



BioTechnology

An Indian Journal

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BTAIJ, 10(3), 2014 [543-550]

Previous aerobics world championships difficulty motions scores factor research based on abc analysis method

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ABSTRACT

In aerobics world championships, final performance is composed of lots of factors, due to difficulty motions are competitive games' viewpoints and highlights, therefore difficulty motions scoring status becomes the key link that affects final scores, what on earth is the factors restrict difficulty motions scores, how to more reasonable improve athlete training charter and let it become the subject of people's attention. So, the paper makes analysis of competitive aerobics difficulty motions scores main influence factors, in the hope of providing scientific proof for factors mentioned in research, and providing guidance for aerobics players' cultivation orientation. In the paper, it firstly applies expert interview and Activity Based Classification(ABC), extracts difficulty motions scores main influence factors "difficult", "stable", "new" and "beauty", then applies quantitative analysis method analyzing "difficult", "stable", utilizes illustration method stating "new" and "beauty", finally uses questionnaire survey analyzing aerobics world championships five sports events corresponding four difficulty motions scores influence factors importance, which provides theoretical basis for competitive aerobics evaluation and teaching.

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KEYWORDS

Competitive aerobics;
 Difficulty motions;
 Scoring factor;
 Average value \pm standard deviation;
 Pearson correlation coefficient;
 Activity based classification (ABC).

INTRODUCTION

Competitive aerobics final score key link is its difficulty motions scores, and aerobics difficulty motions scores influence key points become priority in the sport final performance influence, therefore the paper analyzes competitive aerobics difficulty motions scores influence factors, in the hope of making contributions to aerobics players' technology progress and performance improvement.

For difficulty motions and its perfect completion in-

fluence research, lots of scholars have made efforts, just these efforts propel to aerobics competitive capacities constant improving, from which: Yang Yun-Xia (2013) analyzed 12th aerobics world championships men's single event top three difficulty motions technical indicators, and got Chinese players' difficulty motions compiling aspect levels, level distribution and motions rationality^[1]; Li Ly etc.(2013) applied documents literature, video analysis and mathematical statistics and other methods, made statistical analysis of the 11th aerobics world championships five items 40 sets of motions

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448 difficulty motions from difficulty scores, difficulty types and difficulty use rate, and got that difficulty score and completion score correlations and difficulty score and total score correlation relationships^[2]; Lei Feng-Hua(2013)applied documents literature, questionnaire survey and mathematical statistics and other methods, it researched on Fujian province 14th sports meeting competitive aerobics participating members, analyzed each single item top three games videos, did deeply analyze from difficulty, operational motions and space use aspects, which provides reference evidence for athletes and coaches training and teaching^[3].

This paper on the previous research basis, analyzes aerobics difficulty motions scores influence factors, in the hope of exploring aerobics teaching and appreciation evaluation method, which points out directions for athletes' performance promoting.

RESEARCH OBJECTS AND RESEARCH METHODS

Research objects

Take the 9th, 10th, 11th and 12th aerobics world championships five events finals athletes core competitiveness difficulty motions completion effects as research objects.

Research methods

Questionnaire survey: survey objects are aerobics coaches and referees;

Video analysis: collect the 9th, 10th, 11th and 12th aerobics world championships video information, and make deep analysis of men's singles, women's singles, mixed doubles, three person and six person items finals top eight total 160 sets 1856 difficulty motions, which provides data basis for difficulty motions completion effects to competition scores influence analyzing;

Mathematical statistics: Carry out correlation analysis of data achieved by sorting and analyze table presentation ways, from which involved statistics parameters are frequency N , percentage $N\%$, average value \pm standard deviation $\bar{X} \pm S$ and Pearson correlation coefficient r , not going to talk about previous two parameters, the latter two parameters computational formulas are as formula(1) and formula(2) show.

$$\bar{X} \pm S = \frac{1}{n} \sum_{i=1}^n X_i \pm \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2} \quad (1)$$

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\left(\sum_{i=1}^n (x_i - \bar{x})^2\right) \left(\sum_{i=1}^n (y_i - \bar{y})^2\right)}} = \frac{L_{xy}}{\sqrt{L_{xx} \cdot L_{yy}}} \quad (2)$$

AEROBICS PLAYERS' DIFFICULTY MOTIONS COMPETITION SCORES MAIN INFLUENCE FACTORS EXTRACTING

Main usage of ABC analysis is separating more important factors from lots of complicated factors generated problems, ABC principle tells us that 80% problems are caused by multiple reasons' 20% main reasons, the paper applies ABC analysis method carrying out qualitative analysis of competitive aerobics difficulty motions scores reasons.

