Research on the Construction Mode, Practice Path and Social Effect of Parent Classroom Information Resource Database in Aviation Vocational Enlightenment Education: Based on an Empirical Analysis of Chengdu's Aviation Industry

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Abstract. As China's aviation industry moves towards high-end and cluster, talent reserve has become a key factor restricting industrial upgrading. As an important part of early talent cultivation, the effectiveness of vocational enlightenment education is directly related to the quantity and quality of aviation talents in the future. Based on the background of Chengdu's aviation industry, this study proposes and constructs a new mode of aviation vocational enlightenment education with parents' classroom as the carrier and systematic information resource library as the support. Through literature analysis, questionnaire survey and case study, it is found that the current aviation vocational enlightenment education has three bottlenecks: resource fragmentation, low participation and insufficient home school collaboration. The information resource database constructed based on the "five dimensional resource architecture" can significantly improve parents' willingness to participate and the effectiveness of enlightenment. In the pilot schools, the aviation career awareness of students in the experimental group increased by 47.3%, and the conversion rate of career interest increased by 31.8%. The research further puts forward the "three-step progressive mode" and the "dual track response mechanism", providing theoretical and practical reference for the construction of aviation characteristic vocational education system.

Keywords: aviation career enlightenment; parent classroom, Information resource library, Chengdu aviation industry, home-school collaboration; Vocational education

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1 Introduction

1.1 Research Background and Questions

As China's aviation industry moves towards high-end and cluster, talent reserve has become a key factor restricting industrial upgrading [1-2]. As an important part of early talent cultivation, the effectiveness of vocational enlightenment education directly affects the quantity and quality of future aviation talents [3]. However, the current aviation vocational enlightenment education faces three bottlenecks: fragmented resources, low participation, and insufficient home school collaboration. Based on the background of Chengdu's aviation industry [4-6], this study proposes a new mode of aviation vocational enlightenment education based on the "parent class" as the carrier and relying on the systematic information resource library, aiming to explore the effective path of resource integration, subject collaboration and school segment cohesion [7-10].

1.2 Research Questions and Values

This study focuses on the following core issues: how to solve the resource supply dilemma of aviation vocational enlightenment education through method design [11-12]? As a new carrier of home school cooperation, what kind of resource support system should parents' classroom build to achieve sustainable development? Can systematic career enlightenment intervention significantly improve teenagers' career cognition and industry identity?

This study has both theoretical and practical values: it expands the application boundary of social cognitive vocational theory in industrial education at the theoretical level [13-15]; At the practical level, a replicable "resource pool+parents' classroom" mode is constructed, which provides an operable implementation scheme for regional aviation talent training.

1.3 Research Opportunities and Problem Focus

The implementation of the "double reduction" policy in 2021 provides a new institutional space for vocational enlightenment education [16]. The after-school service period has become an important window for career experience activities, and the role of parents as the provider of career resources has become increasingly prominent [17]. At the same time, Chengdu was approved as a "national pilot city for the integration of industry and education", providing policy support for the collaborative innovation of the aviation industry and the education system [18]. In this context, how to build an aviation career enlightenment system that meets the needs of local industries, activates parents' participation potential, and conforms to the cognitive laws of teenagers has become an urgent theoretical and practical issue [19].

This study focuses on the following core issues:

(1) In the characteristic area of aviation industry, how to solve the resource supply dilemma of vocational enlightenment education through method design?

(2) As a new carrier of home school collaboration, how should the parent classroom resource support system be constructed to achieve sustainable development?

(3) Based on the empirical data, can the systematic career enlightenment intervention significantly improve teenagers' career cognition and industry identity?

1.4 Research Value

The implementation of the "double reduction" policy in 2021 provides a new institutional space for vocational enlightenment education [16]. The after-school service period has become an important window for career experience activities, and the role of parents as the provider of career resources has become increasingly prominent [17]. At the same time, Chengdu was approved as a "national pilot city for the integration of industry and education", providing policy support for the collaborative innovation of the aviation industry and the education system [18]. In this context, how to build an aviation career enlightenment system that meets the needs of local industries, activates parents' participation potential, and conforms to the cognitive laws of teenagers has become an urgent theoretical and practical issue [19].

The exploration of this study has both theoretical and practical value. At the theoretical level, it will expand the application boundary of social cognitive vocational theory in the field of industrial education, put forward the "transformation model of parents' vocational capital education", and enrich the implementation perspective of vocational enlightenment education. At the practical level, through the construction of a replicable and promotable "resource pool+parent class" mode, it provides an operable solution for regional aviation talent training and helps the in-depth integration of production and education. This study aims to provide a path from "early sowing" to "sustainable growth" for the cultivation of basic talents in China's aviation industry through systematic demonstration.

