conditions (3)	18	0.6	6	5	2.5	3	0.1	0.1	1
Conditions (4)	18	0.6	4	4	3	3	0.1	0.1	2

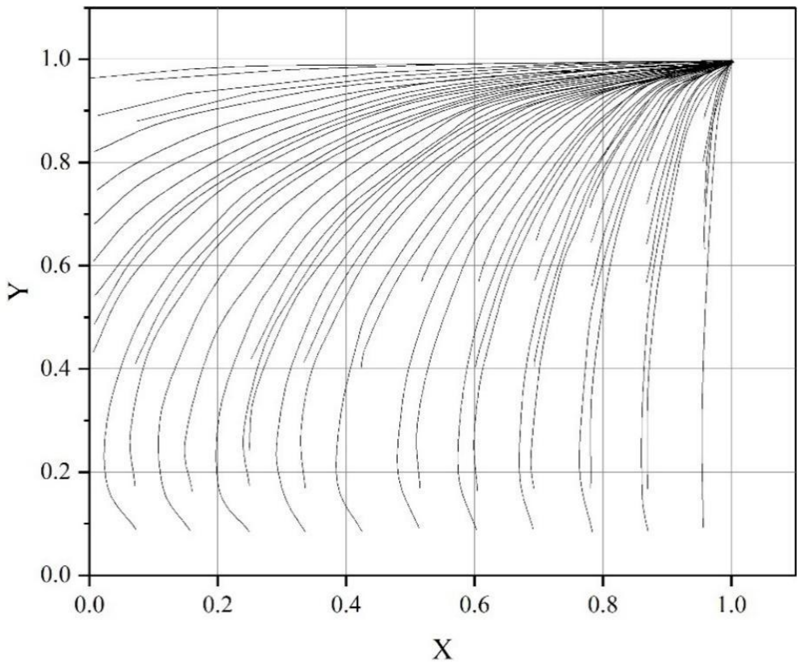
The evolutionary phase diagram of the Matlab simulation is shown in Figure 5. Figures (a) to (d) correspond to the conditions (1) to (4) set in the table above. From the perspective of model stability, conditions (2) to (4) also exhibit ideal evolutionary trends. However, the assignment conditions required to satisfy these three evolutionary scenarios are often difficult to achieve, or even impossible to achieve, in real-world collaborations. When the additional benefits of university-industry collaboration cannot offset the additional costs, or when the penalty for breach of contract is set too high and exceeds the sum of the additional costs and speculative benefits, neither party will have an initial willingness to participate actively. Therefore, this paper primarily focuses on condition (1) to explore the evolutionary process of long-term university-industry collaboration and the influence of sensitivity factors on the strategic choices of the parties involved.



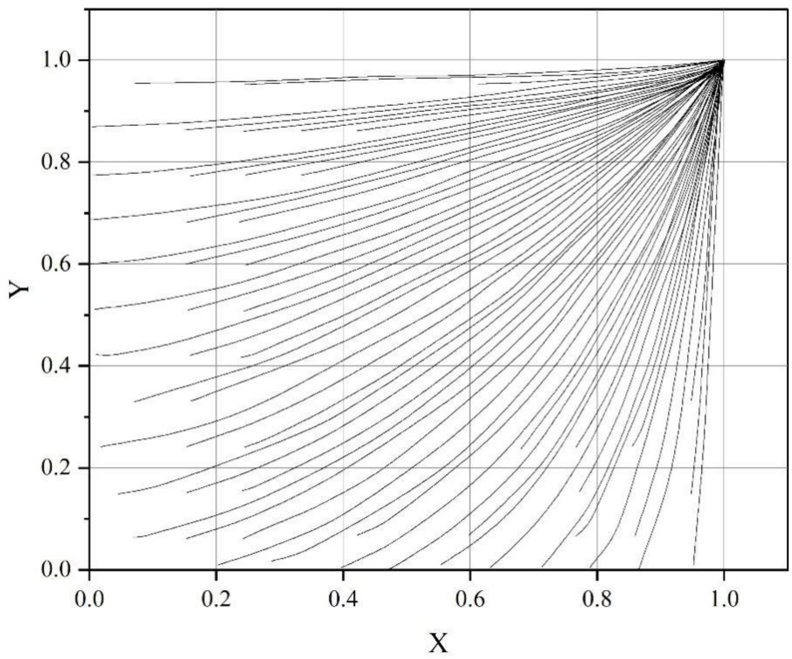
(a) Conditions (1)



