

# Unveiling Entrepreneurial Development in Data Science Using CCIP-PF Model and Statistical Analysis

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## Abstract

This study aims to explore the intricacies of entrepreneurial development within the realm of data science, shedding light on both internal and external factors that play pivotal roles in shaping the entrepreneurial landscape. Through the lens of the CCIP-PF model and employing rigorous statistical analysis, this research endeavors to provide insights crucial for fostering entrepreneurial growth in this dynamic field. The objectives of this study are: 1) To develop the CCIP-PF model and establish an assessment index system for mental health literacy training in junior high schools; and 2) To apply the evaluation index system to junior high school mental health literacy training, thereby promoting the enhancement of educational quality. The sample group consisted of 17 experts who participated in discussions and generated 162 viewpoints on the constituent elements of evaluation for junior high school mental health literacy training. The methodology employed the Delphi method; the instrument utilized a qualitative assessment approach, employing questionnaires to ensure anonymity and provide reliable feedback. A questionnaire survey was conducted among 422 participants in Sichuan Province's relevant educational administrative authorities, middle school mental health education teachers, university lecturers and professors in mental health education, and psychological counselors. The response rate reached 96.2%. The study analyzed the data using mathematical statistics and SPSSAU22.0, focusing on the reliability of the entire questionnaire and its dimensions. The findings of this study are as follows: 1) primary indicators at mean 4.794, SD = 0.473, IQR = 0.125; secondary indicators at mean 4.823, SD = 0.379, IQR = 0.25; tertiary indicators at mean 4.790, SD = 0.424, IQR = 0.302. A factor contribution rate of 74.175% demonstrates efficacy. 2) Empirical research was conducted in various districts of Zigong City, yielding outcomes that align with reality and meet the anticipated objectives.

**Keywords:** Entrepreneurship, Junior High Schools, Data Science, Entrepreneurial Intention, CCIP-PF model

## 1. Introduction

The World Health Organization (WHO) highlighted the pressing issue of mental health among adolescents, emphasizing its global significance and the emergence of up to 50% of mental health conditions before the age of 14 [1]. In a Chinese context, the "Report on the Development of National Mental Health in China (2019–2020)" revealed alarming rates of depression among junior high school students, with a detection rate of approximately 30% and severe depression ranging from 7.6% to 8.6% [2]. The "2022 Survey Report on the Mental Health Status of Adolescents" further indicated that 14.8% of Chinese adolescents face varying degrees of depression risk, prompting the need for focused interventions [3].

Notably, adolescents in the western regions of China exhibited higher levels of depression, loneliness, and smartphone addiction [3], emphasizing the regional variations in mental health challenges. To address this, Zigong City in the western region of Sichuan Province is selected as the research focus. The prevalence of psychological health issues,

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including suicide and self-harm, underlines the inadequacy of psychological health education in Chinese junior high schools, where subjects like language and mathematics often overshadow the importance of mental health education [4].

Recognizing the need for improvement, the Chinese Ministry of Education issued the "Guidelines for Quality Evaluation of Compulsory Education" in 2021, integrating psychological health education into the evaluation criteria for junior high schools [5]. The "Special Action Plan for Comprehensive Strengthening and Improvement of Student Psychological Health Work in the New Era (2023-2025)" further emphasizes the importance of enhanced evaluation in primary, middle, and high schools [6].

In light of this, the research aims to contribute to the field of data science by developing a novel model, drawing inspiration from the Taylor and CIPP models, to establish indicator standards tailored for psychological health education and training programs for junior high school students in Zigong City, Sichuan Province, China. This innovative approach seeks to leverage data-driven insights for practical educational evaluation, ultimately improving the effectiveness and impact of psychological health interventions in the region [7].

## 2. Literature Review

### 2.1. Data-Driven Exploration of Psychological Health Issues in Junior Middle School Students

Junior high school students, typically aged between 12 and 15, navigate a critical phase marked by rapid physiological and psychological development, characteristic of adolescence. This transformative period not only shapes their identity but also renders them highly vulnerable to an array of psychological challenges. A comprehensive examination of current literature unveils a spectrum of eight prevalent manifestations observed among junior middle school students, shedding light on the multifaceted nature of their psychological experiences:

