A Comparative Study of Junior High School Mathematics Textbooks between People's Education Press Version and Gyeonggi Province Department of Education Version: TheCaseofSimilarTriangles

Abstract:

Similar triangles of junior high school mathematics textbooks from Chinese People's Education Press Version and Korean Gyeonggi Province Department of Education Version were selected for the study.The methods of literature study, content analysis and comparative study were utilized to compare the content of similar triangles in the two sets of textbooks from different aspects and dimensions.In the end, the study found that the People's Education Press Version was more complete in depth and breadth, but lacked interest, and the Gyeonggi Province Department of Education Version used the context well, but the knowledge content was relatively shallow.

Keywords: Junior high school textbooks;Comparative research; Similar triangles; People's Education Press Version

1 Introduction

Curriculum reform is a focal point of educational reform, and textbook reform serves as the starting point for curriculum reform. Therefore, textbooks form the foundation of all educational and teaching activities, serving as the fundamental medium of education.

Wu xian and Liu Suhong [1] used qualitative and quantitative research on the People's Education Press and Beijing Normal University Press junior high school mathematics textbooks, analyzing the textbooks from the perspective of the arrangement comparison and arrangement intention of the two editions of the textbook. In the master's thesis of Zhang Huiyi[2], she combined the corresponding mathematics curriculum standards for compulsory education in China and the United States, and quantitatively compared the content based on the Van Hill geometric thinking level theory and complexity, using specific cases for comparative analysis. Li Xiaojing [3] also selected Chinese and American textbooks for comparison, conducting comparative research from the perspectives of content structure, knowledge arrangement system, problem context, inquiry activities, and

knowledge-based thinking levels. Zhou Jingyan [4] and Wang Qi [5] both selected the geometry part for comparison, using literature research, content analysis, and comparative research methods to compare textbooks from macro and micro perspectives. In terms of comparative research methods, many relevant literature have involved difficulty comparison, using the "comprehensive difficulty model of mathematics courses" proposed by Professor BaoJiansheng. For example, in the comparative studyof Ye Lijun and Xi Luwei [6] on "congruent triangles" content example exercises, statistical and weighted calculations were carried out according to the course difficulty model, and the comparison results were presented in the form of radar charts. In the paper "A Comparative Study on the Content of Junior High School Mathematics Textbooks in the People's Education Press Version and the Jiangsu Education Press Version - Taking" Congruent Triangle "as an Example", Shi Yiting [7] also referred to this model and analyzed it from five aspects: exercise difficulty, cognition, operation, background, reasoning, and knowledge content.

Yang Wang [8] compared Chinese and Australian textbooks, involving the distribution and arrangement order of knowledge points, course difficulty, and exercise difficulty in the textbooks. Literature research, content analysis, comparative research, and mathematical modeling methods were adopted, and charts were listed to indicate the comparison process. Ji Won Son andQintong Hu [9] explored the similarities and differences in function content between American and Chinese textbooks, linking some findings with the reasons for the differences in student performance in international comparative tests between the two countries, highlighting the characteristics and advantages and disadvantages of the two versions of textbooks.

Through studying the literature, we find that the mathematics textbooks of junior high schools in China and South Korea are rarely paid less attention to. South Korea has a similar education system and different education institution with China, and its relevance makes its direction of mathematics curriculum reform worthy of our attention and research. Therefore, we refer to the comparative research methods in relevant literature, select typical representative textbooks from China and South Korea as research objects, select the same course content for horizontal comparison, and strive to summarize the similarities and differences between the two, analyze their respective strengths and weaknesses, and get reference and inspiration.

2 Research Ideas

This article adopts literature research, content analysis, and comparative research methods for comparative research. Starting from macro and micro aspects in terms of content, specifically the background information, chapter structure, and knowledge content at the macro level, as well as the presentation of knowledge, examples and exercises, chapter head images and comparison with chapter head language and narration at the micro level, the aim is to analyze and summarize the writing characteristics of the Gyeonggi Province Department of Education Version.

In the comparison of knowledge presentation methods, the comparative model of knowledge presentation methods created by Ye Lijun is referred to, and the knowledge points are divided according to knowledge introduction, knowledge experience, knowledge representation, knowledge explanation, knowledge application and knowledge expansion, and the comparison results are displayed in the form of a table.

