

A Comparative Analysis of the 2018-2021 College Entrance Examination Mathematics National Paper (Science) questions

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Abstract: The college entrance examination system is undergoing constant reform and improvement. In 2021, the new college entrance examination system will be implemented, which will no longer distinguish between arts and sciences. This is a challenge for the proposition of math questions in the college entrance examination. Taking the 2018-2020 National examination paper (science) and 2021 National new high examination paper, a total of 11 mathematics advanced examination questions as the research object, using comparative research method, case study method, statistical analysis method and other research methods, mainly studied the examination content and investigation requirements of the examination paper. Based on the above research, the paper structure, the content of the paper, the core quality of mathematics and the similarities and differences of investigation requirements are obtained, and the proposition of the new college entrance examination mathematics and teachers are put forward.

Keywords: *Mathematics test of college entrance examination*, Mathematics core literacy, Test research.

1. Introduction

Mathematics examination question is an important component of the college entrance examination mathematics, not only is the direct reflection of the college entrance examination mathematics reform, but also is the most authoritative measurement tool for universities to select students accurately. The new gaokao policy will be implemented in 2021, and the math questions will be divided into two forms: the new Gaokao and the National A and B papers. The new gaokao will no longer distinguish between science and arts. Due to a major change in the gaokao policy, the 2021 gaokao questions will be different from the previous ones in terms of size and structure. Therefore, at the present stage, the study of college entrance examination mathematics questions can help teachers understand the examination direction of students' mathematics core literacy, clarify the examination focus, and explore the law of college entrance examination proposition. Based on the Curriculum Standards of Mathematics for Ordinary High School (2017 Edition) and the Evaluation System of China's College Entrance Examination, this paper studies the science questions of the national Paper of Mathematics in the College Entrance examination from 2018 to 2021, focusing on the content of the examination, including the analysis of the structure of the examination paper, the analysis of the content of the examination paper and the core literacy of mathematics. Yu Ping divides the level of mathematics core literacy into knowledge understanding, knowledge transfer and knowledge innovation, which provides a quantifiable reference basis for realizing the embodiment degree of mathematics core literacy in test questions[1].

2. Definition of Concept

2.1. Mathematics test of college entrance examination

By June 2020, Chinese high math test questions are divided into self-proposition of 5 provinces and national volume of 26 provinces. At this time, the college entrance examination system is still a traditional penniless science, but from 2021, many provinces will implement the new college entrance examination policy, students choose 3 compulsory examinations, physics and history, 2 ideological and political, geography, chemistry and biology. The college entrance examination no longer distinguishes the liberal arts and sciences, the test questions in the previous mode in consideration of the different liberal arts and sciences, appropriate to reduce the flexibility and creative difficulty of the test questions, more attention to the students' basic knowledge, basic skills, basic ideas and basic activity experience examination [2], math papers only two sets, namely the new college entrance examination I volume and the new college entrance examination II volume.

2.2. Mathematics core literacy

The concept of core literacy in mathematics has been more clearly defined in the "2017 edition of curriculum standards". Mathematics core literacy is a kind of comprehensive ability which has special importance in mathematics learning. Core literacy reflects the essence and thought of mathematics, which is gradually improved by students in the process of learning mathematics. Comparatively speaking, it is more comprehensive, more complete and more lasting [3]. Mathematics core literacy is not only the characteristic of curriculum standards, but also provides a new direction for mathematics curriculum reform. Based on scholar Yu Ping's classification of core literacy, 18 indicators in Table 1 are formulated as follows:

Table 1. Six mathematics core literacy each level indicator description

Core literacy	Level and coding	Concrete performance
Abstract of mathematics	A1	Understand and apply basic mathematical concepts and problems
	A2	The ability to abstract general propositions and concepts from connected situations
	A3	It can draw inferences from one another and abstract mathematical concepts from comprehensive problems
Logical reasoning	L1	Can carry on simple induction, analogy, deduction and proof, and can grasp the basic form of logical reasoning
	L2	Able to reason logically with familiar ideas in new situations
	L3	Can solve complex problems independently, can view the world rationally, judge and analyze problems
Mathematical modeling	M1	Can master the conventional mathematical model
	M2	Able to find the internal relationship between variables, construct and solve mathematical models
	M3	The model can be optimized and perfected according to the actual situation, and can be extended to solve similar problems
Intuitive imagination	I1	Can understand the basic properties of simple figures and imagine the changes of figures
	I2	It can establish the connection between "number" and "form" by using graphics, so as to explore rules and solve complex problems with the help of graphics
	I3	Be able to flexibly use the combination of number and form to solve open and exploratory new problems
Mathematical calculation	C1	Be familiar with formulas, algorithms, and be able to calculate correctly
	C2	Able to master computational theory, comprehensive application of algorithms and operational skills to solve complex problems
	C3	Able to design reasonable algorithms in new situations, and can clearly judge and analyze problems according to operation results
Data analysis	D1	Ability to select appropriate methods to organize and analyze collected data
	D2	Using probability or statistics related knowledge to describe the rules of phenomena, to solve simple practical problems
	D3	In the process of data processing and analysis, I can comprehensively apply statistical knowledge to discover new problems and reveal new conclusions