- 1) **Inferiority Complex:** As adolescents grapple with a developing sense of self, feelings of inadequacy or inferiority may surface, impacting their overall well-being [8].
- 2) **Rebellious Mindset:** The quest for independence and self-expression often leads to a rebellious mindset, where students may challenge authority figures and societal norms, contributing to their psychological landscape [9].
- 3) **Avoidance Mentality:** Coping with societal expectations and academic pressures may give rise to an avoidance mentality, where students seek refuge from challenges rather than confronting them directly [10].
- 4) **Jealousy Mentality:** Social dynamics and peer relationships play a pivotal role during adolescence, fostering emotions like jealousy that can significantly impact students' psychological well-being [9].
- 5) **Depressive Mindset:** The intricate interplay of hormonal changes and academic stressors may manifest in depressive mindsets, highlighting the need for early detection and intervention strategies [1].
- 6) **Aversion to Learning Mindset:** Academic pressures and the competitive nature of education may contribute to an aversion to learning mindset, potentially hindering students' cognitive and emotional development [9].
- 7) **Early Romantic Mindset:** Explorations in interpersonal relationships and the onset of romantic interests introduce a new dimension, influencing emotional well-being during this critical period [10].
- 8) **Internet Addiction:** In an increasingly digitized world, the prevalence of internet addiction poses a significant concern, affecting not only academic performance but also overall mental health [9].

Understanding and addressing these varied manifestations is essential for developing targeted interventions and support systems to foster the psychological well-being of junior high school students. The intricate interplay of these factors underscores the importance of a holistic and data-informed approach to address the nuanced challenges faced by adolescents in the educational landscape [11].

### 2.2. Analyzing the Landscape of Junior High School Psychological Health Education through Data Science

Wu Xiaocui [12] highlights prevailing issues in psychological health education for junior middle school students, such as inadequate emphasis, insufficient teacher education, resource allocation challenges, and an imperfect assessment and reward system. Yuanyuan Huang and Hongmei Lai [8] underscore issues like insufficient institutional support, funding constraints, and a shortage of qualified teaching staff. Dan Chen [13] identifies issues encompassing

insufficient attention, low professional standards among teachers, limited integration of educational resources, and the absence of a comprehensive assessment and evaluation mechanism. Gaiyun Pan [14] emphasizes the need for attention to students' psychological well-being education and a robust evaluation system.

### 2.3. Integration of Data-Driven Evaluation Models and Indicator Systems in Psychological Health Education

Examining existing evaluation models, including the Taylor model, CIPP model, CSE model, and Opponent model, reveals the influence of data science on educational assessment [15][16]. The Taylor model, primarily centered on educational objectives, faces criticism for neglecting students' needs and adopting arbitrary and mechanistic evaluation criteria [17]. The CIPP model, emphasizing improvement and the evaluation process, encounters limitations in application and feedback of results [18][19].

Yan Linfeng Yao Dewen [20] introduces a data-informed junior high school psychological health education evaluation system with four primary indicators: contextual evaluation, teacher evaluation, process evaluation, and outcome evaluation, along with eighteen secondary indicators and twenty-eight tertiary indicators. Irene [16] present primary and secondary school psychological health education evaluation systems, incorporating data-driven aspects like design, preparation, activity process, effectiveness, organizational management, hardware facilities, teaching staff, evaluation content, methods, and outcomes. This literature review sets the stage for the proposed data science-based model aimed at refining the evaluation and enhancement of psychological health education programs for junior high school students.

## 3. Method

### 3.1. Population

The study engaged a diverse participant pool, utilizing a data-centric approach to comprehensively analyze the landscape of psychological health education in junior high schools. The participants represented various stakeholders, including educational bureau staff from six districts in Zigong City, 117 middle school psychological health educators, head teachers, and students. Additionally, the study included psychology lecturers, professors, counselors, and university students from Sichuan University of Science & Engineering. To enhance the depth of understanding, mental health professionals from the Fifth People's Hospital of Zigong City, as well as instructors from five training institutions within Zigong City, were actively involved.

The data collection process incorporated quantitative and qualitative methodologies, ensuring a holistic exploration of psychological health issues. Surveys, interviews, and focus group discussions were conducted to gather diverse perspectives and insights. The use of advanced statistical tools and data analysis techniques allowed for a rigorous examination of the gathered information. Moreover, data science methodologies were applied to identify patterns, correlations, and trends within the collected data, offering a deeper understanding of the psychological health landscape in junior high schools.

This comprehensive approach, blending traditional research methods with data-driven techniques, positioned the study to extract valuable insights from the varied experiences and viewpoints of the participants. The integration of data science principles not only facilitated a more nuanced exploration of psychological health issues but also paved the way for informed recommendations and strategies for improving the overall psychological well-being of junior high school students in Zigong City.