In the comparative study of the difficulty of the example exercises,the difficulty comparative model created by BaoJiansheng is referred to.The calculation formula is

$$d_i = \frac{\sum_j n_{ij} d_{ij}}{n} (\sum_j n_{ij} = n, i = 1,2,3,4,5; j = 1,2,\ldots).$$

Among them, d_i (i =1,2,3,4,5) represent the difficulty coefficients of the five dimensions of "inquiry", "background", "operation", "reasoning" and "knowledge content", d_{ij} represents the weight of the j -level of the i -dimension, and n represents the total number of questions.

In the narration comparison part, the density calculation refers to the narration density formula proposed by Peng Wenjing.The density distribution refers to the average number of narrations contained in each chapter (section) of the textbook, which is represented by $r = n/m$, where r represents the narration density of each chapter (section) of the textbook, n represents the total number of narrations contained in the textbook (chapter), and m represents the number of chapters (sections) in the textbook of the book (chapter)[10].

3 Comparative Research

3.1 Macro comparison of textbooks between the People's Education Press Version and the Gyeonggi Province Department of Education Version.

Referring to the paper " Comparison and Investigation of "Congruent Triangle" betweenQingdao Edition and PEP and Beijing Normal University EditionsMathematics Textbook "[11], macroscopically compare the content of "similar triangles" between the two versions of textbooks from the aspects of background information, chapter structure, and knowledge content.

Compare the background information of the two versions of textbooks, and the results are shown in Table .1.

Table 1 Background Information Comparison Table

	People's Education Press Version	Gyeonggi Province Department of Education Version
Chapter Name	Similarity	Similarity Of Graphics
Textbook Grade	Grade 9 Volume 2	Grade 8 Volume 2
Page Number	29-46	276-291
Total Number of Pages	18	16
Colour	incolour	in colour

According to Table .1, both versions of the textbook delve into the study of "similar triangles" on a similar basis. But the schedule for studying this in the Gyeonggi Province Department of Education Version is earlier. The required knowledge reserves of students are relatively small, and the requirements for their thinking ability are relatively low.

According to the table of contents, a comprehensive analysis and comparison were conducted on the chapter structure arrangement of similar triangles in the two versions of the textbook.The statistical results are shown in Table .2.

Table 2 Comparison of Chapter Structure Table

	People's Education Press Version	Gyeonggi Province Department of Education Version

Chapter Name	similarity	Similarity of graphics
Section Name	27.2.1 Determination of Similar Triangles 27.2.2 The properties of similar triangles 27.2.3 Examples of Similar Triangle Applications	1.1 Similar graphics 1.2 Similarity conditions for triangles

Based on Table .2, structurally speaking, both versions first learn definitions and then learn decision conditions. The difference is that the Gyeonggi Province Department of Education Version of the textbook first presents the similarity of images, and then introduces definitions and judgment conditions through induction, with similarity conditions as the core content.The People's Education Press Version proposed the determination of similar triangles at the beginning, focusing the content of this chapter evenly on the determination, properties, and applications of similar triangles.

In terms of content, compare the similarities and differences of similar triangle knowledge between the two textbooks. The statistical results are shown in Table 3.

Table .3 Content Comparison Table

	People's Education Press Version	Gyeonggi Province Department of Education Version
Knowledge Content	1. Definition of similar shapes. 2. The definition of similar polygons. 3. Definition and similarity ratio of similar triangles. 4. The determination of similarity in ordinary triangles: the three sides are proportional. 5. The determination of similarity in ordinary triangles: both sides are proportional and have equal angles. 6. The determination of similarity in ordinary triangles: the two corners are	1. The definition and properties of similarity in planar shapes. 2. The definition and properties of similarity in three-dimensional graphics. 3. The condition for a ordinary triangle to be similar: the three sides are proportional. 4. The condition for a ordinary triangle to be similar: both sides are proportional and have equal angles 5. The condition for a ordinary triangle to be similar: the two corners are equal. 6. The similarity of right angled triangles.

equal.

7. Determination of similarity in right angled triangles: a right angled edge corresponds proportionally to the hypotenuse.