(b) Conditions (2)



(c) Conditions (3)



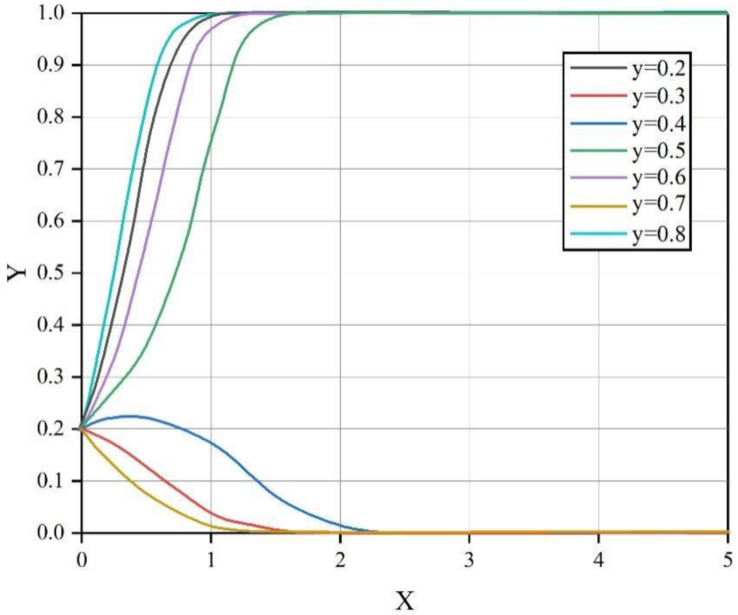
(d) Conditions (4)

Figure 5. Local stability simulation results.

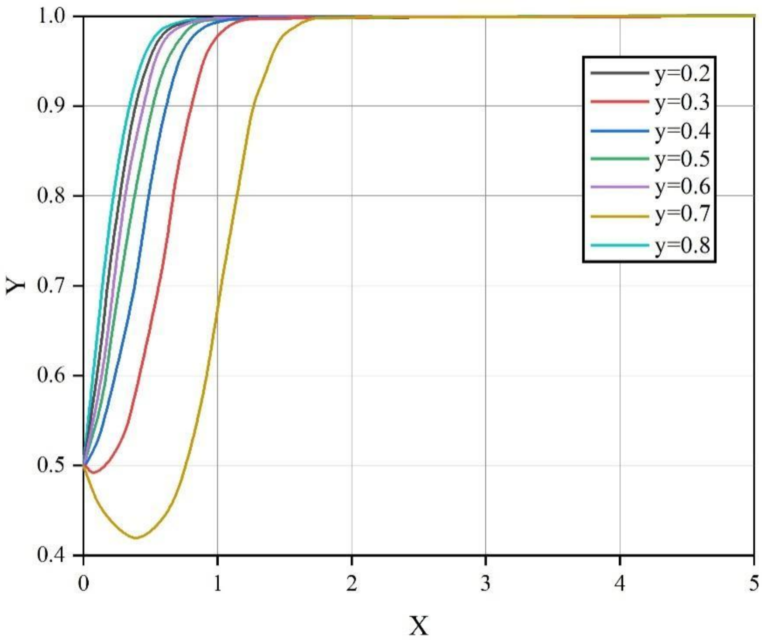
3.2.2. Initial Strategy Analysis

In the collaboration between vocational colleges and enterprises, the initial willingness represents the first feedback received from the collaborating party under conditions of bounded rationality, and thus directly influences subsequent strategic choices and the direction of system evolution. Based on condition (1), assign values to the variables. When one party (either the vocational college or the enterprise) has an initial cooperation intention at low (0.2), medium (0.5), or high (0.8) levels, the evolution of the game system is simulated when the other party's initial cooperation intention varies within the [0.2, 0.8] interval. The specific simulation results are shown in Figure 6. Figures (a) to (c) correspond to the low, medium, and high initial cooperation intentions of either the vocational college or the enterprise, respectively.