For 9th to 12th aerobics world championships difficulty motions selection status, completion status and art layout status, it designs 10 difficulty scores influence factors, and make expert interview screening on them, factors influence designing status and screening results as TABLE 1 show.

By TABLE 1, it is clear that the paper designed 10 competitive aerobics difficulty motions scores influence factors, after being screened by experts, they are converted into difficult, stable, new, beauty, correct and strength six factors, make questionnaire survey on coaches and referees with six factors, it totally investigates on 126 people, regulates the number of people select one factor as selection frequency, regulates selection frequency and six factors total frequency ratio as percentage, and regulates accumulation percentage according to difficult—>stable—>new—>beauty—>correct—>strength order as corresponding percentage. Investigation result is as TABLE 2 show.

By TABLE 2 data, it can get as Figure 1 showed ABC analysis screenshot.

By Figure 1 showed ABC analytic schematic diagram, it is clear that decisive aerobics difficulty motions scores main factors 80% factors are A, B, C and D, therefore analysis in the paper, it carries out four ses-

TABLE 1 : Competitive aerobics difficulty motions scores influence factors designing and screening

Scoring factors	Definition	Screening result
Difficulty	Score is high, it can reflect competitive value	√
Stable	Improvisation is skillful, playing is stable	√
Correct	Motion technique is correct and posture is standard	√
New	Motions layout is interesting and novel and refreshing	√
Special	Give one's own advantages into play, it is distinctive	×
Beauty	Visual sensibility is intense with rich expression	√
Strength	Motion completion is powerful and competent is high	√
Change	It can timely adjust difficulty motions	×
Dangerous	Complete adventurous motions with surprised playing	×
Skillful	Technique is skillful , connection is smart	×

Note: √represents screening process is chosen, ×represents it hasn't been chosen during screening process.

TABLE 2 : Competitive aerobics difficulty score influence factors questionnaire survey result

Scoring factor No.	Scoring factor	Factor selected frequency N	Factor percentage	Factor accumulation percentage N%
A	difficult	126	24.00 %	24.00 %
B	stable	126	24.00 %	48.00 %
C	new	101	19.24 %	67.24 %
D	beauty	90	17.14 %	84.38 %
E	correct	56	10.67 %	95.05 %
F	strength	26	4.95 %	100.00 %

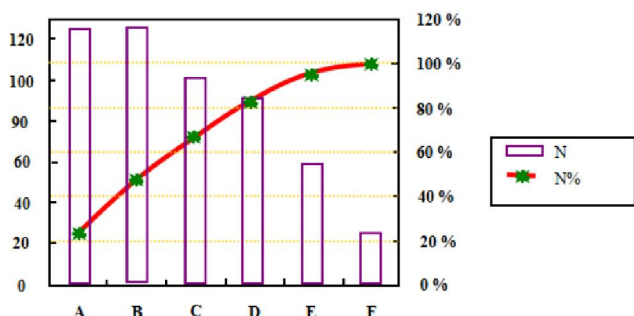


Figure 1 : Aerobics difficulty motions scores influence factors ABC analysis schematic diagram

sions championships athletes comparative analysis with difficult, stable, new and beauty four scores influence factors.

AEROBICS PLAYERS' DIFFICULTY MOTIONS COMPETITIVE SCORES FOUR MAIN INFLUENCE FACTORS ANALYSIS

Main factor "difficult" in motion scores quantitative analysis

Main factor "difficult" that affects difficulty motions scores refers to players' selected motions difficulty de-

gree, main reflection way for difficulty degree is difficulty score, if athletes selected motion difficulty is larger, then the difficulty score will corresponding increase, on the contrary, regular motions achieved difficulty score will become low, under the circumstance that other factors are fixed, higher difficulty score motions will have higher competitiveness, to state analyzing "difficult" importance in motions scores, the section carries out quantitative analysis from recent four sessions' aerobics world championships players' difficulty motion scores selection status, difficulty scores and final scores correlation two aspects, so as to explore "difficult" such scores influence factors importance.