### 3.2. Sample Size and Sampling Method

This study used probability sampling techniques [21][22]. The formula used for calculating the sample size was as follows:

$$n = \frac{Z^2 \cdot p \cdot (1 - p)}{e^2}$$

In the formula,  $n$  represents the required sample size,  $Z$  signifies the Z-score corresponding to the chosen confidence level,  $p$  denotes the proportion of a specific attribute within the population, and  $e$  represents the allowable margin of

error. In this study, Z is set at 95% (corresponding to a Z-score of approximately 1.96), p is established as 50%, and e is determined to be 5%. Consequently, the calculated sample size is 384. To mitigate potential survey collection errors, we augmented the sample size by over 10%, resulting in a final sample size of 422 cases. The Chinese survey software Wenjuanxing distributed 422 survey questionnaires to participants in this study. Ultimately, 406 completed questionnaires were received, with 16 being excluded from the study due to incomplete information. The final analysis was conducted based on the 406 valid questionnaires, resulting in a response rate of 96.2%.

### 3.3. Research Instrument

This study employed questionnaire surveys and expert interviews as research tools. In response to the suggestions provided by the experts regarding the indicator system, a targeted questionnaire was developed comprising 28 survey items. Among these, questions 1 to 9 pertain to basic demographic information such as the gender and educational background of the participants, while questions 10 to 28 address specific aspects of the indicator standards for the mental health education training program in the context of Chongqing, Sichuan Province, China. The questionnaire results were subjected to reliability and validity analysis using SPSS version 22.0 [23][24][14][29]. The analysis yielded the following outcomes:

**Reliability:** The Cronbach's alpha coefficient was 0.964, which exceeded 0.9, indicating a high level of data reliability for this study. Therefore, the data can be considered high quality and suitable for further analysis.

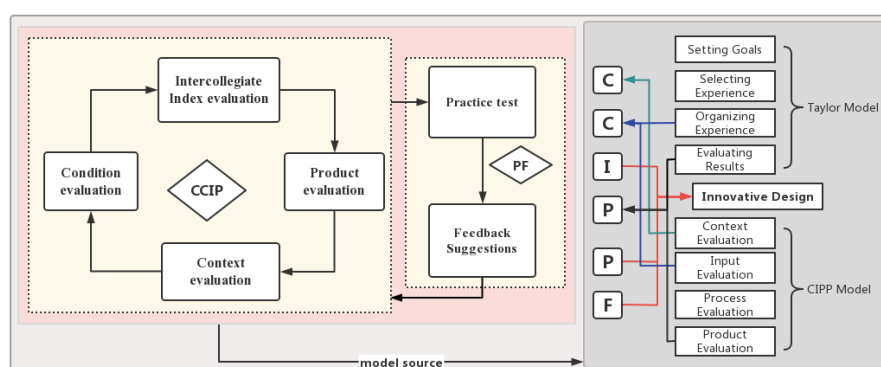
**Validity:** The validity analysis used the KMO (Kaiser-Meyer-Olkin) and Bartlett's tests. The KMO value obtained was 0.938, which exceeded the threshold of 0.8, indicating that the research data was highly suitable for factor extraction, thus reflecting good validity. Additionally, Bartlett's test yielded a p-value of 0, which was less than 0.05, indicating a significant result and further confirming the reasonable validity of the data.

A higher KMO score indicates stronger correlations and more accurate results. The KMO value for the individual factor was 0.895, with a significance of 0.003, indicating suitability for conducting factor analysis.

### 3.4. Framework

A data-driven mixed-methods approach was strategically employed in this study to seamlessly integrate the Taylor model and the CIPP model, capitalizing on their strengths while circumventing their inherent limitations. Embracing a data science perspective, the research adopted a third-party evaluation stance, intertwining the Taylor and CIPP models within a closed-loop structure termed "Evaluation System - Practical Validation - Feedback Recommendations." This innovative approach places a strong emphasis on evaluating both the educational process and its outcomes, aligning with the principles of data-driven decision-making.

