An Evaluation and Analysis of University Curriculum Support Effectiveness in Public Security Colleges for Public Security Joint Examination

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Abstract. In order to explore the relationship between students' scores in the public security joint examination and the allocation of professional courses in schools, and to realize the design of professional courses to serve the practical needs of the joint examination of public security more accurately, a new method for evaluating the effectiveness of association based on the polarization processing technology of parameter values is proposed. Considering the accuracy of the analysis, the students' simulated examination data is used to meet the actual needs, and a special algorithm based on difference array and configuration order is constructed to analyze the effectiveness of curriculum support in public security colleges for public security joint examination. The results show that the scores of police major courses have a significant positive impact on the total scores of the joint entrance examination, but the influence level of police major curriculum construction is relatively weak, and there are areas for further optimization.

Keywords: curriculum education reform, public security colleges, public security joint examination, effectiveness evaluation

1 Introduction

With the rapid development of public security discipline and continuous changes in employment environment, public security professional courses, as an important guarantee for improving students' ability, has been received more attention from the public security industry and academia, especially the rationality effectiveness evaluation of public security professional curriculum design for public security joint examination (PSJE). Considering the differences of individual students and the variability of employment scenarios, the traditional qualitative description method cannot accurately reflect the true degree of curriculum support[1]. In addition, the

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design of examination questions in PSJE is not permanent. Therefore, it is necessary to consider this problem in the design of curriculum support evaluation method.

Based on previous research, this paper proposes a PSJE-oriented evaluation methodology of curriculum support effectiveness. This methodology considers the differences of individual students and the homogenization of courses. Applying the effectiveness analysis theory, the quasi-normal distribution of statistical parameters is combined with the difference coefficient adjustment technology to achieve accurate and dynamic effectiveness evaluation.

2 Methodology

It is mainly used as an overall study of the results corresponding to time sequence degradation, and it is a comprehensive, sensitive analytical methodology. The methodology is based on an understanding of the trend of index variables related to effectiveness degradation over time by numerical fitting to explore the best possible results under a large number of uncertain conditions. Compared with traditional qualitative and semiquantitative analysis methodologies, effectiveness degradation analysis has the advantage of error elimination and subject coverage in dealing with multiscreen variability and avoids the limitations of small-scale changes under a theoretical optimal solution.

Correlation effectiveness analysis is a methodology to explore the correlation strength among uncertain elements. It was first developed by RAND Corporation by integrating effectiveness evaluation theory and statistical technology, and was used to evaluate the effectiveness of its national defense equipment system[2]. It is mainly used to systematically analysis the results corresponding to large individual differences, and it is a comprehensive and sensitive analysis methodology[3]. Based on the understanding of the variation trend of correlation effectiveness with related uncertain indicators, it was obtained the results of correlation strength under a large number of uncertain conditions by numerical fitting[4]. Compared with traditional qualitative and semi-quantitative analysis methods, correlation validity analysis has the advantages of eliminating errors and covering topics when dealing with multi-scene variability, and realizes accurate measurement of correlation strength.

Considering the differences between different elements, it is used numerical polarization algorithm to process the data collected from students' PSJE scores and usual course scores. In addition, by constructing the correlation analysis model of PSJE data, it can be realized the effective evaluation of the effectiveness of curriculum allocation[5]. Thus, the degree of support for PSJE content can be accurately measured, and finally the effective correlation and dynamic adjustment between the curriculum design of police colleges and the cultivation of students' employability can be realized. An overview of the methodology proposed in this study is illustrated in Fig. 1.

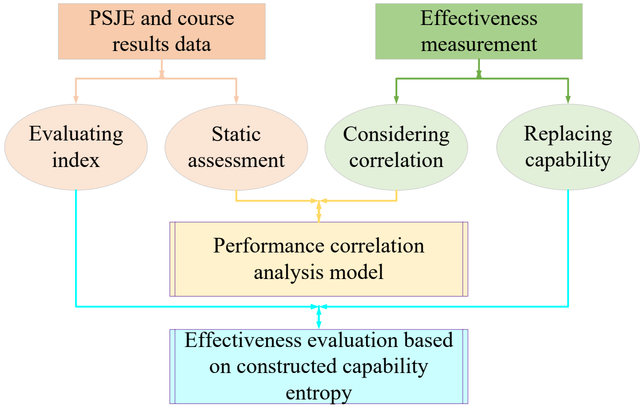

Fig. 1. Schematic diagram of the effectiveness evaluation model

3 Evolution Model Building

The evaluation model is a set of evaluation algorithm based on the effectiveness analysis of the correlation between the results of PSJE and the curriculum system. And, it is a self-defined calculation system for solving the problem of public security curriculum design to serve PSJE[6]. It is mainly used to evaluate the effectiveness of curriculum support in different stages, such as problem identification, data call and system optimization, and provides quantitative basis for subsequent system evaluation and optimization. The model can be used for effective data from various sources such as educational information, network information, and curriculum information. It also can be run through the whole life cycle of students' study.