In FIG competitive aerobics competition rules, it has following three regulations:

- 1) No quantity statistics on 0.1 score and 0.2 score difficulty, generally is connection motion;
- 2) 0.3 score corresponding motions difficulty is minimum;
- 3) 0.4, 0.5, 0.6 takes 0.1 as step length till 1.0 score, the corresponding motion difficulty is gradually increasing, difficulty maximum score is 1.0.

According to the 9th to 12th total four sessions aro-

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bics world championships athletes adopted different scores difficulty motions statistical status is as TABLE 3 show.

By TABLE 3 data, it is clear that the 9th to 10th aerobics world championships minimum score 0.3 score motions is selected, in the 9th session, 0.5 score difficulty motion is most selected, which accounts for 26.25% of total difficulty quantity, till the 10th 0.7 score difficulty motion is most selected, which accounts for 23.33% of total amount, the 11th and 12th aerobics world championships 0.3 score difficulty motion hasn't been selected by athletes, 0.8 score difficulty motion quantity is most, which respectively accounts for difficulty motion total amount 25.45% and 31.03%.

By TABLE 3 data, it can get as Figure 2 showed difficulty motion frequency corresponding difficulty scores with world championships sessions changes trends.

By Figure 2, it is clear that peak appearing position will advance rightwards with number of sessions increasing, that is to say, adopt large difficulty coefficient motions proportions will also become larger and larger with the number of sessions increasing, thereupon, in competitive aerobics championships, athletes' adopted

motions difficulty is gradually increasing, which is also the event competitive features one reaction.

As TABLE 4 showed recent four sessions aerobics world championships men's singles, women's singles, mixed doubles, three person and six person events difficulty average value data and difficulty value and final scores Pearson correlation coefficient as well as differences significance probability.

By TABLE 4 data, it is clear that from the 9th to 11th, women singles event four items and final score are in non-significant correlations, therefore it is known that difficulty motion score and final score have very closely connections, difficulty motion is one of important influence factors that reflects participating motion values.

To sum up: "Difficult" in competition score to final performance influence is very important, if it wants to get ideal performance in competitions, then it needs to ensure difficulty scores when motions layout.

Main factor "stable" in motions scores quantitative analysis

Main factor "stable" that affects difficulty motions scores refers to athletes in competition motions playing is normal and stable, the section uses difficulty motions

TABLE 3 : The 9th to 12th aerobics world championships difficulty motions scores quantity statistical table

Session/Score	Statistics	0.3 score	0.4score	0.5score	0.6score	0.7score	0.8score	0.9score	1.0score	Total sum
The 9 th	Frequency	15	65	126	87	91	64	15	17	480
	Percentage	3.13%	13.54%	26.25%	18.13%	18.95%	13.33%	3.13%	3.54%	100%
The 10 th	Frequency	2	33	92	101	112	85	27	28	480
	Percentage	0.42%	6.87%	19.17%	21.04%	23.33%	17.71%	5.63%	5.83%	100%
The 11 th	Frequency	0	37	73	85	88	114	29	22	448
	Percentage	0.00%	8.26%	16.30%	18.97%	19.64%	25.45%	6.47%	4.91%	100%
The 12 th	Frequency	0	23	50	70	88	139	37	41	448
	Percentage	0.00%	5.13%	11.16%	15.63%	19.64%	31.03%	8.26%	9.15%	100%