3. A Study on The Examination Contents of 2018-2021 Advanced Entrance Examination

3.1. Examination paper structure analysis

Through a comparative study on the question types and

scores of the National College Entrance examination papers of mathematics and science from 2018 to 2020, it is found that the question types and structures of the national papers of science and mathematics in these three years are relatively uniform, but significant changes have taken place since 2021, which are summarized as shown in Table 2 below.

Table 2. Structure analysis of the national mathematics test (Science) gaokao from 2018 to 2021

Topic Test questions	Single choice		Multiple choice		Fill in the blanks		Answer questions		Optional question	
	qid	score	qid	score	qid	score	qid	score	qid	score
National volume I	1-12	12×5	None		13-16	4×5	17-21	5×12	22or23	1×10
National Volume II										
National Volume III										
New gaokao volume I	1-8	8×5	9-12	4×5	13-16	4×5	17, 18-22	1×10+5×12	None	
New gaokao volume II										

The full score of the test papers is 150. The overall structure of the test papers is similar, with multiple choice questions first, fill-in questions later, and solution questions finally. However, detailed analysis shows that the question types in 2021 have slight changes compared with the previous three years. The 2018-2020 test paper adopts the "12+4+5+2 choice 1" test structure, which is subdivided into single choice, fill-in-the-blank, required choice and optional questions. Since 2021, multiple choice questions have been added and cancelled. Instead, the paper structure of "8+4+4+6" has been adopted, which consists of single choice, multiple choice, fill-

in and solution questions respectively. In the 2021 new college entrance examination math paper, a more reasonable design of multiple choice questions, one question with multiple blanks. Based on these new types of questions, the gradient of test questions is strengthened in the aspect of examining mathematical knowledge and key abilities, so that students at different levels can get different scores, which is conducive to better play the mathematical potential of students.

3.2. Examination paper content analysis

The main knowledge points of mathematics in the college entrance examination are mainly divided into four aspects: algebra, function, geometry, statistics and probability. In my research, I divided the paper according to these four aspects, and algebra was subdivided into series, sets, complex

numbers, etc. Function includes function and derivative, trigonometric function and solution triangle, etc. Geometry includes analytic geometry and solid geometry; Statistics and probability include statistics, probability and counting principles [4]. From these four main lines, the contents of the whole volume are divided by year first, and the data is sorted out, as shown in Figure 1 below.

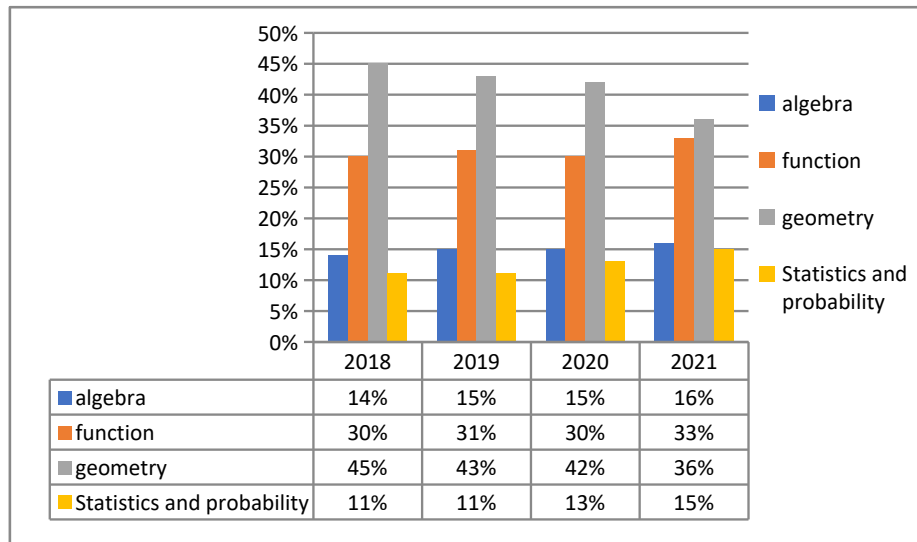


Figure 1. Analysis of the contents of the National Mathematics Paper (Science) in the recent four years

As can be seen from the figure above, function and geometry account for a large proportion of about 30%, with a score of about 45 points, and geometry accounts for about 40%, with a score of about 60 points. These two parts account for about 70% of the paper, with a score of about 105 points. Algebra and statistics and probability accounted for a similar amount of about 20 points on the overall paper. In general, although there are small fluctuations in the proportion of each examination site in the total papers every year, the fluctuation is not big, basically there is no big change in the proportion.