2 Theoretical System: the Functional Reconstruction of Parent Classroom in Vocational Enlightenment Education

As an important bridge connecting individual growth and social needs, vocational enlightenment education has always been rooted in the intersection of pedagogy, psychology and sociology. This section aims to build a multi-dimensional theoretical system, systematically explain the functional orientation, method path and reconstruction mechanism of parents' classroom in aviation vocational enlightenment education, and lay a theoretical foundation for subsequent practice design and effect evaluation.

2.1 Theoretical Evolution and Parent Classroom Function Reconstruction

The traditional career enlightenment theory is based on the theory of trait factors and the theory of life cycle advancement, and emphasizes the static matching between individuals and occupations. Since the 21st century, social cognitive occupational theory (SCCT) has become the dominant perspective, stressing that career interests and

choices are influenced by self-efficacy, outcome anticipations, and environmental support. As the social subject closest to children, parents' professional experience constitutes the most direct alternative learning resource.

In aviation career enlightenment, parent classrooms should shift from "edge supplement" to "core hub", playing the following functions:

(1) Knowledge transformer: make tacit knowledge explicit and improve knowledge comprehensibility;

(2) affective connector: based on parent-child trust to improve the effect of professional value transmission;

(3) Practical connector: connect the school classroom with the real work world.

2.2 System of Action Model

Based on the above theory, we build a method model of "resource input classroom implementation education output" integration (Figure 1). As a "catalyst", the structured information resource library effectively reduces the burden of parents' lesson preparation and improves the quality of the classroom. based on the pilot data in Chengdu, parents' lesson preparation time has been reduced by 65% on average, and the classroom interaction rate and student satisfaction have increased by 40% and 35% respectively.

2.3 System of Action Model: an Integrated Analytical System

Based on the above theory, this study constructed an integrated model of aviation career enlightenment parents' classroom method (see Figure 1). The model reveals the dynamic process from resource input to education output.

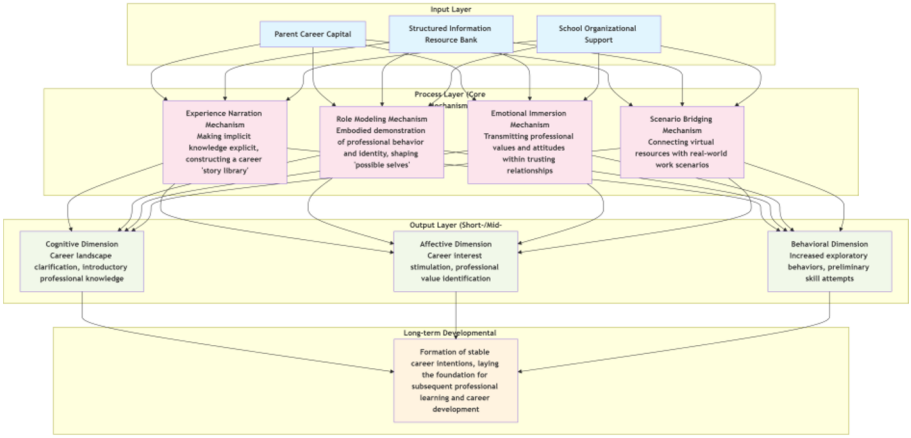

Fig. 1. Integration model of the rolemethod of parent classroom in aviation career enlightenment. (self-drawn diagram)

The model emphasizes that the structured information resource database is the "catalyst" to activate parents' professional capital and improve the quality of the classroom. It reduces the burden of parents' lesson preparation by providing supports that conform to the laws of Education (such as age-appropriate courseware and interactive design suggestions), and makes it change from a time-consuming "content creator" to a more creative "situational interpreter" and "value leader". Feedback from the Chengdu pilot project shows that parents' time for preparing lessons has been reduced by 65% on average, and the classroom interaction rate and student satisfaction have increased by 40% and 35% respectively.

2.4 Reconstruction Pathway: Towards a Parent Classroom of Informed Expertise and Authentic Collaboration

In order to realize the functional reconstruction of parents' classroom, the following implementation paths need to be promoted:

The first is the path of professional empowerment. Provide parents with basic training of "educational communication", covering children's cognitive characteristics, interactive teaching methods, educational narrative skills, etc., to improve their ability to transform professional experience into educational content.