8. Similar triangle property: corresponding angles are equal.

9. Similar triangle property: the corresponding edges are proportional.

10. Similar triangle property: The ratio of the corresponding contour is equal to the similarity ratio.

11. Similar triangle property: The ratio of the corresponding midline is equal to the similarity ratio.

12. Similar triangle property: the ratio of the corresponding angle bisector is equal to the similarity ratio.

13. Similar triangle property: perimeter ratio equals similarity ratio.

14. Similar triangle property: the area ratio is equal to the square of the similarity ratio.

The two versions of the textbook show a significant difference in the number of knowledge points in this chapter. The People's Education Press Version of the textbook has far more knowledge points than the Gyeonggi Province Department of Education Version. The content of the textbook published by People's Education Press Version is richer, and the learning objectives and requirements are more clear.

3.2 Micro comparison of textbooks between the People's Education Press Version and the Gyeonggi Province Department of Education Version

3.2.1 Comparison of knowledge presentation

The three methods of judging similar triangles and the way of presenting knowledge of similar special triangles in the two textbooks are compared.The results are shown in **Error! Reference**

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Table4 Comparison of knowledge presentation modes

Textbook knowledge point Index		The knowledge points in PEPV	Knowledge points quantity	The knowledge points in GPDEV	Knowledge points quantity
Primary index	Secondary index				
Knowledge introduction	Not			One pairs of sides are proportional and the angles between are equal. The two pairs of angles are equal.	2
Mathematical background		The three pairs of sides are proportional. The two pairs of sides are proportional and the angles between are equal. The two pairs of corners are equal. The similarity of right triangles.	4		
Life background					
History of mathematics				The three pairs of sides are proportional. The similarity of	2

			right triangles.	
	Scientific background			
Knowledge experience	Not	The two pairs of corners are equal. The similarity of right triangles.	2	The three pairs of sides are proportional. One pairs of sides are proportional and the angles between are equal. Two pairs of angles are equal. The similarity of right triangles.	4
	hands-on activities	The three pairs of sides are proportional. One pairs of sides are proportional and the angles between are equal.	2	
	Math game			
Representation of knowledge	Only words			
	Words+ Pictures			The three pairs of sides are proportional. One pairs of sides are proportional and the angles between are equal. The two pairs of angles are equal.	4

				The similarity of right triangles.	
	Words+Symbols	The three pairs of sides are proportional.			
	Words + Pictures + Symbols	One pairs of sides are proportional and the angles between are equal. The two pairs of angles are equal. The similarity of right triangles.	4		
Knowledge explanation	Give directly			One pairs of sides are proportional and the angles between are equal. The two pairs of angles are equal.	2
	Illustration	One pairs of sides are proportional and the angles between are equal. The two pairs of angles are equal.	2	The three pairs of sides are proportional. The similarity of right triangles.	2

	Simple proof	The three pairs of sides are proportional. The similarity of right triangles.	2		
	Strict proof				
Knowledge application	Memory type	The three pairs of sides are proportional. The three pairs of sides are proportional.	2	The three pairs of sides are proportional. One pairs of sides are proportional and the angles between are equal. The two pairs of angles are equal. The similarity of right triangles.	4
	Unrelated program type				
	Associated program types	One pairs of sides are proportional and the angles The two pairs of angles are equal. The similarity of right triangles.	3	The three pairs of sides are proportional.	1
	Do math types	One pairs of sides are proportional and the angles	1		

Knowledge extension	Not	The three pairs of sides are proportional. One pairs of sides are proportional and the angles between are equal. The two pairs of angles are equal. The similarity of right triangles.	4	The three pairs of sides are proportional. One pairs of sides are proportional and the angles between are equal. The two pairs of angles are equal. The similarity of right triangles.	4	
	Mathematical knowledge Life application Mathematical culture					

In terms of knowledge introduction, the People's Education Press Version focuses more on the description of mathematical background, while the Gyeonggi Province Department of Education Version focuses more on the popularization of mathematical history, and neither of the two textbooks uses life background nor scientific background.

In terms of knowledge experience, the People's Education Press Version of the textbook set up hands-on operation for the two contents of the decision theorem, while the Gyeonggi Province Department of Education Version of the textbook has no obvious knowledge experience link.