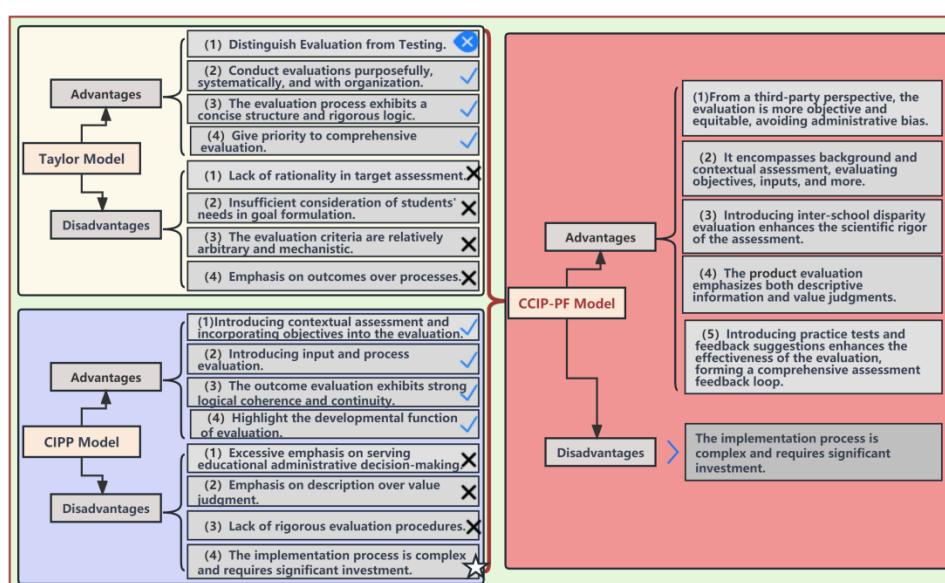
Furthermore, the study incorporated practical application and feedback recommendations into its methodology, leading to the development of the CCIP-PF model. Rooted in data science methodologies, this model is designed to comprehensively analyze the indicator standard system for psychological health education and training programs tailored specifically for junior high school students in Zigong City, Sichuan Province, China. The model's implementation and analysis are visually represented in Figure 1, showcasing its structured and data-centric approach to evaluating and enhancing psychological health education programs.



**Figure 1.** CCIP-PF Model and its Source

Figure 1 shows the CCIP-PF evaluation model on the left-hand side, which comprises six components: (1) Context evaluation; (2) Condition evaluation; (3) Intercollegiate index evaluation; (4) Product evaluation; (5) practice test; (6) Feedback Suggestions. Among them, sections (1) to (4) constitute the CCIP, which forms the evaluation standard system, while sections (5) to (6) represent the PF. The right-hand side of the CCIP-PF model represents its sources, wherein context evaluation (C) and product evaluation (P) are derived from CIPP. Condition evaluation (C) combines elements from CIPP's input assessment and the organization of experiences from the Taylor model. Intercollegiate Index evaluation, practical validation, and feedback recommendations are original contributions to the model.

A comparative analysis of the strengths and weaknesses of the Taylor model, CIPP model, and CCIP-PF model is presented in Figure 2 [25][26][27][28][29][30].



**Figure 2.** Comparative Analysis Chart of the Advantages and Disadvantages of Taylor Model, CIPP Model, and CCIP-PF Model.

Figure 2 shows that the Taylor and CIPP models have four main advantages and disadvantages. The CCIP-PF model adopts the strengths of the Taylor and CIPP models, as indicated by the checkmarks in the left figure while avoiding their weaknesses, as represented by the crosses in the left figure.

One of the advantages of the Taylor model lies in separating evaluation and testing. In the CCIP-PF model, evaluation and testing are placed in two consecutive stages, facilitating a more rigorous examination of the scientific of the evaluation indicator system. Additionally, this approach includes the incorporation of feedback recommendations. A pentagram symbol was marked in the fourth drawback of the CIPP model. In the CCIP-PF model, this limitation was avoided by collaborating with the Education Bureau of Zigong City, Sichuan Province, which helped mitigate the need for significant financial and material resources and enhanced replicability. However, there remains to be a drawback of having a relatively complex procedure requiring substantial input of effort. In conclusion, the CCIP-PF model is superior to the Taylor and CIPP models and better suited for this study.

### 3.5. Research Process

Centered around the CCIP-PF model, this study employed the Delphi method to investigate the indicator standards for psychological health education and training programs tailored for junior high school students in China. Expert interviews and questionnaire surveys were conducted to gather data for the Delphi process. This study used quantitative and qualitative methods to examine data collection, analysis, and statistics. Following four steps, the data were collected

and analyzed to construct the indicator system for evaluating psychological health education in junior high schools in Zigong City, Sichuan Province, China, using the CCIP-PF model.

**STEP 1:** A brainstorming session was conducted to formulate the predictive questions for the indicator standards of junior high school psychological health education and training programs. An open and anonymous approach was used to solicit opinions from 17 experts in psychological health education. The expert opinions were compiled, organized, and categorized. Based on the brainstorming results and relevant literature on psychological health education from the Chinese government and other sources, 48 elements constituting the indicator standards for junior high school psychological health education and training programs were identified. These elements were incorporated into the first interview questionnaire.

**STEP 2:** The first interview questionnaire was used to solicit opinions from the 17 experts. After considering the feedback and identifying the factors and indicators generally deemed unnecessary by the experts, these elements were removed from the indicator system. The system was then revised and improved by incorporating new elements based on the experts' recommendations. The interview questionnaire was adjusted accordingly, resulting in the creation of the second interview questionnaire.