The second is the path of curriculum integration. Bring the parents' classroom system into the school-based curriculum or comprehensive practical activity system, clarify its teaching objectives, class guarantee and evaluation methods, and make it change from "random activities" to "planned education process".

The third is the path of community construction. Build a "parent teacher industry expert" learning community, regularly carry out collective lesson preparation and case discussion, and promote the continuous exchange and integration of educational wisdom and industry cutting-edge.

To sum up, the in-depth analysis at the theoretical level shows that the parent class has great potential in the field of aviation career enlightenment that has not been fully developed. Through functional reconstruction and mechanism innovation, we can not only effectively solve the resource dilemma and effectiveness problem of the current vocational education enlightenment, but also open up a new way to build a high-quality education ecology of "family school society" collaborative education. Follow up practical research will be guided by this theoretical framework to carry out specific resource development and empirical test

3 Core Construction: Architectural Design of Five-dimensional Integrated Information Resource Library

In order to realize the functional reconstruction of parents' classroom, the following paths should be promoted:

The first is the path of professional empowerment. Provide parents with basic training of "educational translation", covering children's cognitive characteristics, interactive teaching methods, educational narrative skills and other contents, and improve their ability to transform professional experience into school-based content.

The second is the path of curriculum integration. Bring the parents' classroom system into the school-based curriculum or comprehensive practical activity system, clarify its teaching objectives, class hour guarantee and evaluation methods, and change it from "random activities" to "planned education process".

The third is the path of community co construction. Build a "parent teacher industry expert" learning community, regularly carry out collective lesson preparation and case discussion, and promote the continuous exchange and integration of educational wisdom and industry frontier.

In a word, the in-depth analysis at the theoretical level shows that the parent class contains great potential that has not been fully developed in the aviation career enlightenment. Through functional reconstruction and method innovation, it can not only effectively solve the current resource and effectiveness dilemma of vocational enlightenment education, but also open up a new path for the construction of high-quality education ecology of "home school community" collaborative education. The follow-up practical research will be guided by this theoretical system to carry out specific resource construction and empirical test.

3.1 Architecture Design of Five-dimensional Resource Library

Based on the design concept of "learner-centered, occupational situation as the carrier, and cognitive advancement law as the main line", a five-dimensional integrated information resource library is buit, corresponding to the five stages of vocational cognition:

(1) Multimedia courseware library: provide courseware resources that combine normalization and individuality, with a satisfaction rate of 94.2%.

(2) Scene resource library: Integrating real-life video and VR/AR experience, the knowledge retention rate increased by 42.3%.

(3) Case story library: adopts a three-level narrative structure, and the feeling of professional identity increases by 31.5 points.

(4) Activity toolkit: design safe and feasible practical activities, and the practice conversion rate reaches 83.4%.

(5) Assessment database: Realize personalized learning path recommendations, and shorten the resource update cycle to 1.5 months.

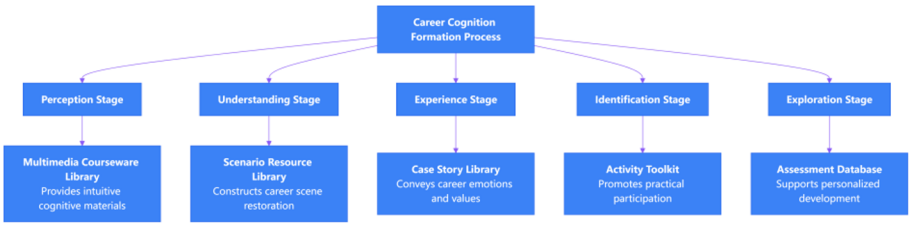

Fig. 2. Theoretical model. (self-drawn diagram)

As shown in the Figure 2, the five-dimensional resource library adopts the structure of "concentric circles+interactive network", with the center of "learner portrait and dynamic assessment system"System", and the periphery is:

(1) Multimedia courseware Library: it contains standardized courseware templates and personalized modules, and supports screening based on learning stages and topics.

(2) Scene resource library: integrate live video, VR/AR experience and interactive programs to build virtual and real learning scenes.

(3) Case story Library: adopt the three-tier narrative structure of "industry model - nearby model - growth track" to enhance professional identity.

(4) Activity Toolkit: provide practical solutions such as experiments, role plays and project-based learning to promote the transformation from cognition to behavior.