In terms of knowledge representation, the Gyeonggi Province Department of Education Version is mainly presented in the form of text and graphics, while the People's Education Press Version is mainly presented in the form of a combination of text, graphics and symbols, with symbols added.

In terms of knowledge explanation, the Gyeonggi Province Department of Education Version of the textbook prefers to directly give conclusions and examples, and does not show the reasoning

process and theorem proving well. The People's Education Press Version of teaching materials are more inclined to give examples and simple proofs.

In terms of knowledge application, the Gyeonggi Province Department of Education Version of the textbook is more memory-based, requiring students to have a clear memory of knowledge points, and the requirements for students' application ability are not high.

In the aspect of knowledge expansion, neither of the two textbooks touches on it.

3.2.2 Example exercise comparison

The comparison in the first part is a comparison of the types of exercises.

Table 5 Statistical table of similar triangular exercise types

	People's Education Press Version		Gyeonggi Province Department of Education Version	
	Number	Proportion	Number	Proportion
Choice exercises	1	6.25%		
Proof exercises	5	17.86%	1	6.25%
Free-response exercises	16	57.14%	14	87.5%
True or falseexercises	6	21.43%		
Drawing exercises	1	3.57%		

The two textbooks have different emphasis on the type selection of example exercises. The People's Education Press Version tends to answer application-type exercises, deepen students' understanding and mastery by using them, consolidate concept-related knowledge with proof and TRUE or FALSE exercises. However, Gyeonggi Province Department of Education Version of the exercise type is concentrated on Free-response exercises, a small number of multiple choice exercises and proof exercises, the exercise type is not rich, the knowledge level is relatively simple.

The comparison in the second part is the comprehensive difficulty comparison.

First of all, the difficulty level of the five dimensions of the test questions is identified, and the natural assignment of the grade variables is carried out. Then, the comprehensive difficulty model created by BaoJiansheng is weighted and averaged to obtain the quantitative indicators of each

dimension. Finally, the comprehensive analysis features of the radar map are drawn. The results are shown inTable 6.

Table 6Analysis table of BaoJiansheng's comprehensive difficulty model

Difficulty factor	Grade level	PEPV		GPDEV		weighted average	
		Number of exercises (27 in total)	proportion	Number of exercises (48 in total)	proportion	PEPV	GPDEV
Exploration	Memorization	0	0%	3	6%	2.48	2.04
	Understanding	14	52%	40	83%		
	Exploration	13	48%	5	10%		
Background	No background	19	70%	42	88%	1.296	1.15
	Personal life	8	30%	5	10%		
	Common sense	0	0%	1	2%		
	Scientific situation	0	0%	0	0%		
Computation	No computation	4	15%	3	6%	2.56	2.67
	Numeric computation	6	22%	11	23%		
	Simple symbolic computation	15	56%	33	69%		
	Complex symbolic computation	2	7%	1	2%		
Inference	No inference	0	0%	1	2%	2.11	2.00
	Simple inference	24	89%	46	96%		
	Complex inference	3	11%	1	2%		
Quantity contained of knowledge	Single knowledge point	5	19%	14	29%	2.04	1.98
	Two knowledge points	16	59%	21	44%		
	Three or more knowledge points	6	22%	13	27%		

The exercises of the similar triangular parts of the two versions were statistically analyzed

according to the level division of exploration factors, and the results were shown in Figure 1. On the whole, the two versions have the same general trend, but the proportion of understanding and exploration in the People's Education Press Version is not much different and the proportion is higher, while the proportion of understanding in the Gyeonggi Province Department of Education Version is larger.