**STEP 3:** The second interview questionnaire, which incorporated the revisions and improvements based on the feedback from the initial round of 17 experts, was used to seek opinions and suggestions from the same group of experts again. The indicator system's constituting elements were further refined and adjusted considering their valuable input. The interview questionnaire was modified accordingly, resulting in the creation of the third interview questionnaire.

**STEP 4:** The third round of the questionnaire survey, which incorporated the final refinements based on the feedback from the 17 experts, achieved a unanimous consensus among the experts. As a result, the indicator standards system for psychological health education and training programs in junior high schools in Zigong City, Sichuan Province, China, was established.

**Questionnaire survey:** A questionnaire survey was conducted to validate the reliability and validity of the indicator standards for psychological health education and training programs in junior high schools in Zigong City, Sichuan Province, China, developed through the Delphi method.

### 3.6. Statistical Analysis

In the first step, the brainstorming phase, 17 experts engaged in discussions regarding the constituent elements of the indicator standards system for psychological health education and training programs in junior high schools in China, yielding a total of 162 viewpoints. Three interviews were conducted during the second to fourth steps to revise and refine the constituent elements. Finally, the experts provided the following recommendations for the evaluation criteria system under the CCIP-PF model.

- (1) Context evaluation includes institutional, organizational, and curriculum development. Institutional development involves mental health education planning, management systems, and teacher research and development systems.
- (2) Context evaluation includes teacher, student, and financial support.
- (3) Intercollegiate Indexed valuation: It includes teacher management, hardware resources, information technology level, and classroom teaching.
- (4) Product evaluation: It includes individual benefits of students, collective benefits, teacher growth, and level of recognition.

The tertiary indicator system is presented together in the Delphi method results.

## 4. Result and Discussion

### 4.1. The CCIP-PF Model Was Employed to Establish an Assessment Indicator Framework for Junior High School Mental Health Literacy Training.

Delphi technology research involved three rounds, with an average of expert opinions increasing, standard deviation decreasing, and coefficient of variation decreasing. Experts showed high consensus and approval regarding developing

the indicator standard system for Chinese middle school mental health education and training projects using the CCIP-PF model. Incongruent). According to Table 1.

Note: In the table 1-2 below, M= Mean (1.00-1.49 = Strongly disagree; 1.50-2.49 = Disagree; 2.50-3.49 = Neutral; 3.50-4.49 = Moderately agree; 4.50-5.00 = Strongly agree); SD = Standard Deviation; IQR = Interquartile Range (IQR≤ 1.00 = Congruent; IQR>1.00 =Incongruent).

Table 1 displays that the 17 experts agreed on the four primary indicators, with a mean of 4.794, SD=0.473, and IQR=0.125. Among them, Context evaluation consists of 3 secondary indicators, Context evaluation consists of 3 secondary indicators, Intercollegiate Index evaluation consists of 4 secondary indicators, and product evaluation consists of 4 secondary indicators. The mean value of the strongest agreement among the 17 experts for the 14 secondary indicators is 4.823, with a standard deviation of 0.379 and an interquartile range of 0.25. The consensus among the experts is unanimous.

**Table 1.** Results of expert input on tier-1 and two indicators.

Table 2 displays the background evaluation of the evaluation indicators for the Chinese middle school mental health education training program, which consists of 43 tertiary indicators and provides a detailed and comprehensive description for each of them. The 17 experts demonstrated strong consensus regarding the 43 tertiary indicators with a mean of 4.790, SD=0.424, and IQR=0.302, indicating a unanimous agreement among the experts.

**Table 2.** Results of expert input on tier-3 indicators

Level 1 indicators	Level 2 indicators	MEAN <sup>2</sup>	SD	IQR <sup>□</sup>	Opinion of experts
A1. Context evaluation	B1. Institution-building	4.824	0.393	0.000	Strongly agree
	B2. Institution-building	4.706	0.470	1.000	Strongly agree
	B3. Curriculum development	4.706	0.470	1.000	Strongly agree
Total		4.765	0.562	0.000	Strongly agree
A2. Condition evaluation	B4. Teacher guarantees	4.824	0.393	0.000	Strongly agree
	B5. Student protection	4.765	0.437	0.500	Strongly agree
	B6. Financial security	4.882	0.332	0.000	Strongly agree
Total		4.765	0.437	0.500	Strongly agree
A3. Intercollegiate Index evaluation	B7. Teacher development	4.765	0.437	0.500	Strongly agree
	B8. Hardware resources	4.824	0.393	0.000	Strongly agree
	B9. Informatization level	4.882	0.332	0.000	Strongly agree
Total	B10. Classroom instruction	4.941	0.243	0.000	Strongly agree
		4.882	0.332	0.000	Strongly agree
		4.882	0.332	0.000	Strongly agree
A4. Product evaluation	B11. Individual student benefits	4.882	0.332	0.000	Strongly agree
	B12. Collective benefit for students	4.941	0.243	0.000	Strongly agree
	B13. Teacher growth	4.824	0.393	0.000	Strongly agree
Total	B14. Level of Recognition	4.765	0.437	0.500	Strongly agree
		4.765	0.562	0.000	Strongly agree