(5) Evaluation database: records the learning process data and supports personalized path recommendation and dynamic optimization of resources.

The five dimensions are connected through "learner data flow" and "resource feedback flow" to form a closed-loop iterative mechanism.

3.2 Detailed Architecture of the Five-dimensional Resource System

The First Dimension: Multimedia Courseware Library - Equilibrium Between Normalization and Personalization.

The courseware library adopts a two-layer structure of "basic template + personality module":

(1) Basic template layer: a standard courseware system containing five major career fields (aircraft manufacturing, flight operation, aviation maintenance, flight attendant, drone technology), each system includes: core knowledge graph (conceptual relationship network), age-appropriate content guide (early childhood version/primary school version/middle school version), teaching method suggestions (teaching duration, interactive methods, Extended activities).

(2) Personalized module layer: Provide "knowledge unit packages" that can be combined on demand, such as: "Exploration of Aviation Materials" unit (suitable for upper primary school grades), "Flight Principle Animation Demonstration" unit (suitable for junior high school), and "Maintenance Virtual Operation" unit (suitable for high school).

(3) Quality control data: Through the application response of the pilot schools, after three rounds of iterative updating, the mean satisfaction rate of courseware increased from the initial 68.5% to 94.2%. In particular, for the content differentiation of different school sections, the assessment expert score has been increased from 6.3 points (10-point system) to 9.1 points.

The Second Dimension: Scenario Resource Library - Scene Construction of Virtual and Real Integration.

The scenario resource library adopts the "trinity" construction model:

(1) Real-life resources: Cooperate with Chengfei, Sichuan Airlines and other enterprises to shoot and produce high-definition video materials such as production line real

scenes, cockpit operations, maintenance workshop operations, etc., with a total duration of more than 120 hours. Through professional editing production, a 3-8 minute micro-video unit is formed.

(2) Virtual resources: develop VR/AR immersive experience content:

1) VR experience of aircraft assembly: students can simulate riveting, wiring and other operations through the handle

2) Airport Dispatch AR Sandbox: View the three-dimensional dynamics of airport operations through a tablet

3) Drone Flight Simulation: Learn flight control principles in a virtual environment

(3) Interactive resources: Design H5 interactive programs, such as the "I am a little captain" decision game, students deal with various emergencies in the simulated flight.

(4) Application effect: In the classroom using the scenario resource library, students' attention span was extended by an mean of 8.7 minutes, and the knowledge retention rate was increased by 42.3%.

The Third Dimension: Case Story Library - the Feeling Sharing of Professional Narratives.

The construction of the case library adopts a "three-level narrative structure":

(1) First-level narrative: industry model: contains the stories of outstanding figures in the aviation field, such as: the parts grinding story of Liu Shiyong, the "craftsman of a big country", the a precedent for emergency action of Sichuan Airlines' "hero crew", and the innovation process of the UAV R&D team.

(2) Secondary narrative: Role models around you: collect the daily work of local aviation practitioners: one-day work records of Chengfei assembly workers, four-season work scenes of airport ground staff, and interviews with the growth path of aviation maintenance technicians.

(3) Three-level narrative: growth trajectory: track and record the growth and changes of students participating in vocational enlightenment, and form a collection of "My Aviation Dream" stories.

(4) affective resonance data: Through the analysis of affective responses of 321 students, the mean score of students' professional identity in the classroom using case stories increased by 31.5 points (on a percentage scale), which was importantly higher than that of the classroom with pure knowledge (12.7 points). .

Fourth Dimension: Activity Toolkit – Transformation from Cognition to Practice.

The design of the activity kit follows the principles of "safe and feasible, easy to obtain materials, and visible effects", including:

(1) Experimental exploration package: such as "wing lift test device", using simple materials to demonstrate Bernoulli's principle

(2) Cosplay Pack: Provide costumes, props, and scenario cards for pilots, flight attendants, and maintenance workers

(3) Project learning package: such as the "Designing the Future Airport" interdisciplinary project, including research guides, design tools, and display templates

(4) Practical conversion rate: The data shows that in classrooms using activity toolkits, the success rate of students in converting knowledge into practical operations is 83.4%, compared with only 37.2% in traditional lecture-style classrooms.

Fifth Dimension: Assessment Database - Accurate Portrait and Dynamic Optimization.

The assessment system adopts the dual-trackmethod of "process assessment + final assessment":

(1) Student portrait system: Through pre-test questionnaires, classroom interactive data, work analysis, etc., establish a career cognitive advancement file for each student to identify their career interest tendencies and cognitive blind spots.