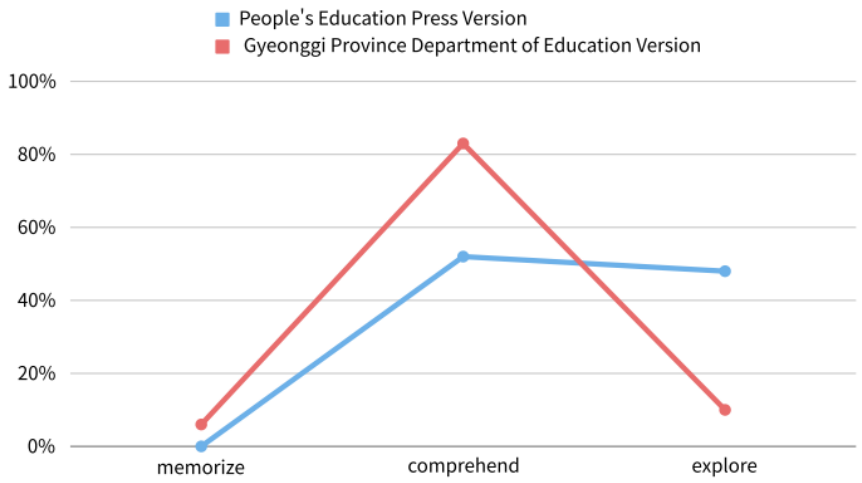


Figure .1Comparison diagram of exploring factors

Statistics were conducted according to the level division of background factors, and the results were shown in Figure 2. Overall, the two versions have the highest level of no background, without the support of public knowledge and scientific background, while the Gyeonggi Province Department of Education Version is completely at the level of no background.

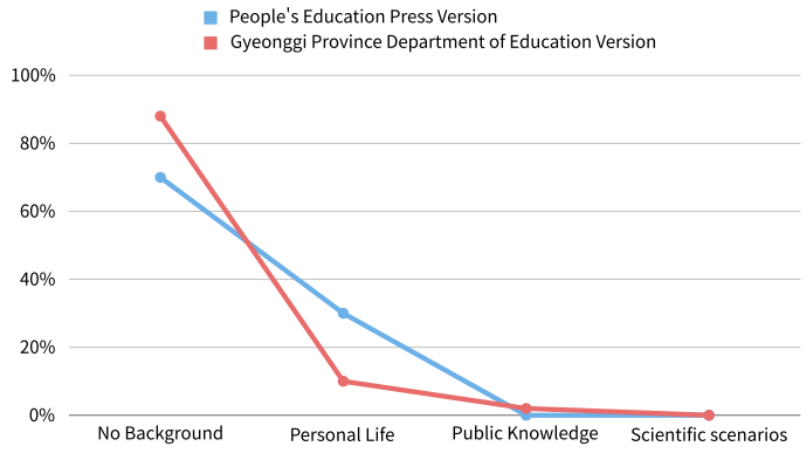


Figure .2Comparison of background factors

Statistics were carried out according to the level division of operational factors, and the results were shown in Figure .3. The general direction of the broken line is similar, and the two versions mainly focus on numerical operations, involving partial non-operations and simple symbolic operations. The numerical arithmetic level of the Gyeonggi Province Department of Education Version is higher than that of the People's Education Press Version, which involves some simple symbolic arithmetic in addition to numerical arithmetic. In the chapter on similar triangles, the Gyeonggi Province Department of Education Version focuses on the application of similar triangle properties, while the People's Education Press Version focuses on applied calculation and logical proof.

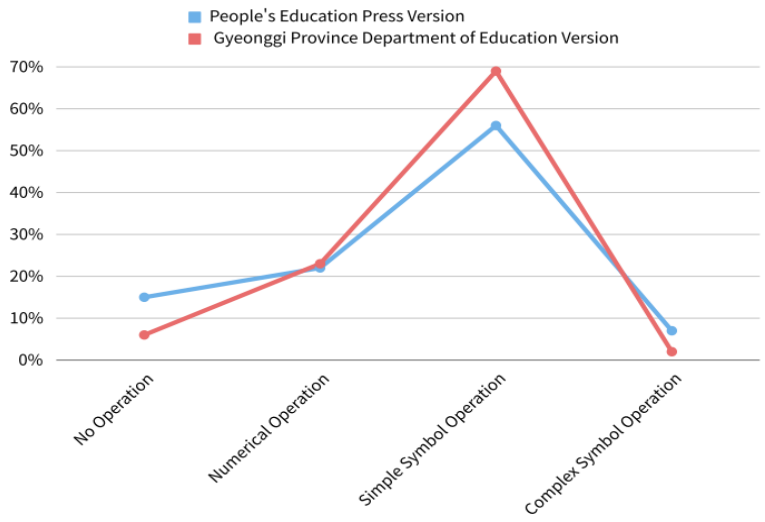


Figure 3Comparison of operational factors

According to the level division of reasoning factors, statistical results were obtained, as shown inFigure 4. On the whole, the line chart of the two versions is basically the same, with the most simple reasoning. The difference is that the Gyeonggi Province Department of Education Version has more no reasoning, and the People's Education Press Version has more complex reasoning. In part, however, the Gyeonggi Province Department of Education Version focuses more on students' fundamentals, starting with no reasoning and gradually advancing to simple reasoning.