3.3. Vertical and horizontal analysis of core literacy of mathematics

3.3.1. A holistic analysis of literacy

When analyzing the mathematical core literacy of each question in these 11 papers, this paper subdivides the examination of the mathematical core literacy of each question into the corresponding score value of the specific mathematical core literacy. Take Section 16 of Volume I of the 2021 new College Entrance Examination for example.

A school student in the study of folk paper-cut art, found that paper-cut often along a certain axis of paper symmetry folded paper size $20\text{dm} \times 12\text{dm}$ rectangular paper, fold it in half 1 times and you get two sizes of $10\text{dm} \times 12\text{dm}$, $20\text{dm} \times 6\text{dm}$ graphics, The sum of their area is 240dm^2 , fold it in half 2 times and you get three sizes of $5\text{dm} \times 12\text{dm}$, $10\text{dm} \times 6\text{dm}$, $20\text{dm} \times 3\text{dm}$ graphics, The sum of their area is 180dm^2 , In the same way, fold it in half four times to get the number of figures of different specifications _____; If I fold it in half n times, so $\sum_{k=1}^n S_k =$

_____ dm^2 .

This question is different from the examination of number series in previous test papers. It takes origami, a traditional Chinese culture, as the background, and asks students to observe the law contained in it after analyzing the question. That is, after each half is folded, the number of figures with different rules will increase, and the area of the new figure is also half of the area before folding, and the area of each figure after folding is equal. Therefore, after folding n times in half, n+1 figures can be obtained, and the area of each figure is $240 \left(\frac{1}{2}\right)^n$, then the general term formula of the series can be obtained as $s_n = 240(n+1) \left(\frac{1}{2}\right)^n$. The problem solving in this step focuses on the examination of students' mathematical core literacy of logical reasoning and data analysis, and then obtains the answer based on the dislocation subtraction of the series of numbers. This step focuses on the examination of students' mathematical operation core literacy, which reflects that under the new curriculum reform, the exam questions pay more attention to the examination of the discipline literacy of mathematical culture.

Since the total score of this question is 5 points, and the literacy of data analysis and mathematical operation is more prominent, the mathematical core literacy of this question is divided into L2-1, D1-2, and C2-2 according to Table 2-1. According to Table 1-1, this paper summarizes the examination situation of each level of the six mathematical core literacy in each paper and the total value of the paper, as shown in Table 3 below:

Table 3. The National Examination of Mathematics (Science) literacy level of College Entrance Examination from 2018 to 2021

Literacy level	2018			2019			2020			2021		Mean value%
	I	II	III	I	II	III	I	II	III	I	II	
A1	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.00	1.00	0.15
A2	0.00	1.25	8.75	0.00	1.25	1.87	3.13	0.00	0.00	2.00	2.66	1.90
A3	0.00	0.00	3.13	0.00	0.00	0.00	0.00	0.00	0.00	1.30	1.33	0.52
L1	3.13	0.00	0.00	2.50	0.00	1.25	3.13	0.00	1.25	2.25	2.00	1.41
L2	21.24	16.87	10.00	25.63	25.63	14.37	23.12	25.00	16.87	9.16	11.25	18.10
L3	4.37	2.50	3.75	9.38	9.38	3.13	10.62	5.00	3.13	5.33	4.66	5.57
M1	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.66	0.00	0.30
M2	1.25	2.50	3.75	0.00	2.50	0.00	0.00	4.37	1.88	3.33	2.50	2.01
M3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I1	0.63	0.00	3.13	0.00	0.00	0.00	1.25	0.00	0.00	1.33	1.30	0.69
I2	10.62	6.25	7.50	10.63	9.38	13.13	14.38	9.38	11.88	6.00	7.42	9.69
I3	0.00	3.75	2.50	0.00	0.00	6.25	0.00	2.50	5.00	4.66	1.47	2.38
C1	3.13	6.25	12.50	6.87	6.25	9.38	5.00	7.50	6.87	11.33	10.62	7.79
C2	43.75	43.13	36.25	35.62	31.87	35.62	34.37	30.63	37.50	34.66	39.31	36.61
C3	7.50	8.75	6.87	7.50	11.87	8.75	5.00	10.62	10.62	10.00	9.75	8.84
D1	1.25	1.25	0.00	0.00	0.00	1.25	0.00	1.87	1.25	1.33	1.25	0.86
D2	2.50	7.50	1.87	0.00	1.87	4.37	0.00	3.13	3.75	4.66	3.48	3.01
D3	0.00	0.00	0.00	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
summary	100	100	100	100	100	100	100	100	100	100	100	100