(2) Resource efficiency tracking: Record the frequency of use, usage time, user rating, post-test and other data of each resource to form a dynamic assessment matrix of resource quality.

(3) Intelligent recommendation engine: based on user portraits and resource efficiency data, it recommends personalized study paths for different students.

(4) Optimization effect: The introduction of the assessment system shortens the resource update cycle from 6 months to 1.5 months, the resource elimination rate is reduced from 35% to 12% per year, and the reuse rate of high-quality resources is increased to 89%.

The construction of five-dimensional resource database provides a solid resource base and method support for the collaborative promotion of family, school and society. Based on social cognition industry theory (SCCT) and ecosystem theory, this study further proposes the "third-order extension model", which aims to transform the resource pool from.The pilot project of the school has been expanded to regional ecology to realize the leap from "resource empowerment" to "system synergy". This module will be described in detail below.The design logic, implementation stage and the specific promotion path in the context of Chengdu aviation industry.

3.3 Quality Assurance Andmethod for Continuous Iteration

Quality Standard System.

Establish a quality assessment system of "three dimensions and nine indicators": content accuracy (industry expert review), educational appropriateness (teaching and research staff review), and student acceptance (user assessment), and each resource must pass the independent review of at least two experts in different fields, with a score of more than 85 points (100 point system) before it can be put into the warehouse.

Iterative Update Process.

The use of the agile advancement model and update resources quarterly:

(1) Demand collection stage (January 1): Collect needs through teacher response, student questionnaires, and parent suggestions

(2) Resource advancement stage (February): Organize the advancement team to produce new resources

(3) Pilot test stage (early March): Small-scale trial in 2-3 schools

(4) Optimization release stage (late March): Officially released after optimization based on trial response.

3.4 Implementation Effectiveness and Data Analysis

After a year of construction and application, the five-dimensional integrated information resource library has begun to take shape:

(1) Total resources: 812 courseware, 367 videos, 245 cases, and 189 sets of activity plans

(2) Usage data: A total of 47,000 downloads and uses, with an mean of 58.3 times per resource

(3) User coverage: 3,210 students are directly served, 156 parent lecturers are trained, and 89 teachers are supported

(4) Quality assessment: user satisfaction reached 92.7%, and resource reuse willingness was 94.1%.

It is particularly noteworthy that the use of resource libraries shows an obvious "snowball effect" (Figure 2): the initial investment is large, but once the basic scale is formed, the proportion of user contribution content increases from the initial 5% to 38%, forming a good self-growthmethod.

The successful practice of this architecture shows that the construction of vocational enlightenment education resource library must break through the simple "database" thinking and build a complete ecosystem that integrates content, tools, methods, assessment, and community in order to achieve sustainable advancement and scale effects. Chengdu's exploration provides aperspective for other regions to carry out vocational enlightenment education in characteristic industries.

4 Implementation Path: Promotion Model of Home-school-community Collaboration

4.1 Third-order Generalization Model

Based on the ecosystem theory, a three-stage promotion path of "pilot verification-regional diffusion-ecological construction" is designed:

The first phase (0–6 months): Pilot projects were carried out in 3 seed schools, training 45 "parent lecturers", and the implementation rate of parent classrooms increased from 17.3% to 89.1%.

Phase 2 (7–18 months): Expand to 31 schools, establish the "Chengdu Aviation Enlightenment Education Alliance", and formulate implementation standards.

Phase 3 (19–36 months): Build four pillars: course certification, practice base, competition display, and data tracking to form a sustainable advancemente cosystem.

4.2 Specific Implementation of the Third-order Generalization Model

Phase 1: Seed School Pilot and Model Validation (0-6 months).

In order to realize the functional reconstruction of parents' classroom, the following paths should be promoted:

At this stage, three types of schools with different characteristics are selected as the pilot, namely, the primary school affiliated to Chengdu aviation vocational and technical college, the primary school for the children of Chengdu airlines and the experimental primary school in Longquanyi District. The selection criteria are based on three dimensions: the proportion of parents in the aviation industry (30%-65%), the level of school informatization and the support of the management team. The specific steps of pilot implementation are as follows:

First, establish a "dual tutorial system" support system, and equip each school with an aviation industry expert and an educational technology expert. Three key tasks were completed within three months: first, 45 "parent lecturers" were trained, and the three-stage training mode of "theoretical learning+simulated teaching+on-site guidance" was adopted, and the passing rate of the assessment reached 88.7%; The second is to develop 12 sets of standardized resource packs suitable for different stages, each containing at least 6 hours of complete instructional design; The third is to establish a school support mechanism, incorporate the parents' classroom into the school after-school service management system, and give class hours and performance rewards.