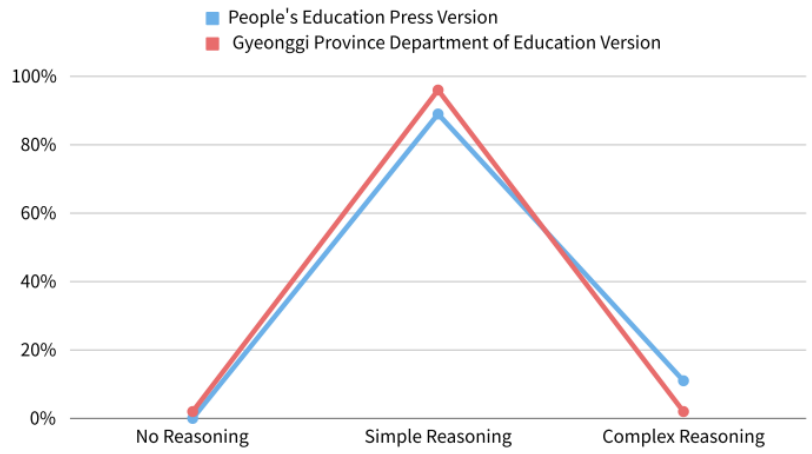


Figure 4Inference factor comparison diagram

According to the different levels of knowledge content factors, the statistics are carried out, and the results are shown in Figure .5. According to the larger change rate of the line chart in the People's Education Press Version, the line chart in the Gyeonggi Province Department of Education Version is relatively smooth, which shows that the distribution of knowledge points in the Gyeonggi Province Department of Education Version is more uniform and the requirements are more average, while the People's Education Press Version pays more attention to the examination and simple application of the two knowledge points learned in this chapter.

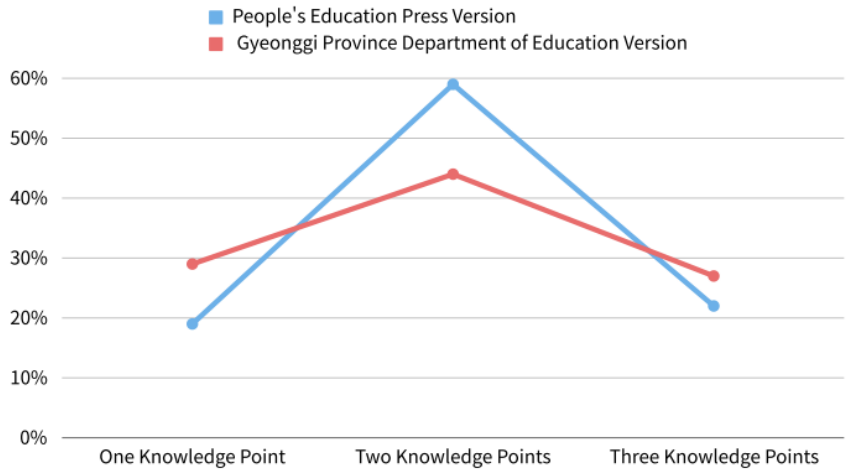


Figure .5Comparison of knowledge content factors

The radar map is drawn according to the statistical results of the above difficulty factors. In the form of intuitive, comprehensive comparison of its difficulty level.