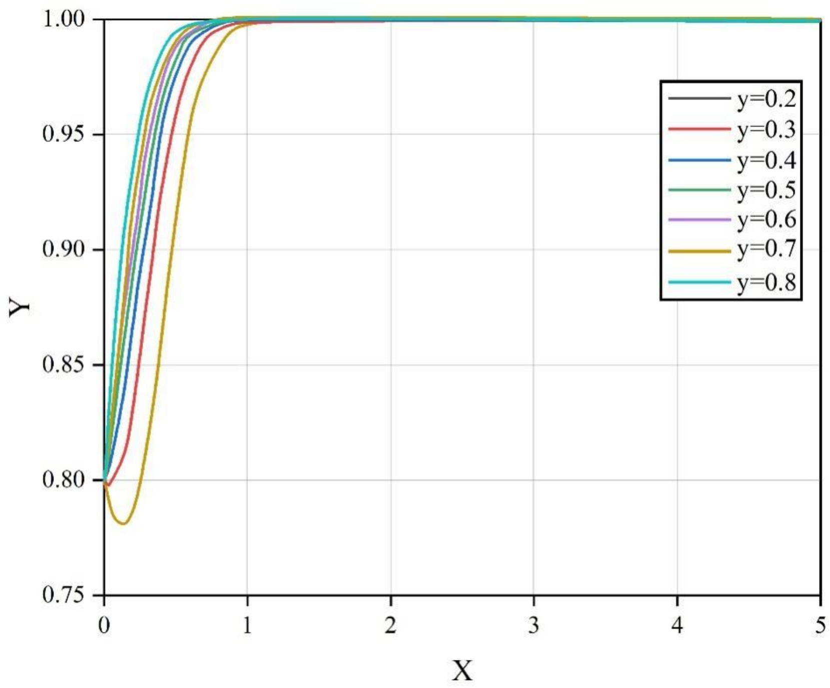
Based on the simulation results, it can be observed that when the initial cooperation willingness of the vocational college is low, the system's evolutionary direction undergoes a fundamental shift as the enterprise's initial cooperation willingness changes. When both parties have low initial cooperation willingness, the evolution trend of school-enterprise cooperation continuously converges toward the (0,0) point, i.e., the vocational college passively participates in cooperation, and the enterprise passively participates in cooperation. When the vocational college maintains a low level of participation willingness, if enterprises unilaterally express a strong desire to cooperate, the system begins to evolve toward the (1,1) direction when the enterprise's cooperation willingness reaches 0.5, i.e., (vocational colleges actively participate in cooperation, and enterprises actively participate in cooperation); if the enterprise's cooperation willingness becomes more explicit at this point, it can be observed that the system's evolution toward (1,1) accelerates. When the initial cooperation willingness of vocational colleges is at an intermediate level, and the initial cooperation willingness of enterprises is at a low level, the cooperation between the two parties will experience phased fluctuations, but ultimately it will still tend to evolve toward the (1,1) direction; as the initial cooperation intentions of enterprises continue to increase, the evolution speed of the school-enterprise cooperation system toward the (1,1) direction becomes faster and faster. When the initial cooperation intentions of both parties have reached a relatively high level, cooperation becomes more efficient, and the development of the cooperation system becomes more coordinated and stable.



(a) Initial willingness to cooperate is at a low level



(b) Initial willingness to cooperate is at a medium level



(c) Initial willingness to cooperate is at a high level

Figure 6. Initial subject change simulation results.

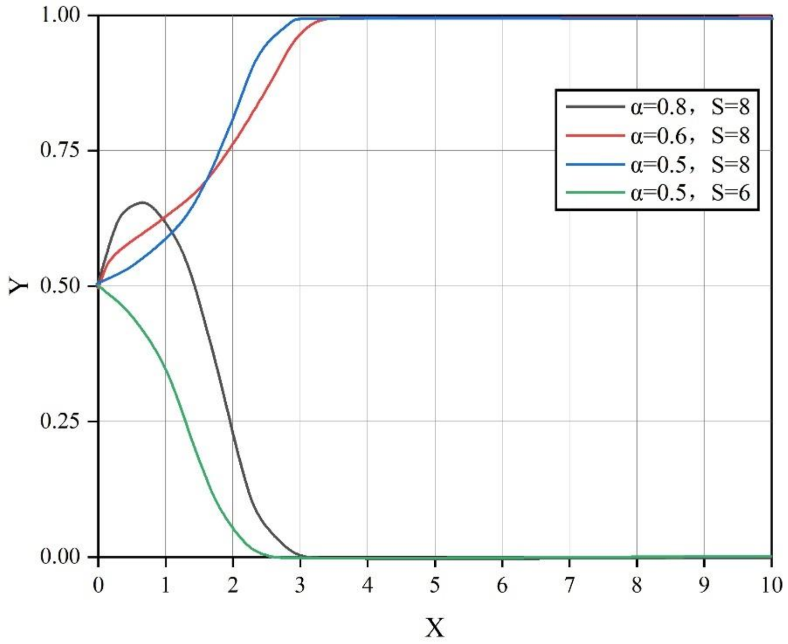
3.2.3. Numerical Simulation Analysis of Influencing Factors