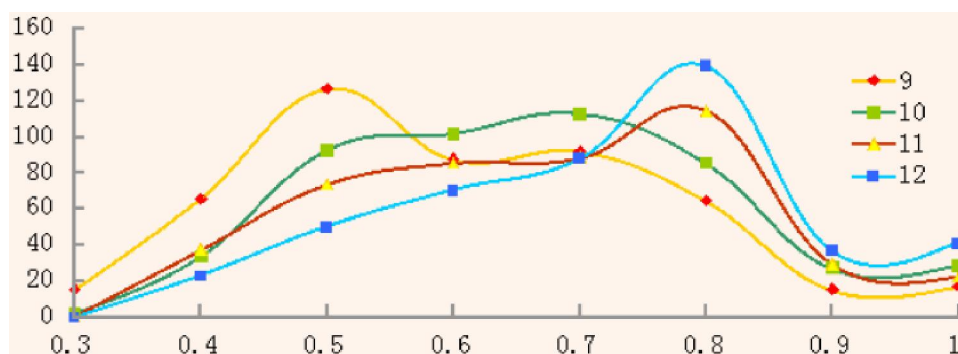


Figure 2 : Difficulty motions frequency corresponding difficulty scores with number of sessions change trend chart

TABLE 4 : The 9th and 12th aerobics world championships difficulty average score and final score correlation analysis table

Number of session /event	Statistical parameters	Men singles	Women singles	Mixed doubles	Three person	Six person
The 9 th	Average value±standard deviation	3.84±0.37	3.09±0.40	3.03±0.29	3.60±0.21	3.26±0.50
	Pearson coefficient	[0.870]	[0.856]	[0.708]	[0.890]	[0.909]
	Significance probability	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01
The 10 th	Average value±standard deviation	4.12±0.47	3.66±0.32	3.58±0.23	3.97±0.19	3.41±0.37
	Pearson coefficient	[0.920]	[0.712]	[0.926]	[0.847]	[0.965]
	Significance probability	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
The 11 th	Average value±standard deviation	3.81±0.37	3.48±0.20	3.64±0.37	3.93±0.38	3.73±0.38
	Pearson coefficient	[0.933]	[0.738]	[0.841]	[0.984]	[0.883]
	Significance probability	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
The 12 th	Average value±standard deviation	3.94±0.20	3.52±0.10	3.87±0.25	4.22±0.49	3.89±0.49
	Pearson coefficient	[0.912]	[0.635]	[0.804]	[0.934]	[0.942]
	Significance probability	< 0.01	< 0.05	< 0.05	< 0.01	< 0.01

Note: **[]** represents significance is lower than 0.01, **[]** represents significance is lower than 0.05.

score rate and loss rate to represent athletes stable playing indicator, therefore in the paper, it makes statistics on declared score and actual score from the 9th to 12th aerobics championships, and then makes statistics on A group to D group four difficulty motions four sessions competitive games deduction times, in the hope of using percentage presented score rate and loss rate to take athletes games’ “stable” factor value.

As TABLE 5 showed five aerobics events in recent four sessions world championships presented declared score and actual score statistical status, and cal-

culate corresponding number of sessions corresponding items score rate.

By TABLE 5 data, it is clear that the 9th men singles, mixed doubles and six person event as well as the 10th and 12th except for six person event, score rate all are above 98%, and difficulty motions stable completion is the key to athletes ace, score rate 100% events are also correspondingly increasing with the number of sessions increasing, from other aspect analyzing, it is clear that athletes in games selected motions include each kind of difficulty motions, to get ideal scores, it needs to add

TABLE 5 : 9th to 12th aerobics world championships athletes score rate statistics table

Number of sessions/event	Statistics	Men singles	Women singles	Mixed doubles	Three person	Six person
The 9th	Declared score	4.15	3.90	3.45	4.10	3.85
	Actual score	4.10	3.70	3.40	3.85	3.85
	Percentage (score rate)	98.80%	94.87%	98.55%	93.90%	100%
The 10th	Declared score	4.40	4.05	3.75	4.35	4.30
	Actual score	4.40	4.05	3.75	4.35	3.85
	Percentage (score rate)	100%	100%	100%	100%	89.53%
The 11th	Declared score	4.35	3.65	4.05	4.55	4.25
	Actual score	4.30	3.65	4.05	4.50	4.25
	Percentage (score rate)	98.85%	100%	100%	98.90%	100%
The 12th	Declared score	4.15	3.60	4.10	4.70	4.75
	Actual score	4.15	3.60	4.10	4.65	4.35
	Percentage (score rate)	100%	100%	100%	98.94	91.58%