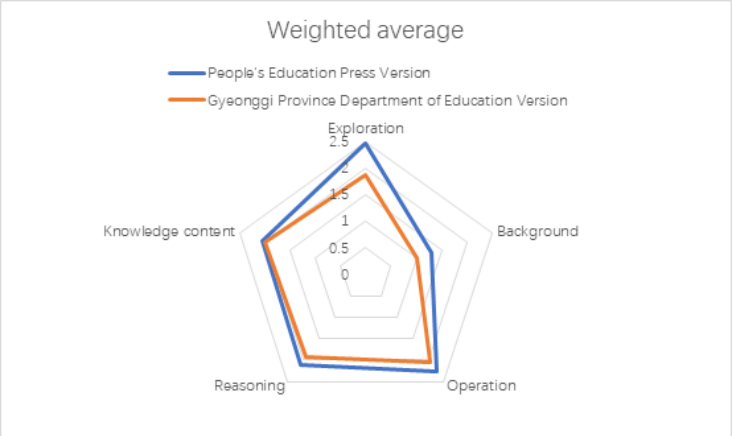


Figure 6Comprehensive difficulty model radar chart

3.2.3 Comparison of chapter head picture and chapter head language

Compare the different presentation of the two editions of teaching materials in the chapter header to explore their different roles. The comparison results are shown inTable .7.

Table .7 Comparison table at the head of chapter

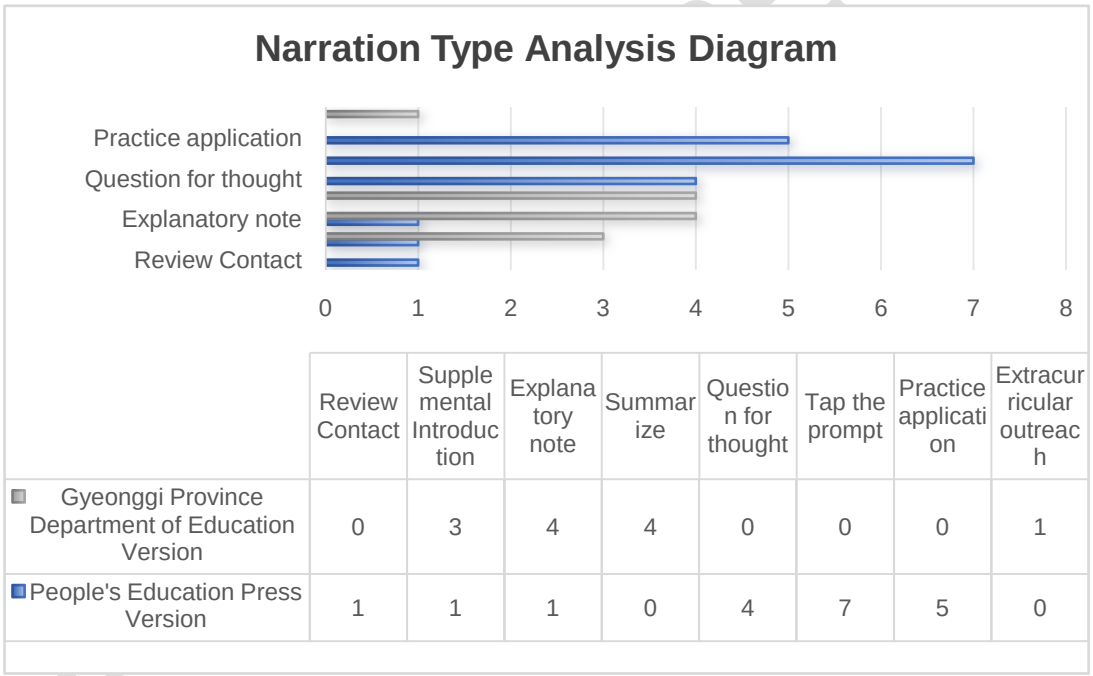
	People's Education Press Version	Gyeonggi Province Department of Education Version
Chapter Title	have	have
Chapter heading language	have	have
Chapter heading language form	Knowledge review+Learning objectives and requirements	Quoting Gulliver's travels
chapter heading directory	not	have
chapter heading picture	a picture of the Great Wall	Cartoon picture of Gulliver's Travels

The chapter header of both versions consists of the chapter title, background image, and text. The difference is that the chapter section of the People's Education Press Version is directly related to the learning content, and the text is intuitive and detailed. For example, the People's Education Press Version used a set of pictures of the Great Wall, all identical in different sizes, to convey the ideas of graphic similarity. In addition to this, the relevant mathematical problems are directly raised.The Jangdou language of the Gyeonggi Province Department of Education Version starts with a fairy tale narrative, and then subtly connects math knowledge with fairy tales to stimulate their interest in

learning. .This is reflected in that they quoted the ratio of giant and small man in the story of Gulliver's travels, and began with interesting stories rather than geometric figures.In addition, the Gyeonggi Province Department of Education Version textbook also includes a chapter list at the beginning of the chapter to help students understand the main content and structure of the chapter.