This section will examine the impact of two key factors—revenue costs and government support—on the evolution of the game system.

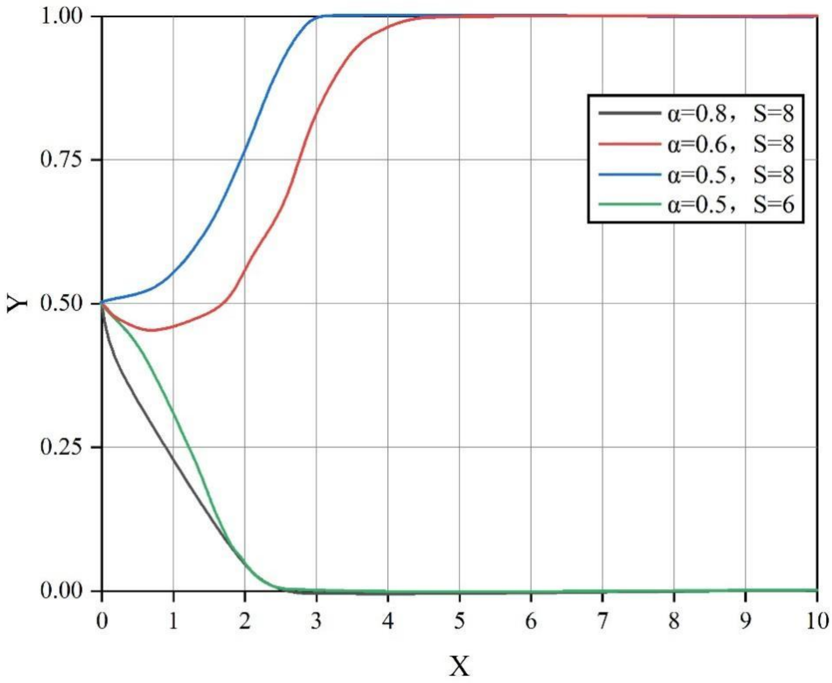
1) The impact of revenue costs on system evolution

The indicators involved in revenue costs in this subsection are: α ($\alpha \in (0,1)$) — distribution ratio coefficient; S — excess revenue generated by active cooperation between schools and enterprises; β — cooperation costs incurred by schools; C — cooperation costs incurred 1….by schools and enterprises through active cooperation.

The impact of excess returns from active cooperation between schools and enterprises and the revenue distribution coefficient on the system's evolutionary path is shown in Figure 7, where Figures (a) and (b) correspond to the probability of active cooperation by schools and the probability of active cooperation by enterprises, respectively. When returns are evenly distributed between the school and the enterprise (α = 0.5), and the returns from active cooperation are at a low level (S = 6), the system evolves toward (passive cooperation, passive cooperation). As the returns from active cooperation increase (S = 8), the system evolves toward (active cooperation, active cooperation), indicating that achieving higher excess returns through school-enterprise cooperation effectively promoting more active participation in cooperation between schools and enterprises. When the excess returns from positive cooperation are at a high level (S = 8), as the benefit distribution coefficient α is adjusted to 0.6 and 0.8, the school-enterprise cooperation strategy evolves from (positive cooperation, positive cooperation) to (negative cooperation, negative cooperation), and the speed of this evolution accelerates, indicating that an imbalance in the distribution of cooperation benefits leads to a decline in the willingness of both parties to cooperate.