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TABLE 6 : The 9th to 12th aerobics world championships different difficulties groups' loss statistical result table

Difficulty grouping	Number of championships sessions	Using frequency	Total frequency	Loss values	Lose rate
A group difficulty motions	The9th	87	388	9	2.32%
	The 10th	99			
	The 11th	98			
	The 12th	104			
B group difficulty motions	The9th	68	250	8	3.20%
	The 10th	69			
	The 11th	62			
C group difficulty motions	The 12th	51	900	125	13.89%
	The9th	236			
	The 10th	231			
D group difficulty motions	The 11th	215	318	39	12.26%
	The 12th	218			
	The9th	89			
	The 10th	81			
	The 11th	75			
	The 12th	73			

more larger difficulty motions in motions, and larger difficulty motions are prone to appear loss phenomenon, therefore to ideal scores achievements, it is required to strive for avoiding difficulty motions loss, only difficulty motions scores stability that it would be possible to win the game.

To make analysis of each difficulty motions loss rate, in the paper, it gets as TABLE 6 showed four groups of difficulty motions loss statistical data, in the hope of exploring difficulty motions prone to occur unstable detailed links features.

By TABLE 6, it is clear that selected A group difficulty motions athletes loss rate minimum is only 2.32%, selected C group difficulty motions athletes maximum loss rate arrives at 13.89%, A group difficulty motion, B group difficulty motion and D group difficulty motion selected quantity are quite low by comparing with C group's, but D group difficulty motions selected person loss rate is very high that arrives at 12.26, thereupon

athletes in C group motions and D group motions' loss rate are the largest, they should take stable training on the two groups of motions at ordinary training, that is to say, they can have stable playing when selecting C group motions and D group motions, which has crucial influences on final performance.

Main factor "new" in motions scores analysis

Main factor "new" that affects difficulty motions scores refer to athlete in set motions' most impulsive viewpoints motions, the motions generation is established on the basis of athletes better technical level, difficulty motions "new" generally reflects on motions layout or motions breakthrough, therefore the section analyzes with difficulty motions innovative selection and creative layout, in the hope of providing basis for "new" as sport score main influence factors reasons.

In difficulty motions creative layout, it takes the 12th aerobics world championships final Chinese man single

TABLE 7 : Difficulty motions scores influence factors importance on five aerobics items questionnaire survey result table

Factor/Item	Men singles	Women singles	Mixed doubles	Three person	Six person
"difficult"	4.79 ± 0.41	4.69 ± 0.47	4.48 ± 0.51	4.62 ± 0.49	4.34 ± 0.67
"stable"	4.72 ± 0.45	4.55 ± 0.50	4.62 ± 0.49	4.41 ± 0.50	4.59 ± 0.50
"new"	4.07 ± 0.70	3.69 ± 0.81	3.86 ± 0.69	3.97 ± 0.82	4.10 ± 0.82
"beauty"	3.55 ± 0.69	3.97 ± 0.82	3.90 ± 0.82	3.76 ± 0.83	3.83 ± 0.85

athlete Li Liang-Fa as an example to make explanation, the athlete fully plays his advantage, applies back somersault push up connecting Thomas 1/1 turn into Wenson motions layout innovation, let whole set of motions artistry get strengthen, which is also the reason that the athlete gets referees' high scores, let him stand out from competition.

In difficulty motions innovative selection, by statistics, it gets athletes totally select 1856 pieces of difficulty motions from the 9th to 10th aerobics world championships, but athletes whole sets of difficulty motions use frequency is low and link that can reflect motion breakthrough is called athletes' innovation point, which is also the source of "new"; in 10th world championship men singles final, Chinese athlete Ao Jin-Ping adopted free fall 2/1 turns, in the 10th world championship men singles final French athlete Benjamin adopted jump 3/1 to push up motion, the two adopted above two kinds of motions are competitive rules' difficulty motions, but other athletes concentrate on selecting piked jump type, Cossack jump type and Straddle leap type and others series of C group difficulty motions, in this way, let the two athletes became referees eyes "rare one", it also just the two athletes won referees high score with such "rare one" "new" features.