3.2.4 Narration comparison

Narration is generally divided into eight categories: review and contact, supplementary introduction, explanation, summary, question inspiration, call tips, exercise and extra-curricular development. According to the classification, the two textbooks are compared, and the results are shown in Figure 7.



	Review Contact	Supplemental Introduction	Explanatory note	Summarize	Question for thought	Tap the prompt	Practice application	Extracurricular outreach
Gyeonggi Province Department of Education Version	0	3	4	4	0	0	0	1
People's Education Press Version	1	1	1	0	4	7	5	0

Figure 7Narration type analysis diagram

As shown in Figure 7, the narration types of the People's Education Press Version textbooks are rich, aiming to promote students' in-depth understanding of knowledge through diversified expressions, and pay attention to giving instructions to students' learning. The Gyeonggi Province Department of Education Version, on the other hand, combines mathematical knowledge with the

story, and the narration serves only as a tool for generalization and summary.

According to the voiceover density calculation model, the voiceover density of the two editions of teaching materials was counted, and the results were shown inTable 8.

Table .8 Voiceover density statistics

	People's Education Press Version	Gyeonggi Province Department of Education Version
Narration total	19	12
Chapter total	3	2
Narration density	6.33	6

The narration density of each section of the People's Education Press Version is 6.33, while the narration density in the Gyeonggi Province Education Department Version is 6. The distribution of narration in the People's Education PressVersion is relatively dense, and the Gyeonggi Province Education Department Version shows the role positioning of narration well.

4 Conclusion

Combined with the reference literature, such as the General High School Mathematics Curriculum Standards[12].This article selects the content of "similar triangles" as the research object in the People's Education Press Version and Gyeonggi Province Department of Education Version, and analyzes the similarities and differences in the content of "similar triangles" from both macro and micro perspectives.

On the macro level, (1) In terms of background information, the main difference lies in the arrangement of study stages. The People's Education Press Version puts the learning of "similar triangles" in the second volume of the ninth grade. The Gyeonggi Province Department of Education Version is scheduled for the second volume of the eighth grade. (2) In terms of chapter structure, both versions of the textbook are generally the same. However, the People's Education Press Version regards the criteria for determining similar triangles as one of the important teaching contents. The Gyeonggi Province Department of Education Version puts the criteria for determining the similarity of similar triangles as the core of teaching.(3) In terms of knowledge content, both versions of the textbook involve the definition of similar triangles. But the People's Education Press Version involves richer knowledge points, while the scope of knowledge of the Gyeonggi Province Department of Education Version is narrower.

On the micro level, (1) In terms of knowledge presentation, both versions of the textbook adopt the method of inquiry-based introduction. The People's Education Press Version adopts a problem-solving approach. The Gyeonggi Province Department of Education Version uses story scenario introduction. (2) In the example section, both versions of the textbook have diverse examples and emphasize the basic knowledge points. However, the People's Education Press Version tends to focus more on solving real-life mathematical problems, while the Gyeonggi Province Department of Education Version focuses on solving mathematical problems. In the part of exercises, the People's Education Press Version has a larger number and richer types of exercises than the Gyeonggi Province Department of Education Version. (3) Inthe header of the chapter, for the People's Education Press Version, a number of questions are used to show the learning requirements of the content of the chapter. But the Gyeonggi Province Department of Education Version is mainly based on the illustrations of Gulliver's Travels, with no mention of relevant knowledge content. (4) In terms of density, the People's Education Press Version is slightly more than the Gyeonggi Province Department of Education Version, but the distribution density is similar.

Through the above comparison of the two versions in the relevant parts of similar triangles, it can be found that the two versions of the textbook have their own characteristics in writing and certain differences in writing.

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