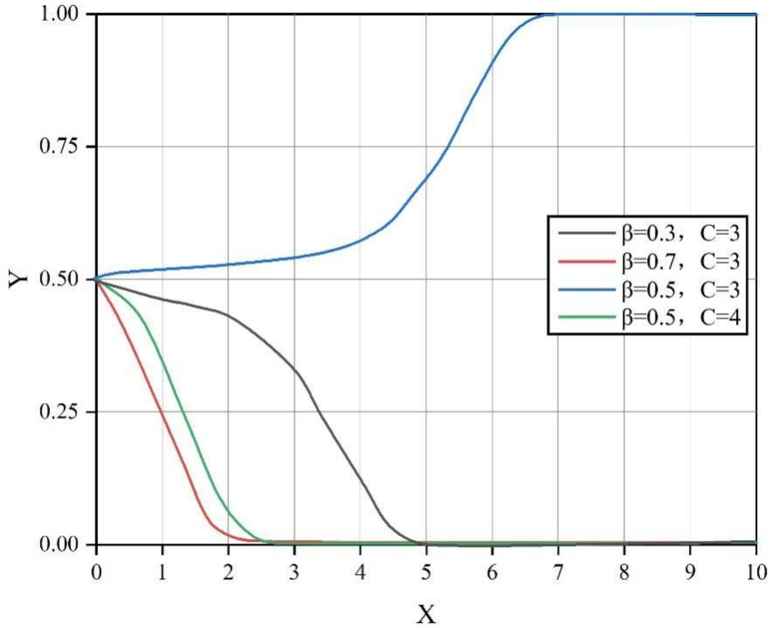
(a)Probability of active cooperation between schools



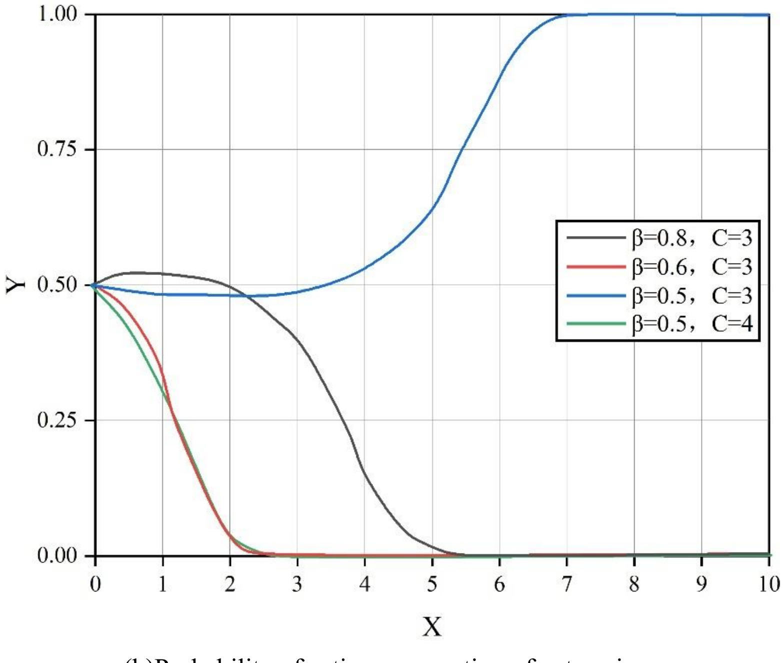
(b)Probability of active cooperation of enterprises

Figure 7. Influence of school-enterprise cooperation income on system evolution.

The impact of cost allocation coefficients on the system's evolutionary path is shown in Figure 8, where Figures (a) and (b) correspond to the probability of positive cooperation by schools and the probability of positive cooperation by enterprises, respectively. When the initial state β = 0.5 and C = 4 is adjusted to β = 0.5 and C = 3, the system evolves from (passive cooperation, passive cooperation) toward (active cooperation, active cooperation), indicating that reducing the cost of school-enterprise cooperation can enhance the cooperative enthusiasm of both parties. Additionally, when the cost is reduced to the level of positive cooperation between schools and enterprises (C = 3), adjusting the cost-sharing coefficient β to 0.3 and 0.7, respectively, causes the system to evolve from (positive cooperation, positive cooperation) to (negative cooperation, negative cooperation), indicating that there exists a reasonable range of cost-sharing coefficients between schools and enterprises during the cooperation process, which can encourage both parties to adopt positive cooperation strategies.