As can be seen from the above table, the examination proportion of different papers on the mathematics core literacy and level is different. Some papers have tested a certain level of a certain kind of mathematics core literacy, while some papers have not tested the level of the mathematics core literacy. There is a gap in the proportion of different core literacy. However, it is found that the test of mathematical operation accounts for the largest proportion of 53.24%, followed by the test of logical reasoning ability accounts for 25.08%. On the contrary, the ratio of

mathematical abstraction level I, mathematical modeling level II and data analysis level III was 0.15%, 2.01% and 0.17%, respectively, indicating a relatively low proportion of examination.

3.3.2. The horizontal distribution of literacy

After analyzing and summarizing the literacy level of the 11 papers studied, the ratio of knowledge understanding, knowledge transfer and knowledge innovation in three different levels was obtained, as shown in Table 4 below.

Table 4. Literacy level distribution of 11 papers

Volume subcategory		Knowledge understanding level Level 1 (%)	Knowledge transfer level Level 2 (%)	Knowledge innovation level Level 3 (%)
2018	National volume I	8.77	79.36	11.87
	National volume II	7.50	77.50	15.00
	National volume III	15.63	68.12	16.25
2019	National volume I	9.37	71.88	18.75
	National volume II	6.25	72.50	21.25
	National volume III	12.51	69.36	18.13
2020	National volume I	9.38	75.00	15.62
	National volume II	9.37	72.51	18.12
	National volume III	9.37	71.88	18.75
2021	New gaokao volume I	18.90	59.81	21.29
	New gaokao volume II	16.17	66.62	17.21
Mean value		11.20	71.32	17.48

It can be seen from the data in the table that the examination focus of the papers in the recent four years is the knowledge transfer level of students, accounting for 71.32% of the average value of the total papers, and the ratio of knowledge understanding level and knowledge innovation level is close. Specifically looking at Level 1, it was significantly higher than other papers in the national III paper and the new college entrance examination I and II paper in 2018, while the proportion of the examination of the national II paper in 2019 was at least 6.25%. In 2018, the investigation of Level 2 in the national Paper I accounted for 80%, and the proportion of the new college entrance examination paper I was at least about 60%. It can be seen that college entrance examination mathematics attaches importance to students' knowledge transfer level. Compared with level 3, it can be found that the

examination proportion of the national Paper I in 2018 is the lowest, and the examination proportion of the new college entrance examination I in 2021 is the highest, but the examination of this level over the years is close to 17.48%.

In conclusion, Chinese college entrance examination mathematics lays more emphasis on cultivating students' ability to transfer existing knowledge to solve more complex problems, instead of examining students' mastering of basic knowledge. But all three levels were examined, but the proportion of each level was different. In order to better grasp the test situation of these three levels of mathematics core literacy, the above data are used to calculate the test proportion of each level according to the year, as shown in Figure 2 below.

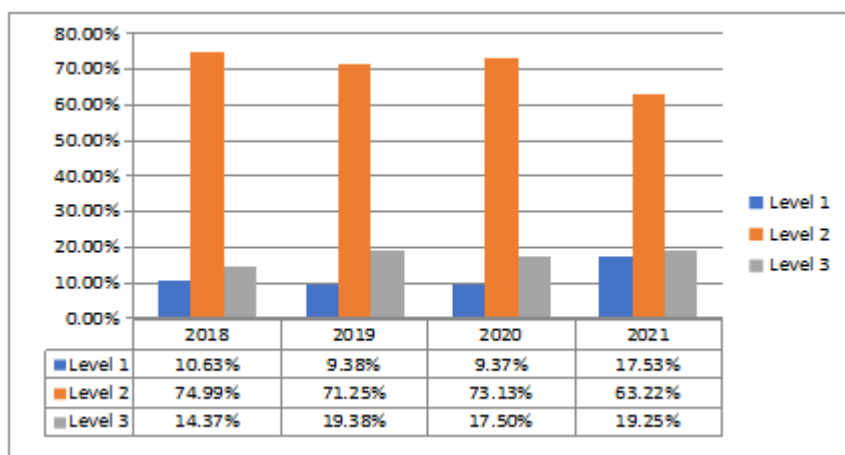


Figure 2. Overall examination of core literacy level in different years

From the longitudinal perspective of years, it can be found that in the first three years, the examination level of knowledge understanding tends to be stable and basically has little change. However, due to the reform of the new college entrance examination system in 2021, the difficulty of the questions is not so great. In 2021, the examination level of basic knowledge has increased significantly, which is about 7% higher than that in the previous three years. The examination of knowledge innovation ability is also on the rise year by year. It can be found that the college entrance examination is more and more conducive to the selection of college students. From the figure above, it can be clearly seen that the overall change of the three levels of core literacy in the Mathematics National Paper (Science) of the four-year college entrance examination, the proportion of the examination of level 1 is much higher than the other two levels, but it is always fluctuating around 70% of the whole paper. While the observation of level 2 shows that the examination of the mathematics of the college entrance examination is paying more and more attention to the innovative ability of mathematical knowledge. The overall trend is upward.