3.1 Polarization Processing of Index Data

Due to the interference of and equipment factors, measurement errors will more or less exist in the test[7]. Assuming that the system effectiveness is composed of several capability indexes, each index expressed by capability characteristic quantity is $s_i(i=\{1,2,\ldots,i,n-1,n\})$.

Also, assuming that each index is composed of multiple elements, in which the characterization value of the elements set as p_{ij}, which represents the characterization value of the jth indicators expressed for the ith evaluation object.

Design of Element Representation Value

Based on the distribution characteristics of qualified and failed capacity elements, each element is set with corresponding qualified and failed two-level reference values on the basis of unit failure[8]. Transformed into the characterization values of elements through reference constant processing, the measured values of elements can be expressed as:

$$p_{ij} = \alpha + (1-\alpha)\frac{x_{ij}-m_{ij}}{h_{ij}-m_{ij}} \tag{1}$$

where x_{ij} represents the measured value of the jth element in the ith capability, m_{ij} and h_{ij} represent the corresponding invalid and qualified reference values respectively, and α is an adjustment constant, usually with a value of 0.8. Also, considering that the average score of the national PSJE is about 69/100, the value of α was adjusted to 0.69 here.

Design of Capability Characteristic Quantity

Based on the design of curriculum support effectiveness evaluation model, the combination of elements constituting ability is divided into two related scenarios: series and parallel, and its ability feature quantity can be expressed as:

$$\text{Series：} \ s_i = p_{i1}p_{i2}\cdots p_{in} \tag{2}$$

$$\text{Parallel：} \ s_i = \sum_{j=1}^{n} \varphi_j p_{ij} \tag{3}$$

where φ_j represents the weighting coefficient of the jth element corresponding to the ability, generally treated with equal weight.

3.2 Curriculum Support Effectiveness Calculation

Considering that curriculum support ability is influenced by curriculum elements and is positively correlated, curriculum support ability entropy is not a probability problem of ability system, but an uncertain correlation between transmission elements and system[9]. This shows that ability entropy solves the uncertainty of ability fluctuation, not the uncertainty of ability value. Therefore, combined with the derivation of ability entropy model, it can be transformed the calculated ability eigenvalue s_i into the ability entropy value, calculated as:

$$I = q\log_d \frac{1}{1-q} \tag{4}$$

where q represents the effective probability of capability, d represents generally constant 10, and I represents the entropy value of corresponding capability.

The effective probability of curriculum support ability under task condition is curriculum support effectiveness, so the uncertainty of curriculum support ability is the entropy representation of curriculum support effectiveness. Based on this logical correlation and the above Equation 4, the effectiveness index value corresponding to curriculum support ability can be expressed as:

$$e_i = s_i \, log_d \frac{1}{1-s_i} \tag{5}$$

Where e_i represents the capability entropy efficiency value corresponding to the ith capability, and s_i is solved by the series or parallel calculation method in Equation

2 according to the specific element association relationship. For special cases $s_i = 1$, the value is selected as ln $ln\frac{1}{1-\alpha}$.

4 Experimental Verification

4.1 Data Processing and Usability Verification

Selecting the score data of "All Police Alliance" PSJE and simulated course, the level of course support ability was calculated. Based on the statistical data screening criteria and numerical statistics, it was determined the benchmark of comprehensive score passing (60 points). At the same time, considering the differences among universities and comparing the target universities, combined with the statistical results of index collection, 100 groups of data from 5 universities are selected for analysis. The statistics of PSJE data are shown in Table 1 and Fig. 2 below:

Table 1. Basic statistical information of samples

Names	Size	Min	Max	Average	Sd	Median
PSJE results	100	60.1	76.6	67.20	3.99	66.71

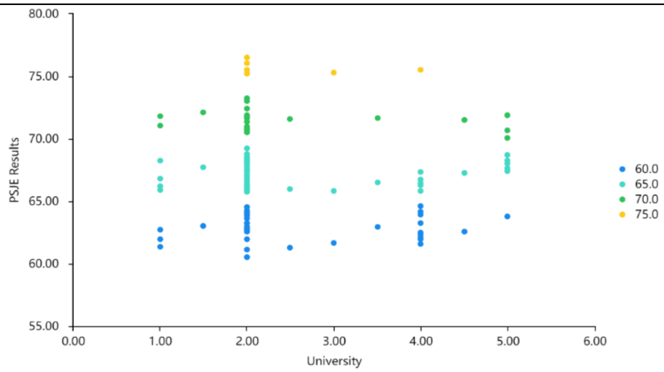

Fig. 2. Scores Distribution of PSEJ Based on Universities

The statistical data in Table 1 and Fig. 2 show that the number of test students in the second university is the highest, and the distribution of scores in each university is relatively balanced. The cross section shows that the second university with high scores above 75 points accounts for the largest proportion, but from the vertical section, it is found that the span of middle and low scores is also the largest in the second university, that is, the concentration of students in low sub-regions is also higher.

At the same time, the overall distribution of PSJE is statistically analyzed, as shown in Table 2 and Fig. 3. It can be seen from Table 2 that the results of Jarque-Bera test on the data show that all the total scores of the joint entrance examination are not significant ($p>0.05$), which means that the original hypothesis (original hypothesis: normal distribution of data) is accepted, and all the total scores of the joint entrance examination have normal characteristics. At the same time, Fig. 3 shows that the overall average score is about 68, which is consistent with the national average score of about 67-70 in recent years, indicating that the test data has good representativeness. At the same time, the scores of the middle and low segments in Fig. 3 are relatively high, which has room for further optimization.

Table 2. Jarque-Bera test

Names	Size	χ^2	*df*	*P*
PSJE results	100	3.803	2	0.149

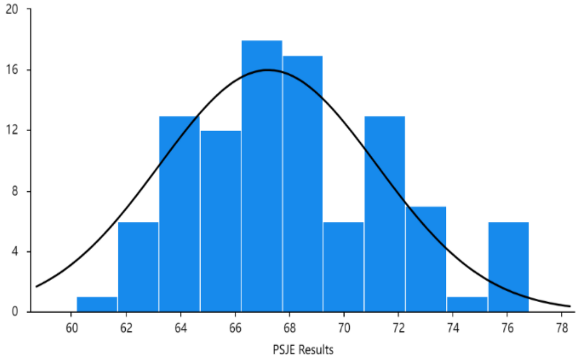

Fig. 3. Distribution of PSJE Based on Scores

Based on the distribution of the above statistical data, it was further analyzed the mean difference and skewness as shown in Table 3. It is found that the median of the current PSJE data is 66 points, which is lower than the average score, indicating that the overall PSJE results show a slope shape, and the overall results need to be further improved.

4.2 Correlation Effectiveness Analysis

Based on the above-mentioned statistical data of PSJE and course simulation values, the correlation was analyzed as shown in Table 3. From Table 3, it can be found that correlation analysis is used to study the correlation between the total scores of PSJE and the scores of specialized courses, general courses and usual scores, and Pearson correlation coefficient is used to express the strength of the correlation.

Table 3. Pearson correlation

		PSJE results
specialized courses	Correlation coefficient	0.199*

		PSJE results
	p	0.047
	Size	100
	Correlation coefficient	0.063
general courses	*p*	0.537
	Size	100
	Correlation coefficient	-0.006
usual scores	*p*	0.950
	Size	100

$^*p<0.05$ $^{**}p<0.01$

Firstly, through the correlation analysis between PSJE results and average score of courses, we find that the correlation value is-0.006, which is close to 0, and the *p* value is 0.950>0.05, which shows that there is no direct correlation between PSJE results and average score of courses in general. Therefore, we make a further analysis of specialized courses and general courses, and find that the correlation between PSJE results and specialized courses is 0.199, and shows a significant level of 0.05, which shows that there is a significant positive correlation between PSJE results and specialized courses. The correlation value between PSJE results and general courses is 0.063, which is close to 0, and the p value is 0.537>0.05, which shows that there is no correlation between PSJE results and general courses.

In order to further explore the degree of correlation, it was further measured the regression coefficients of PSJE results and specialized courses, and obtained the following coefficients by using the curve regression model, as shown in Table 4 and Fig. 4.