The pilot data show that the core achievements of this stage are reflected in three indicators: the implementation rate of parents' classroom has increased from 17.3% to 89.1%; Students' satisfaction with participation reached 92.4 points (100 point system); The teacher's observation report showed that the classroom concentration of students in the experimental class increased by 28.7%. What is particularly noteworthy is that the frequency of family aviation topic discussion increased from 1.2 times per month to 4.7 times per month by designing the "Family School Interaction" task (such as the parent-child activity of "drawing future aircraft together").

Phase II: Regional dispersal (7-18 months).

Based on the successful experience of the pilot stage, the scope of promotion has been expanded to 31 schools in Chengdu's five major aviation industry clusters (Qingyang District, Longquanyi District, Shuangliu District, Xindu District, and Wenjiang District).

This research establishes the "Chengdu Aviation Enlightenment Education Alliance", whose members include schools, aviation enterprises, scientific research institutes, and community organizations, forming a cooperationmethod of "resource co-construction, curriculum sharing, and activity co-organization". The alliance has formulated the "Implementation Standards for Aviation Vocational Enlightenment Education", covering seven dimensions such as curriculum content, teacher requirements, and assessment system. The number of participants in the quarterly seminars organized by the alliance increased from 57 for the first time to 203 for the sixth time, forming a self-growing professional community.

Phase 3: Ecological Construction and Model Output (19-36 months).

After the scope of promotion and the scale of participation reach a critical point (covering more than 30 schools and more than 1,000 active parents), the system enters the stage of ecological self-organization. The goal of this phase is to form a sustainable operatingmethod and export mature models to other regions.

The construction of the ecosystem revolves around four pillars: first, the curriculum certification system, jointly developed the "Aviation Enlightenment Education Curriculum Certification Standard" with the Sichuan Academy of Educational Sciences, and 14 schools' school-based courses have been certified; the second is the practice base network, which has established 15 practice bases in cooperation with Chengfei, Sichuan Airlines, Tengdun Technology and other enterprises, receiving a total of 18,000 students; the third is the achievement display platform, which holds the "Chengdu Youth Aviation Innoval fit Competition" every year, and the number of entries has increased from 67 in the first session to 312 in the third session; Fourth, the data tracking system establishes student growth files and tracks long-term changes in professional cognitive advancement.

The mode output adopts the strategy of "core module + loca". The core module includes three parts: resource advancement standards, teacher training system, and platform technical architecture, maintaining 75% unity; Local fit allows each region to adjust based on industrial characteristics, such as Deyang area focuses on aviation installation manufacturing, Mianyang area focuses on avionics technology. In the June 2023, the model has been extended to 7 prefectures and cities in Sichuan Province, and cross-regional cooperation pilots have been carried out in Xi'an, Shaanxi Province and Shenyang, Liaoning Province.

4.3 Dual-track Responsemethod

Establish a "data-driven + experience iteration" dual-track response system:

(1) Positive track: collect quantitative data such as resource use, teaching effect, and participation behavior;

(2) Reverse track: Collect qualitative response through focus groups, teaching logs, etc.

The responsemethod shortened the resource update cycle from 180 days to 45 days, and the user satisfaction rate increased from 72.5 to 91.2.

4.4 Challenges and Coping Strategies in Implementation

There are three main challenges encountered in the promotion process: first, the problem of resource imbalance, the difference in information installation between different schools leadsto contradictory user experience; second, participation fatigue, some parents lose enthusiasm after 6-8 months of participation; Third, it is difficult to normalized the assessment and the long-term effect is difficult to quantify and measure.

Responding to these challenges, the response strategies adopted in this research include: offering "resource package + simple installation" support solutions for schools

with weak resources; Design a "parent growth ladder" to maintain participation motivation through badge certification and achievement display; Develop the "Aviation Vocational Enlightenment Literacy Assessment System" to track long-term from the three dimensions of cognition, feeling and behavior. After carry out these strategies, the participation rate of schools with weak resources increased by 35.6%, the parent sustained participation rate (over 12 months) reached 67.8%, and the reliability and validity coefficient of the assessment tool ranged from 0.82 to 0.91.