question in these 11 papers, the examination requirements of each question were subdivided into "basic, comprehensive, applicable and innovative" to obtain the corresponding score, which was converted into the average value of the whole paper, and the following table 5 was obtained.

By observing the table above, we can see that the requirements of each test paper are different. No matter what kind of questions or which set of papers pay more attention to the basic examination, accounting for 63.24% of the overall papers, followed by comprehensive accounting for 23.59%, and finally, the ratio of applicability and innovation is roughly the same, the ratio of four parts is about 6:2:1:1. From the perspective of question types, it can be seen that basic, comprehensive and application are almost tested to a certain extent in the three types of questions in each set of papers, but innovation is not so. For example, innovation is not tested in the three sets of papers in 2018, the national Paper I in 2020 and the fill-in-the blanks in the new college entrance examination paper I in 2021.

Then I sorted out and summarized the distribution of examination requirements in each question type, and got the situation as shown in Figure 3 below.

4. Study on Examination Requirements of 2018-2021 Advanced Entrance Examination

4.1. Examination requires a holistic analysis

When analyzing the examination requirements of each

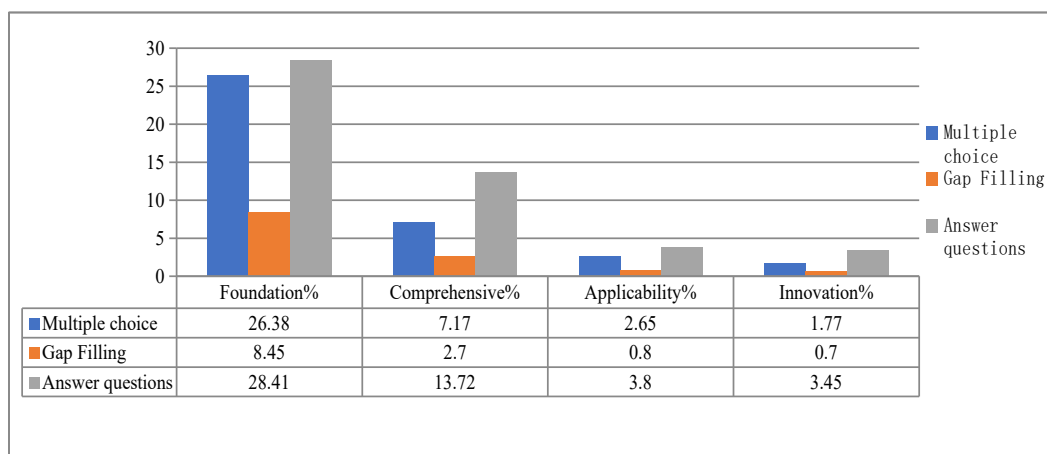


Figure 3. Distribution of test requirements in each question type

Table 5. 2018-2021 College Entrance examination requirements of mathematics National volume (science) distribution

Volume subcategory	Topic	Foundation %	Comprehensive %	Applicability %	Innovation %
2018 National volume I	Multiple choice	24.37	9.38	1.25	2Innovation.50
	Gap Filling	8.75	3.13	0.63	0.00
	Answer questions	34.99	13.12	1.25	0.63
2018 National volume II	Multiple choice	31.87	5.00	0.00	0.63
	Gap Filling	11.25	1.25	0.00	0.00
	Answer questions	29.37	16.25	1.25	3.13
2018 National volume III	Multiple choice	30.00	5.63	0.00	1.88
	Gap Filling	9.38	3.13	0.00	0.00
	Answer questions	34.35	14.37	0.63	0.63
2019 volume I	Multiple choice	29.36	2.50	3.13	2.50
	Gap Filling	10.00	1.88	0.63	0.00
	Answer questions	26.87	16.25	1.25	5.63
2019 National volume II	Multiple choice	28.75	6.88	1.25	0.63
	Gap Filling	10.0	0.63	1.25	0.63
	Answer questions	33.73	13.75	1.25	1.25
2019 National volume III	Multiple choice	31.87	5.00	0.00	0.63
	Gap Filling	6.88	4.38	0.63	0.63
	Answer questions	41.23	6.25	1.25	1.25
2020 volume I	Multiple choice	21.87	9.38	3.75	2.50
	Gap Filling	5.63	5.63	1.25	0.00
	Answer questions	17.50	14.37	11.87	6.25
2020 National volume II	Multiple choice	16.88	8.75	8.13	3.75
	Gap Filling	7.50	1.25	1.88	1.88
	Answer questions	20.00	11.87	10.61	7.50
2020 National volume III	Multiple choice	22.50	5.63	5.63	3.75
	Gap Filling	6.25	3.13	1.25	1.88
	Answer questions	22.50	20.00	3.13	4.35
2021 New gaokao volume I	Multiple choice	26.00	10.00	4.00	0.00
	Gap Filling	8.66	2.00	1.34	1.34
	Answer questions	25.33	12.00	5.33	4
2021 New gaokao volume II	Multiple choice	26.67	10.67	2.00	0.66
	Gap Filling	8.67	3.33	0.00	1.33
	Answer questions	26.67	12.67	4.00	3.33
Aggregate proportion%		63.24	23.59	7.25	5.92