Level 2 indicators	Level 3 indicators	MEAN	SD	IQR	Opinion of experts
B1. Institution-building	C1. Develop a mental health education plan.	4.765	0.437	0.500	Strongly agree
	C2. Develop a mental health management system.	4.824	0.393	0.000	Strongly agree
	C3. Establishment of a system for teaching and research in mental health education.	4.882	0.332	0.000	Strongly agree
B2. Institution-building	C4. Establishment of a teaching and research center for mental health education courses.	4.765	0.562	0.000	Strongly agree

Level 2 indicators	Level 3 indicators	MEAN	SD	IQR	Opinion of experts
B3. Curriculum development	C5. Establishment of a psychological and psychosocial counseling room.	4.765	0.437	0.500	Strongly agree
	C6. Establishment of synergistic mechanisms such as schools and families.	4.824	0.393	0.000	Strongly agree
	C7. The teaching program meets the requirements set by the Ministry of Education.	4.765	0.437	0.500	Strongly agree
	C8. The objectives and content of the curriculum meet the requirements set by the Ministry of Education.	4.824	0.393	0.000	Strongly agree
	C9. Specialized mental health education materials are available.	4.824	0.393	0.000	Strongly agree
	C10. Offer a second class in mental health education.	4.824	0.393	0.000	Strongly agree
B4. Teacher guarantees	C11. Schools have at least one full-time (part-time) mental health education teacher.	4.706	0.470	1.000	Strongly agree
	C12. Establishment of a separate appraisal system for the titles of mental health education teachers.	4.765	0.437	0.500	Strongly agree
	C13. Treatment is not lower than teachers' average salary and income level in compulsory education schools.	4.765	0.437	0.500	Strongly agree
B5. Student protection	C14. Establishment of a "lifelong" mental health profile	4.824	0.393	0.000	Strongly agree
	C15. Establishment of a student mental health website	4.706	0.470	1.000	Strongly agree
	C16. Establish a student mental health crisis intervention plan	4.824	0.393	0.000	Strongly agree
	C17. Establishing channels for student feedback in the classroom	4.706	0.588	0.500	Strongly agree
B6. Financial security	C18. County governments include funding for student mental health work in their budgets.	4.824	0.393	0.000	Strongly agree
	C19. Schools include funding for student mental health work in their budgets.	4.765	0.437	0.500	Strongly agree
	C20. There is special funding for professional skills training for mental health education teachers.	4.706	0.470	1.000	Strongly agree
	C21. 5-year 360-hour training completion rate for mental health teachers	4.824	0.393	0.000	Strongly agree
B7. Teacher development	C22. Percentage of mental health teachers exchanged for rotation each year countywide	4.765	0.437	0.500	Strongly agree
	C23. Induction rate of full-time mental health teachers with a psychological teacher's license	4.765	0.437	0.500	Strongly agree
	C24. per pupil mental health teaching and support room space	4.824	0.393	0.000	Strongly agree
B8. Hardware resources	C25. Area of sports venues per pupil	4.765	0.437	0.500	Strongly agree
	C26. Value of mental health teaching equipment per pupil	4.882	0.332	0.000	Strongly agree
	C27. Number of books and video materials needed for mental health per student	4.882	0.332	0.000	Strongly agree
B9. Informatization level	C28. Number of networked multimedia classrooms per 100 students	4.882	0.332	0.000	Strongly agree
	C29. Teachers can skillfully use information technology to organize instruction	4.765	0.437	0.500	Strongly agree
B10. Classroom instruction	C30. Rationalize the use of teaching methods such as case studies.	4.765	0.437	0.500	Strongly agree
	C31. The course has a lively atmosphere.	4.765	0.437	0.500	Strongly agree
	C32. The teacher can design teaching sessions rationally.	4.824	0.393	0.000	Strongly agree
B11. Individual student benefits	C33. Psychological tests show greater improvement in better mental health.	4.824	0.393	0.000	Strongly agree
	C34. Learn to regulate and control their emotions.	4.824	0.393	0.000	Strongly agree
	C35. Learn to evaluate yourself objectively.	4.824	0.393	0.000	Strongly agree
	C36. Class cohesion is significantly improved	4.765	0.562	0.000	Strongly agree