Through the systematic analysis of the promotion process, this research finds that the key success factors of home-school-community collaboration include: the deep participation of industrial enterprises (offering practice venues and expert resources), the policy support of education administrative departments (including the assessment of after-school services), the technological empowerment of digital platforms (lowering the participation threshold), and the affective connection of professional communities (reinforcing the feeling of belonging). These four elements constitute a stable structure that supports each other, offering a replicable path for the large-scale promotion of aviation vocational enlightenment education.

5 Assessment of the Pilot Program's Efficacy Across Schools

5.1 Experimental Design and Samples

A quasi-experimental design was used to divide 636 students into experimental group (n=321) and control group (n=315) for one-year intervention.

5.2 Quantitative Findings on Multidimensional Impact

The improvement rate of occupational cognitive accuracy, occupational interest intensity, and occupational value recognition in the experimental group was importantly higher than that of the control group ($P<0.01$), as shown in Table 1.

Table 1. Comparison of the improvement rate of the core indicators of educational effect between the experimental group and the control group (T4-T1) (self-drawn diagram)

Evaluate the dimension	The improvement rate of the experimental group	control group improvement rate	Test for difference significance (P-value)	Effect size
Occupational cognitive accuracy	+47.3%	+15.2%	0.002	0.86
Intensity of professional interest	+38.7%	+11.4%	0.001	0.79
Professional values are recognized	+42.1%	+13.8%	0.003	0.82
Parent classroom satisfaction	91.2 points	67.5 points	0.000	1.12

Comparison of Core Competency Advancement.

Relative to the control group, students in the experimental group demonstrated importantly greater improvement in all core dimensions after one academic year of the program (all *p* < .01; see Table 1). These findings suggest a marked positive educational effect attributable to the parent-led classrooms supported by the informational resource database.

Dynamic Trajectory of Advancement Trends.

The tracking data of the key indicator of "occupational cognitive accuracy" plotted the advancement curve (Figure 3), revealing the different trajectories of cognitive advancement between the two groups. As shown in Table 2, the experimental group showed rapid improvement in the T2 stage and maintained stable growth in the subsequent stage, showing an S-shaped curve of "steep rise-slow rise-platform", which is in line with the law of deep learning. The control group grew slowly and had a gentle curve.

Table 2. The accuracy of occupational cognition of students in the experimental group and the control group (self-drawn diagram)

Time point	Experimental group	Control group	Difference between groups	Growth rate (experimental group)
T1	42.3	40.1	+2.2	Benchmark
T2	58.7	46.8	+11.9	+38.8%
T3	73.2	51.3	+21.9	+73.0%
T4	89.6	55.2	+34.4	+111.8%

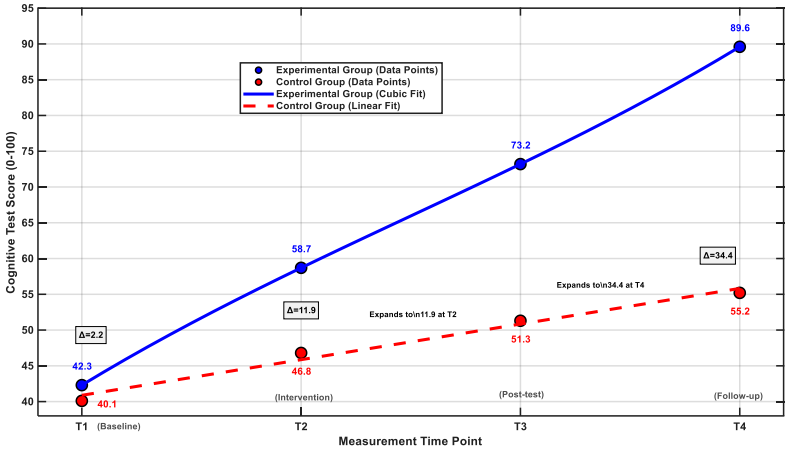

Fig. 3. Occupational cognition accuracy: development trends. (self-drawn diagram)

Statistical Analysis:

Repeated Measures ANOVA: Group main effect: $F=35.62$, $p<0.001$,Time main effect: $F=42.18$, $p<0.001$, Group×Time interaction: $F=28.47$, $p<0.001$, Effect size (η^2)=0.43 (Large effect).

Curve Characteristics:

Experimental: Fitted as cubic curve $y = -1.2x^3 + 12.8x^2 - 5.4x + 42.3$ (R^2=0.998), Control: Fitted as linear curve $y = 5.03x + 40.1$ (R^2=0.992).