Among the four different test requirements, it is found that the proportion of the answer questions is the largest, the fill in the blank questions is the least, the basic, application and innovation in the test of multiple choice and solution questions are consistent. However, comprehensiveness is in the solution of the examination degree is more than twice the multiple choice questions, so it can be seen that different

types of questions and examination requirements are related.

In order to better explore the examination degree of these four test requirements in different papers, I divided the data according to 11 test papers, and imported the data into Excel and used the histogram to see the differences more directly, as shown in Figure 4 below:

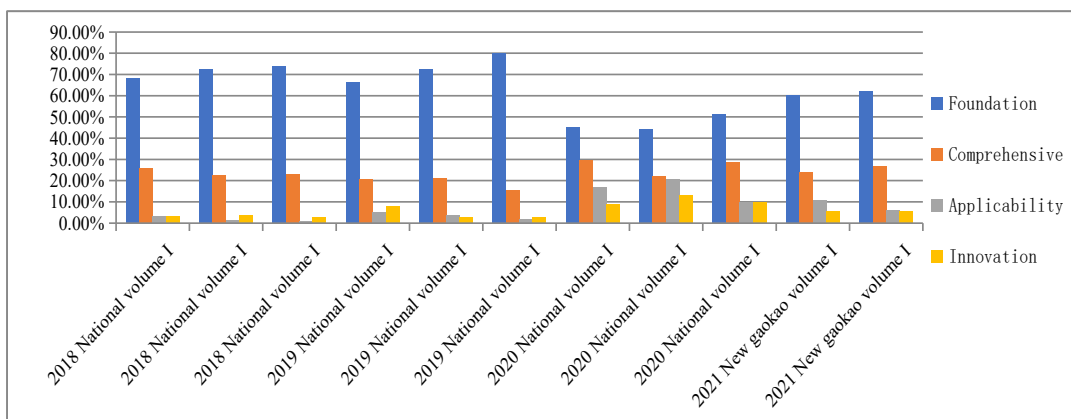


Figure 4. Distribution of examination requirements in each volume

As can be seen from the figure above, basic knowledge was the focus of the four years of college entrance examination papers, but it dropped sharply in 2020 and gradually increased from 2021. Comprehensive tests ranked second, with a stable rate of about 20 to 30 percent over the years. In 2020, the applicability test was significantly improved, and the applicability test was generally higher than the comprehensive test. It can be seen that the advanced examination questions gradually pay attention to the

cultivation of students' ability to use knowledge.

4.2. The investigation required a longitudinal analysis

In order to analyze the test requirements longitudinally, the distribution of test requirements in different years is summarized and the following line chart is obtained.