(a)Probability of active cooperation between schools



(b)Probability of active cooperation of enterprises

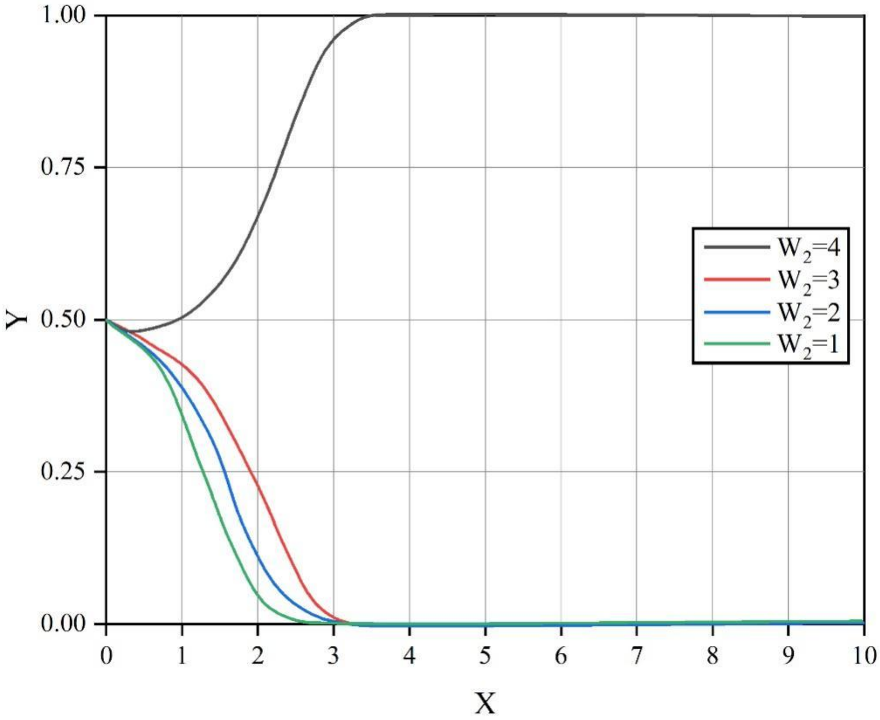
Figure 8. Influence of school-enterprise cooperation cost on system evolution.

2) The impact of government support on system evolution

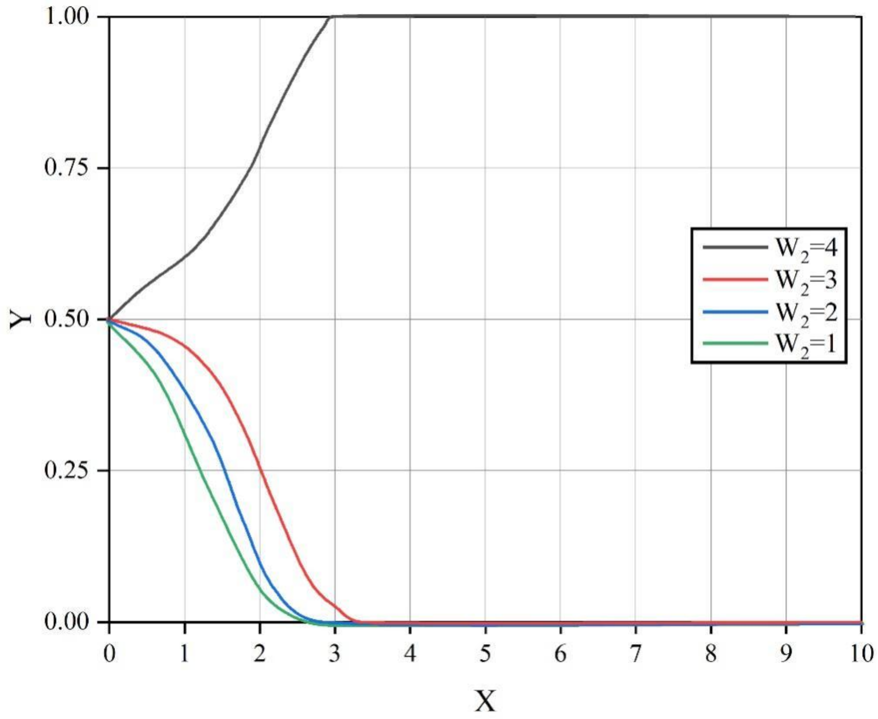
The indicators involved in the government system are W_1, W_2 and F respectively, corresponding to financial support for schools that actively engage in school-enterprise cooperation, policy incentives for enterprises from government departments, and performance evaluation penalties for poor school-enterprise cooperation results due to a passive cooperation strategy.