To sum up: athletes in competitive games, if they can apply others unused same difficulty motions and can normal play, or apply innovative kinds of motions and innovative type routine layout can let the player gets more ideal effects in scoring.

Main factor "beauty" in motions scores analysis

Main factor "beauty" that affects difficulty motions scores refer to athletes presented motions layering and appreciation features in competitive games are called as beauty, athletes if can present flow motions, decent expression status in completion difficulty motions process can win more high scores, which is also athletes achieved impression scores from referee, in order to more detailed state "beauty" in motions scores importance, the section analyzes from difficulty motions specification and difficulty motions body language two aspects.

It is well known that athletes all over the world have their own adept difficulty motions, these adept motions not only can reflect difficulty values, but also can

Highlight unique artistic charm for referees and audiences, it illustrates with Spanish player Evan as an example, the athlete had unique features in flexibility difficulty motions expression ;in the 10th world championship men singles finals Evan adopted free double illusion to vertical split difficulty perfect completion, meanwhile two legs opening arrive at 200°, these motions were perfect interpretation of high difficulty, which was just the perfect motion won referee and audience cheering, adding heavier chips for final scores.

For difficulty motion body language "beauty" expression, it takes Brazil player Lopez as an example to illustrate, the player in the 10th aerobics world championship adopted shoulder shaking posture and smile expression to communicate with people on court when completing Mongovan, these body languages express athletes master capacity of difficulty motions, which not only can add beauty in motions but also can leave their skillful impressions in referee's minds, and build basis for final scores.

"Beauty" exhibition not just can be done by body language and exaggerated motions, but needs skillful techniques, stable performance and innovative layout common work, it requires that athletes generate harmony unity in overall motions, in this way it can highlight athletes individual charm, meanwhile achieve higher competition scores.

Athletes scores four main influence factors importance analysis

Carry out competitive aerobics difficulty scores influence factors importance questionnaire survey statistics on the 9th to 12th aerobics world championships men singles, women singles, mixed doubles, three people and six people total five items, and set five score levels, the higher scores are, the stronger importance would be, set highest score is 5 score, the lowest score is 1 score, do scores presentation by experts investigation summarized average value \pm standard deviation way to corresponding items influence levels, its statistical result is as TABLE 7 show, TABLE 7 selected influence factors are "difficult", "stable", "new" and "beauty".

By TABLE 7 data, it is clear that in men singles event, importance of "difficult" is higher than that of "stable", and "new" is more important than "beauty", while in women singles event, importance of "beauty"

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is higher than that of “new”, on a whole, “difficult” and “beauty” influence level to each event are higher than “new” and “beauty”.

Due to mixed doubles events unique features showing “beauty” importance, except for women singles events, mixed doubles events in “new” and “beauty” have more influence than other events “beauty”.

Due to six person event equal to a team organization, individual ability requires harmony and unity so that can display perfect motions, it is just so many people caused the event is prone to appear poor stability situation, therefore the event “stable” is strongest level in each influence factors.

CONCLUSIONS

The paper firstly designs 10 aerobics competition performance influence factors, and keeps designed influence factors six items by expert interviewing, then applies ABC analysis method extracting aerobics difficulty motions scores four main influence factors “difficult” “stable” “new” and “beauty”; to extract four influence factors importance in competitive scores by using ABC analysis method, the paper adopts quantitative analysis method, analyzes “difficult” and “stable”, extracts representation “difficult” players difficulty motions scores selection status, difficulty scores and final scores correlation data and representation “stable” score rate and loss rate data, it gets “difficult” and “stable” importance reason in aerobics world championship difficulty motions scores; utilize illustration way stating athletes presenting “new” and “beauty” features in competitiveness, and put forward “new” and “beauty” generating basis is basic motion technique skillfulness level and difficulty motions stability; use questionnaire survey method to make statistical investigation on recent four sessions aerobics world championships five sport events, except for investigating “difficult” “stable” “new” and “beauty” scores four main influence factors to corre-

sponding items influence levels result, and analyzing each item features and its corresponding influence factors presented investigation data reasons.

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