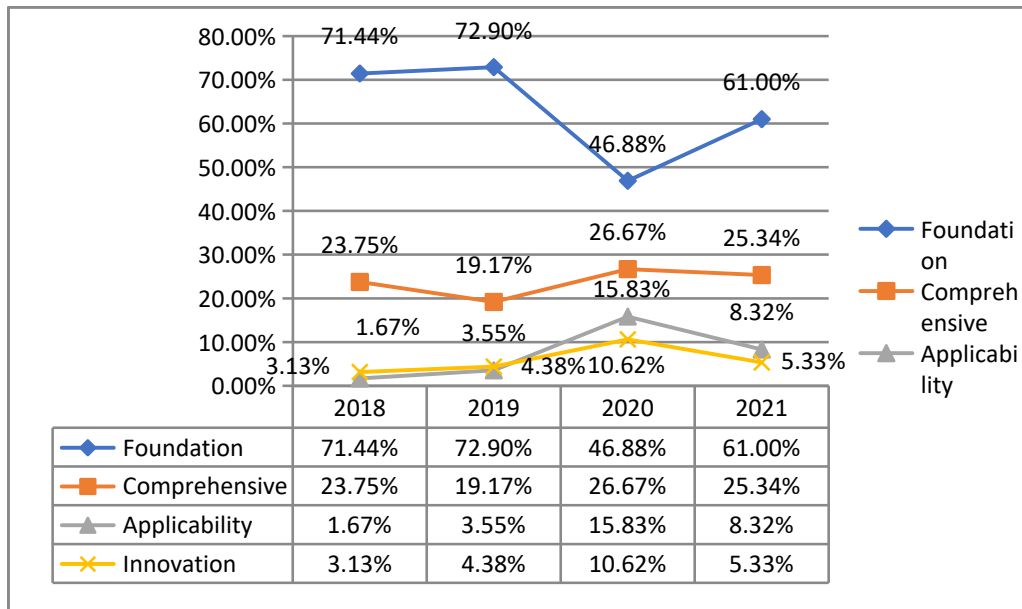


Figure 5. Distribution of test requests in different years

As can be seen from the figure above, there was no significant change in the examination of these four aspects in 2018 and 2019, but 2020 was a turning point year. In this year, the foundation dropped significantly, from about 72% before to 47%, a decrease of 25%. The other three examination requirements all had a slight increase in this year. In 2021, only the comprehensive proportion was maintained, still about 25%, and the proportion of the other three gradually returned to the normal range of previous years. Thus, at present our country's college entrance examination mathematics from emphasizing the basic gradually turns to

pay attention to comprehensive examination.

4.3. Horizontal analysis inspection requirements

Now, the examination requirements are analyzed from a horizontal perspective, and the examination requirements are classified by volume. Since there are only volume I and volume II from 2021, only volume I and volume II over the years are studied during the study, as shown in Figure 6 below.

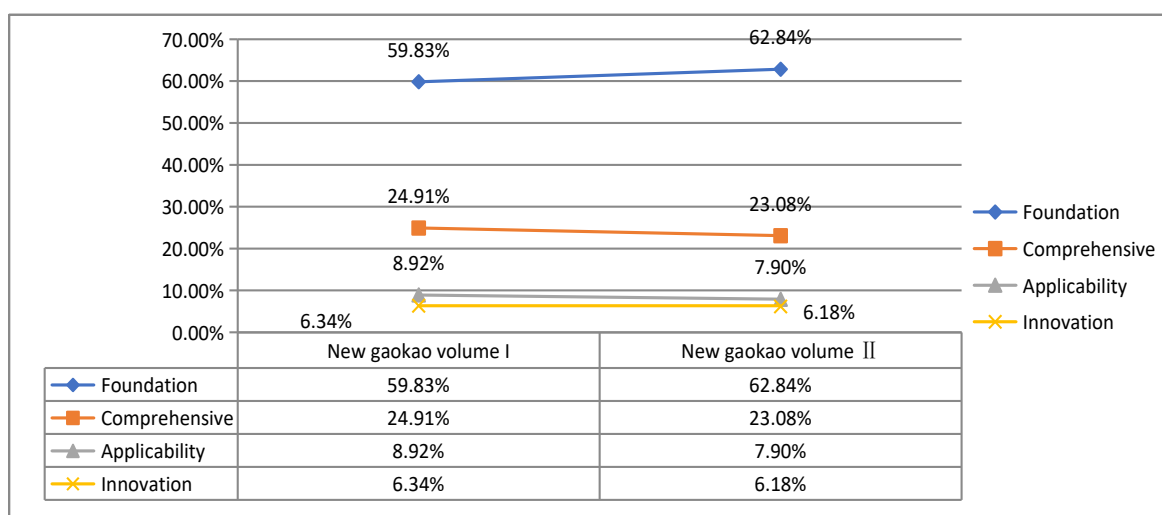


Figure 6. Distribution of test requirements for different volumes

As can be clearly seen from the line chart, there are slight changes in the emphasis of examination requirements in different volumes. In the basic examination, the national volume II examination proportion is higher, accounting for 62.84% of the whole paper. In the comprehensive examination, the national paper I is higher, accounting for 24.91% of the whole paper, but in the application and innovation, there is little gap between the two. It is known that the national volume II pays more attention to the examination of the basic, but no matter the national volume I or the national volume II, the highest proportion of examination is the basic, so the basic is always the focus of the college entrance examination math paper.