The impact of incentive policies on system evolution is shown in Figure 9, where Figures (a) and (b) correspond to the probability of active cooperation between schools and the probability of active cooperation between enterprises, respectively. The government strengthens incentives for enterprises to participate in school-enterprise cooperation, with W_2 = 1, W_2 = 2, W_2 = 3, and W_2 = 4, respectively.

where when W_2 takes values of 1, 2, and 3, the system evolves toward the (passive cooperation, passive cooperation) direction, but the evolution speed becomes slower and slower; when W_2 = 4, the strategies chosen by both schools and enterprises tend toward (active cooperation, active cooperation). This indicates that in school-enterprise cooperation, government departments can effectively enhance the enthusiasm of enterprises through incentive measures such as tax incentives and financial subsidies.



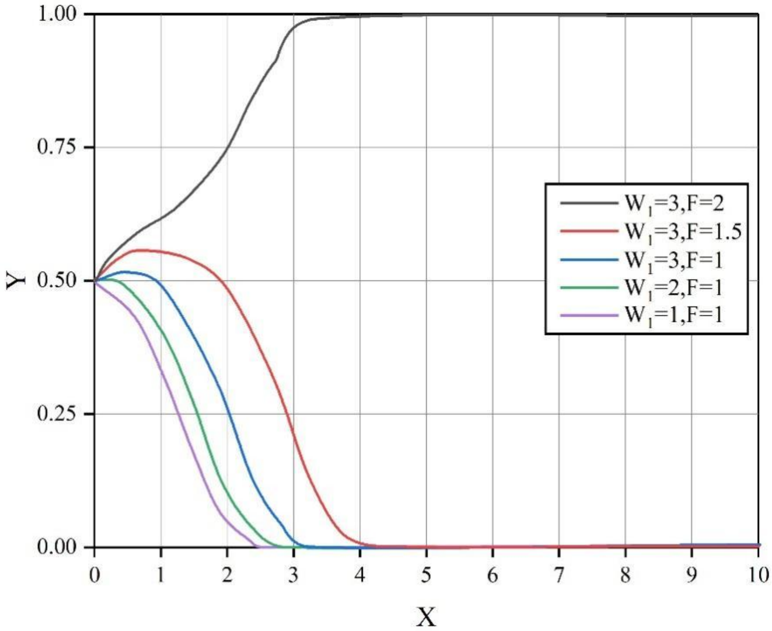
(a) Probability of active cooperation between schools



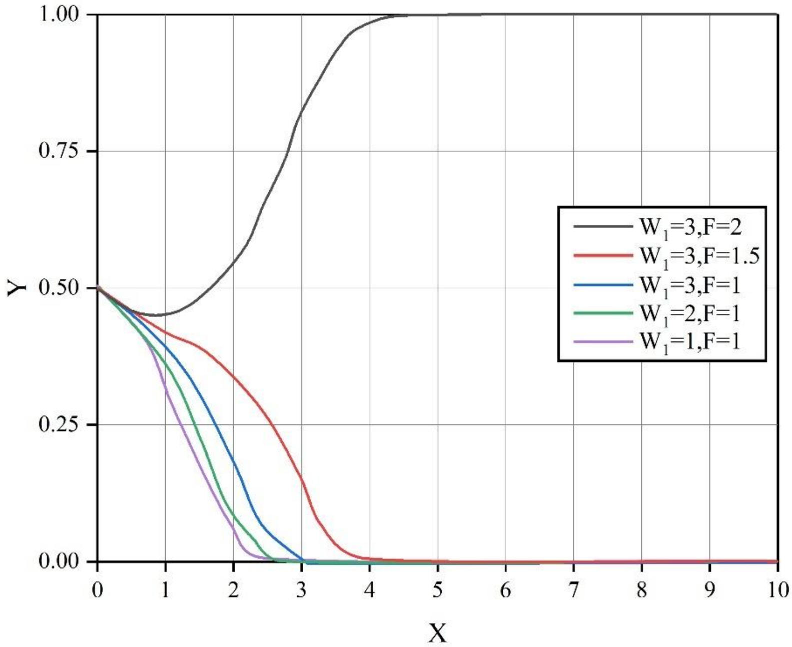
(b) Probability of active cooperation of enterprises

Figure 9. Influence of incentive policy on system evolution.