Table 4. Results of linear regression analysis (n=100)

	U-S-C		S-C	*t*	*p*	Collinearity diagnosis	
	B	S	*Beta*			VIF	least square
specialized courses	0.506	0.127	0.696	4.001	0.000**	3.402	0.294
general courses	0.040	0.061	0.062	0.659	0.511	1.001	0.999
usual scores	-0.273	0.080	-0.590	-3.389	0.001*	3.403	0.294
R^2	0.146						
Adjusting R^2	0.120						

	U-S-C		S-C	t	p	Collinearity diagnosis	
	B	S	*Beta*			VIF	least square
F	*F* (3,96) =5.483, *p*=0.002						
D-W value	0.291						

*$p<0.05$ **$p<0.01$

From Table 4, it can be found that the model formula is: PSJE results=47.54+0.506*specialized courses+0.040*general courses -0.273*usual scores, and the model R^2 square value is 0.146, which means that specialized courses, general courses and usual Scores can explain 14.6% of PSJE results. It is found that the model passes the F test (F=5. 483, p=0. 002<0.05), which means that at least one of specialized courses, general courses and usual scores will have an impact on PSJE results, and the regression coefficient of specialized courses is 0.506 (t=4. 001, p=0<0.01), which means that specialized courses will have a significant positive impact on PSJE results. The quantitative regression coefficient of general courses is 0.040 (t=0. 659, p=0. 511>0.05), which means that general courses will not affect PSJE results.

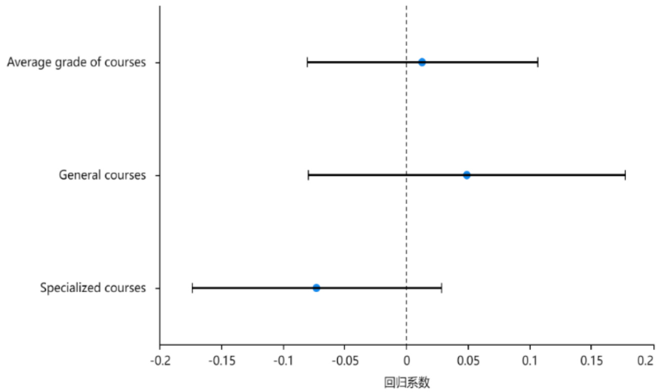

Fig. 4. Regression coefficient distribution

Combined with the regression data in the above Fig. 4, it shows that the current curriculum design can't support the promotion of PSJE results as a whole. The main interference item is that general courses can't directly affect PSJE results, and the correlation influence level of specialized courses is relatively weak, so there is room for further optimization.

5 Conclusions

Sustaining the rational allocation of police curriculum design through correlation analysis highly depends on the accuracy of correlation effectiveness evaluation. To comprehensively evaluate scene variability and avoid the influence of individual differences, this study developed an exploratory method based on range parameter processing and efficiency capability entropy evaluation. The evaluation construction is oriented to the needs of accurately grasping the changing situation of the PSJE and optimizing the supporting efficiency of the public security professional curriculum system, and builds a related efficiency evaluation model of the public security professional curriculum system for the PSJE[10]. The related index data are extracted and processed from the basic information collection and real-time information platform of the personnel involved in the PSJE. The system efficiency calculation algorithm is used to comprehensively evaluate and analyze the public security professional curriculum system for the PSJE, and the quasi-normal distribution method of statistical parameters is adopted to reduce the fluctuation error of multi-scene features. Dynamic evaluation of correlation efficiency is realized by using optimized regression curve fitting. The test case results show that the exploratory method accurately measures the system correlation performance difference scenarios. The results show that the scores of police major courses have a significant positive impact on the total scores of the joint entry example, but the influence level of police major curriculum construction is relatively weak, and there are areas for further optimization.

In addition, a follow-up of this study can continue to optimize the evaluation model by introducing an uncertainty measurement algorithm, combined with relevant effectiveness entropy to further improve the accuracy of the evaluation model and provide an accurate and reliable reference for construction of curriculum correlation impact evaluation system.

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Author Contributions: Fan Kong had the idea and designed the concept of implementation and test. Jun Shen did the data analysis, conducted all the implementation, and wrote the draft of this paper. Fan Li and Xia Zhong contributed comments to improve the method and revised the manuscript in terms of language. All authors have read and agreed to the published version of the manuscript

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