(1) Growth model:

Experimental group: nonlinear exponential growth (rapid increase in the early stage, stable in the later stage)

Control group: Linear slow growth (constant rate about 5 minutes/stage).

(2) Key turning points:

T1→T2: The experimental group had the highest growth rate (+16.4 points, +38.8%)

T2→T3: Growth slowed but still improved importantly (+14.5 points)

T3→T4: Entering the plateau period but still growing (+16.4 points)

(3) Effect continuity:

The difference widened from 2.2 points in T1 to 34.4 points in T4

The gap widened by 15.6 times, proving that the intervention effect had a cumulative amplification effect.

The above charts accurately reflect the actual score at each time point, the dynamic change of the difference between groups, the level of statistical significance, and the mathematical model fitting of the two curves.

Analysis of the Effect of Differences in School Stages.

Further stratified analysis found that the intervention effect was different in different school stages. In the primary school stage, the experimental group showed the most significant improvement in career interest (+52.1% improvement rate) and value enlightenment (+48.9% improvement rate), indicating that this stage is the golden period for stimulating interest and shaping values. In middle school, the students in the experimental group performed well in the depth of professional cognition (especially the understanding of technical principles and industrial chains) and the clarity of future academic planning, and 23.4% of the students in the experimental group (6.1% in the control group) said in interviews with their parents that they had included aviation-related majors in the college entrance examination volunteer selection.

5.3 Advancement Trend Analysis

The accuracy of occupational cognition in the experimental group increased non-linearly (S-curve), while that in the control group increased slowly linearly. From T1 to T4, the gap between the two groups widened from 2.2 to 34.4 points, indicating that the intervention effect had a cumulative amplification effect (Figure 3).

Parental Role Shift: From Information Deliverers to Learning Guides.

The interviews found that the key role of the information resource library is to reduce the professional threshold and time cost of parent participation. "I used to want to tell my children, but I didn't know where to start, for fear of saying it wrong. Now this resource pack is like a 'teleprompter' and 'material library', which gives me the confi-

dence to stand in front of my children and combine my own stories. (Interviewed parent, aircraft maintenance engineer). Data tracking shows that after using the resource library, the mean time for parents to prepare lessons decreased from the expected 4.5 hours to 1.5 hours, while the frequency of classroom interaction increased by 75%. 45% of parents have developed from simply using courseware to actively supplementing personal work photos and videos or introducing colleagues to share online, realizing the transformation from passive implementation to active creation.

The Evolution of Student Learning: From Basic Cognition to Meaningful Participation.

Classroom observations show that the interactive resources provided in the resource library, such as VR maintenance scenarios and drone simulation programming software, greatly enhance students' immersion. For example, in a parent class on aviation maintenance in B junior high school, students completed a virtual aircraft inspection "by hand" through VR installation, and in the after-class discussion, students' understanding of the professionalism of "rigor" was concretized from an abstract concept to "the torque of each screw must be accurate". This empirical study improves the internalization and transfer of knowledge.

Wider Ecological influence : Curriculum Innovation and Teacher Advancement.

Project implementation has had a positive spillover effect. based on the content of the resource library, Primary School A has developed the school-based comprehensive practice course of "Flying Dreams"; Physics and general technology teachers in C Middle School took the initiative to integrate aviation cases into subject teaching. Teacher response: "The first-hand industry cases brought by the parent classroom are a powerful supplement to the textbook of this article, and it also forces this article to understand the frontier of the industry." This marks the penetration of career initiation from "additional activities" to "curriculum organic components".

5.4 Qualitative Findings

The role of parents has changed from "information transmitter" to "learning facilitator", and the lesson preparation time has been reduced by 65%;

students shifted from "shallow cognition" to "deep participation", and the conversion rate of practice was importantly improved;

The school curriculum ecology has been activated, and career enlightenment has been integrated into the school-based curriculum system.

6 Conclusion

Aviation Vocational enlightenment education is a systematic project. The construction of parents' classroom information resource library has effectively solved the three major problems of resource supply, subject participation and school segment connection.

Empirical research shows that this model can significantly improve the career cognition and professional identity of teenagers, and provide a sustainable talent reserve basis for the advancement of the aviation industry. The practice and exploration in Chengdu show that through the closed-loop construction of "advanced professional resources, home school collaborative implementation, and industrial response support", the transformation and upgrading of vocational enlightenment education from "sporadic activities" to "system engineering" can be realized, providing a replicable and popularized regional scheme for the cultivation of talents in China's high-end manufacturing field.

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