Level 2 indicators	Level 3 indicators	MEAN	SD	IQR	Opinion of experts
B12. Collective benefit for students	C37. Form an optimistic, harmonious, upwardly mobile mental health culture.	4.765	0.437	0.500	Strongly agree
	C38. The classroom and learning styles have improved significantly.	4.824	0.393	0.000	Strongly agree
B13. Teacher growth	C39. Teachers can reflect on the teaching and learning process, and their competence is enhanced.	4.824	0.393	0.000	Strongly agree
	C40. Teachers are constantly improving their personalities and are psychologically optimistic.	4.706	0.470	1.000	Strongly agree
B14. Level of Recognition	C41. Percentage of social "satisfaction" ratings	4.706	0.470	1.000	Strongly agree
	C42. Percentage of "satisfaction" ratings by parents and students	4.824	0.393	0.000	Strongly agree
	C43. Percentage of teacher "satisfaction" rating	4.706	0.470	1.000	Strongly agree

Factor analysis was conducted on the questionnaire results using principal component analysis, extracting four main component factors, as shown in Tables 3 and 4 [23].

**Table 3.** Explanation of Variance

Total Variance Explained						
Ingredient	Explanatory rate of variance before rotation			Post-rotation variance explained		
	Characteristic root	Explanation of variance (%)	Cumulative variance explained (%)	Characteristic root	Explanation of variance (%)	Cumulative variance explained (%)
1	11.606	61.082	61.082	391.341	20.597	20.597
2	0.982	5.169	66.251	357.775	18.83	39.427
3	0.833	4.383	70.634	354.779	18.673	58.1
4	0.673	3.542	74.175	305.433	16.075	74.175
5	0.609	3.207	77.383			
6	0.556	2.926	80.308			
7	0.496	2.611	82.919			
8	0.443	2.333	85.252			
9	0.409	2.154	87.406			
10	0.391	2.055	89.461			
11	0.371	1.953	91.414			
12	0.292	1.539	92.954			
13	0.281	1.477	94.431			
14	0.248	1.307	95.738			
15	0.23	1.211	96.948			
16	0.191	1.005	97.953			
17	0.141	0.743	98.697			

18	0.134	0.706	99.403			
19	0.113	0.597	100			

Table 3 shows that the contribution rate of the factors to the explanation of variables is 74.175%, exceeding 60%, which is considered ideal. The higher the variance explained, the more critical the principal component is, and its weight should be proportionally higher.

**Table 4.** The factor loading coefficients.

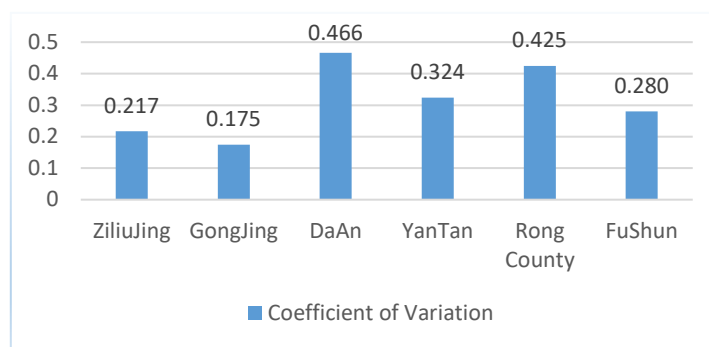
Table of Rotated Factor Loading Factors					
Ingredient	Rotated Factor Loading Factor				Degree of commonality (Common factor variance)
	Factor 1	Factor 2	Factor 3	Factor 4	
1	0.240	0.194	0.615	0.484	0.708
2	0.291	0.328	0.654	0.365	0.754
3	0.497	0.285	0.593	0.282	0.760
4	0.313	0.462	0.625	0.211	0.747
5	0.650	0.264	0.382	0.305	0.732
6	0.331	0.495	0.549	0.289	0.740
7	0.490	0.329	0.563	0.072	0.670
8	0.620	0.328	0.244	0.361	0.682
9	0.413	0.733	0.217	0.102	0.765
10	0.346	0.149	0.306	0.641	0.646
11	0.653	0.375	0.326	0.237	0.730
12	0.289	0.617	0.510	0.155	0.748
13	0.670	0.155	0.436	0.333	0.774
14	0.262	0.736	0.240	0.350	0.791
15	0.336	0.159	0.410	0.647	0.724
16	0.162	0.664	0.435	0.316	0.756
17	0.444	0.561	0.126	0.508	0.787
18	0.155	0.295	0.126	0.834	0.822
19	0.769	0.305	0.175	0.207	0.758

Table 4 displays the analysis of common factor variance, with all common factor variances above 0.5, indicating that each variable can be adequately represented.