5. Summary and Suggestion

5.1. Summary

In terms of structure, the 2018-2020 National Examination Paper of Mathematics (science) remains relatively stable in structure, while the 2021 National New high examination paper has undergone great changes in question type, question quantity and score. The 2021 National New high examination has added multiple choice questions and reduced one optional question. In terms of score value, the 2021 college entrance examination paper's multiple-choice score is set as "5 points for all correct answers, 0 points for wrong answers, 2 points for partial correct answers", 10 points for the first answer question, 12 points for the remaining 5 questions, and 12 points for each answer question in the national paper (science) without multiple-choice answers. It can be seen that due to the changes of question type and amount, the score of the national new college entrance examination in 2021 will change correspondingly, but the overall change is not much. Second, in terms of content, through the analysis of the specific examination situation of the four main content lines of "algebra", "function", "geometry" and "probability and statistics" in the 11 papers, it is concluded that the examination situation of the main content line in the 11 papers is relatively stable, with the proportion of "geometry", "function", "algebra" and "probability and statistics" successively from high to low. And the proportion of "geometry" is decreasing year by year, while the proportion of "function" is increasing year by year. Third, the level of mathematics core literacy, the use of Yuping's mathematics core literacy evaluation framework, the examination of mathematics core literacy and the specific performance level of quantitative processing. It is found that every kind of literacy is examined in the paper, but its proportion is different. Among them, the proportion of mathematical operation is the highest, followed by logical reasoning, intuitive imagination, and data analysis, mathematical abstraction and mathematical modeling are the least [5]. The examination of three levels of mathematics core literacy is also different. The examination proportion of knowledge transfer level is the largest, and the examination of knowledge understanding level is the lowest.

5.2. Suggestions

5.2.1. Mathematical proposition of college entrance examination

The new college entrance examination system is gradually established, and the scope of the order of the new college

entrance examination mathematics questions will be gradually expanded in the future. Based on the research of the college entrance examination mathematics questions, this paper puts forward the following four suggestions: First, on the basis of the current four types of questions, we can make the forms more diversified to meet the selection of diverse talents, appropriately reduce the traditional objective multiple choice questions, and appropriately increase the problems that can be solved with multiple solutions. Second, the test questions should pay more attention to the ability of students to connect math knowledge with life, and integrate emotions, attitudes and values into math literacy, so as to better highlight the core function of the college entrance examination of "cultivating virtues and educating people". Third, it is appropriate to reduce the examination of mathematical operations, more reasonable arrangement of six mathematical core literacy in the examination proportion of the paper. According to the research, although the number of arithmetic ability questions is relatively large, it has a downward trend. In the future college entrance examination, it is necessary to gradually increase the examination of data analysis, mathematical abstraction, mathematical modeling and other literacy. Fourth, pay attention to the transfer and innovation of knowledge, fully coordinate the proportion of mathematics core literacy level.

5.2.2. Teacher teaching

The study of college entrance examination mathematics test questions not only serves the proposition of college entrance examination, but also points out the direction of high school mathematics teaching. The following three suggestions are put forward: First, a new question type, multiple choice, appears for the first time in the structure of the question type, which is unprecedented in the mathematics of college entrance examination. Therefore, it is essential to strengthen the practice of multiple choice for students and let them master the methods and skills of doing multiple choice questions. The second is to pay more attention to the cultivation of students' mathematical literacy, not because of the slow calculation of students and not let them calculate in class, ignore the calculation process of students, only pay attention to the results, should teach students how to skillfully calculate; At the same time, cultivate students' independent thinking ability, let them learn how to analyze and think, improve students' logical reasoning ability. Thirdly, it is suggested that teachers pay attention to the transfer of students' mathematical knowledge and realize the flexible application of knowledge. When encountering new puzzles or applicable and open problems, students should be able to form new problem-solving ideas by analogy with the problem-solving methods they have mastered, solve problems creatively, and flexibly apply the knowledge they have learned in daily life.

References

- [1] P.Yu(2017).Framework of Evaluation about Mathematics Key Competencies.Journal of mathematics education,Vol.26, No.2,p.19-23+59.
- [2] HP.Yang,M.Li(2021).An analysis of the examination of the Core Literacy in the mathematics questions of College Entrance Examination—A case study of the new College Entrance Examination in 2020 and 2021.Company in Mathematics, No.6,p.97-104.

- [3] Ministry of Education of the People's Republic of China(2020).Curriculum Standard of Mathematics for Ordinary High School (2017 edition, 2020 revision).People's Education Press.
- [4] YH.Huang(2021).Research on the National Mathematics (Science) papers of college entrance examination from 2018 to 2020. Qinghai Normal University.
- [5] B.Song(2021).Evaluation of Core Literature-oriented College Entrance Examination Mathematics Questions——Taking 2020 National College Entrance Examination II as an example.Research of Mathematic Teaching-Learning,Vol.40, No.4,p.46-51.