The impact of financial support and performance appraisal on the evolution of the system is shown in Figure 10, and Figures (a) and (b) correspond to the probability of positive cooperation between schools and enterprises, respectively. When the performance appraisal F given by the government to the school is 1, and the financial support W_1 is 1, 2, and 3 respectively, the system still converges in (negative cooperation, negative cooperation); With the increase of government performance appraisal, when F =1.5, the trend of school evolution in the direction of positive cooperation increases, but the sustainability is not strong, and the system still converges in the state of (negative cooperation, negative cooperation), but when F =2, the system reaches a stable state of positive cooperation. Due to the principal-agent relationship between the government and the school, the government gives the school financial support in the process of school-enterprise cooperation, and hopes that the school will improve the social benefits with the effectiveness of school-enterprise cooperation, and strengthen the supervision of the school through performance appraisal and evaluation, which can eliminate the possible moral hazard problem of the school, so as to promote the school to actively carry out school-enterprise cooperation.



(a) Probability of active cooperation between schools



(b) Probability of active cooperation of enterprises

Figure 10. Impact of financial support and performance appraisal on system evolution.

4. Conclusion

This paper employs system dynamics principles to investigate the interactive development mechanisms between vocational college art design education and corporate digital content operations. In terms of the objective demand for vocational college art design education in corporate digital content operations, there is a mismatch between corporate demand for vocational art professionals and the actual supply, which constrains corporate economic development but also generates an objective demand for vocational art design education. Additionally, vocational colleges cultivate talent to provide qualified labor and high-end professionals for enterprises. The increasing demand for higher-quality labor from enterprises has intensified the pressure on vocational college art design programs to cultivate talent, yet the overall development direction remains clear. Collaboration between vocational colleges and enterprises will enhance enterprise management levels, while students' internship experiences in enterprises will help them adapt more quickly to their job roles after graduation. Additionally, faculty members from vocational colleges engaging in exchanges with enterprises can assist enterprises in improving operational management efficiency.

Considering factors such as the benefits and costs for both vocational colleges and enterprises, as well as government support, this paper constructs an evolutionary game model between vocational colleges and enterprises. It analyzes the evolutionary process and outcomes of school-enterprise cooperation in the bidirectional empowerment process between vocational art design education and enterprise digital content operations. When both parties have low initial cooperation intentions, the evolutionary trend of school-enterprise cooperation tends toward the (0,0) point, i.e., (vocational colleges passively participate in cooperation, and enterprises passively participate in cooperation). When vocational colleges maintain a low level of cooperation willingness while enterprises exhibit strong cooperation willingness, the evolutionary trend of school-enterprise cooperation moves toward the (1,1) direction, i.e., (vocational colleges actively participate in cooperation, and enterprises actively participate in cooperation). If vocational colleges adopt an intermediate level of initial cooperation willingness while enterprises remain at a low level, the cooperation between the two parties will experience phased fluctuations but ultimately still evolve toward the (1,1) direction. The study explores the impact of factors such as cost-benefit analysis and government support on the evolution of school-enterprise cooperation. In terms of the impact of cost-benefit analysis on system evolution, when the excess returns from active cooperation are evenly distributed (α = 0.5) but the returns from active cooperation are at a low level, the system evolves toward (passive cooperation, passive cooperation). If the returns from active cooperation increase, the system evolves toward (active cooperation, active cooperation). When the excess returns from positive cooperation are at a high level (S = 8), adjusting the revenue distribution coefficient α to 0.6 or 0.8 leads to an imbalance in the distribution of cooperative returns, thereby reducing the willingness of both parties to cooperate. However, a reasonable range for the cost-sharing coefficient can encourage both parties to adopt positive cooperation strategies. In terms of the impact of benefits and costs on system evolution, when the government strengthens incentives for enterprises to participate in university-enterprise cooperation, the system evolves toward (passive cooperation, passive cooperation), but the evolution speed slows down. When W_2 = 4, the system tends toward (active cooperation, active cooperation), demonstrating that government incentive measures such as tax incentives and financial subsidies can effectively enhance enterprises' willingness to cooperate. As the government's performance evaluation intensity F increases, the trend toward positive cooperation among schools strengthens, reaching a stable positive cooperation state when F =2. Government incentives and support in school-enterprise cooperation can eliminate moral hazard issues through enhanced regulatory measures, thereby promoting the development of such cooperation.

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