The reliability coefficient of this measurement system is 0.964, indicating high reliability and a well-established structure with strong internal consistency. The factor analysis demonstrates a high level of goodness-of-fit and reasonableness, suggesting that no modifications are necessary.

#### 4.2. Apply the evaluation index system to junior high school mental health literacy training, thereby promoting the enhancement of educational quality.

We conducted an empirical study in all administrative regions of Zigong City, Sichuan Province, China, which include Ziliujing, Gongjing, Da'an, Yantan, Rong County, and Fushun. Taking the tertiary indicator "C25 per capita sports facility area" as an example, we selected this indicator for analysis. The per capita sports venue area for junior high school students in the six regions was 7.13m<sup>2</sup>, 9.91m<sup>2</sup>, 8.69m<sup>2</sup>, 11.27m<sup>2</sup>, 8.46m<sup>2</sup>, and 9.97m<sup>2</sup>(China, 2018), respectively. The coefficient of variation (CV) was utilized to assess the disparities among these regions, and the results are presented in Figure 3.



**Figure 3.** The coefficient of variation (CV) for the per capita sports venue area among junior high schools in Zigong City, indicating the Intercollegiate Index disparities.

According to the requirements of the "Supervision and Evaluation Measures for Quality and Balanced Development of Compulsory Education in County-Level Areas" issued by the Chinese Ministry of Education, the coefficient of variation (CV) for the "per capita sports venue area" among junior high schools should be  $\leq 0.45$ . A smaller CV indicates a higher level of compliance with the standard. As depicted in Figure 3, the junior high schools in Da'an District did not meet the standard. Simultaneously, the per capita sports venue area compliance level can be clearly distinguished in the following order from highest to lowest: Gongjing District, Ziliujing District, Fushun County, Yantan District, Rong County, and Da'an District.

The test results align with the actual conditions of the mental health education training program for junior high schools in Zigong City, objectively reflecting the issues related to the program and achieving the expected outcomes.

## 5. Conclusion

In addressing the prevailing challenges within junior high school mental health education and recognizing the gaps in existing evaluative research, this study introduces a groundbreaking approach - the CCIP-PF model. This model represents a significant advancement in comparison to prior research on evaluation indicator frameworks, particularly in its novel consideration of factors related to government functions, school roles, societal impact, and teacher contributions. The inclusion of examination, testing, feedback, and recommendation components establishes a comprehensive evaluation cycle, thereby rectifying the deficiencies in evaluation criteria research for mental health education training programs in Chinese junior high schools. This innovation holds considerable theoretical significance within the realm of data science.

Through empirical investigation, the efficacy of the CCIP-PF evaluation model in developing an indicator framework for junior high school mental health training programs becomes evident. The model enables a thorough assessment of program quality and standards across diverse administrative regions, facilitating the timely identification of issues and offering targeted practical guidelines for governmental and educational institutions. Its robust applicability, innovation, and scalability contribute both theoretically and practically to the field of data-driven educational evaluation.

Ultimately, this study operationalized the CCIP-PF model by constructing four primary indicators, fourteen secondary indicators, and forty-three tertiary indicators tailored for evaluating the junior high school mental health education training program in Zigong City, Sichuan Province. The incorporation of practical validation (P) and feedback recommendations (F) forms a closed-loop evaluation system, emphasizing both qualitative and quantitative evaluation. This comprehensive approach aids in the identification and resolution of issues, fostering continuous improvement in the quality of junior high school mental health education training.

Despite its contributions, the study acknowledges certain limitations. The broad scope of the CCIP-PF evaluation indicator framework necessitates extensive data collection during the evaluation process, potentially posing challenges during statistical analysis. As a forward-looking strategy, the exploration of an automated data entry and processing system is recommended to streamline and enhance the efficiency of future evaluations within the data science paradigm.

## 6. Declarations

### 6.1. Author Contributions

Conceptualization: J.Z., S.B., I.S., and T.S.; Methodology: T.S.; Software: J.Z.; Validation: J.Z. and T.S.; Formal Analysis: J.Z. and T.S.; Investigation: P.S.; Resources: I.S.; Data Curation: P.S.; Writing Original Draft Preparation: P.S. and J.Z.; Writing Review and Editing: P.S. and J.Z.; Visualization: J.Z.; All authors have read and agreed to the published version of the manuscript.

### 6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

### 6.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### 6.4. Institutional Review Board Statement

Not applicable.

### 6.5. Informed Consent Statement

Not applicable.

### 6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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