A Comparative Study on Exercise Difficulty of "Triangle" in Chinese and Vietnamese Junior High School Mathematics Textbooks

Abstract: The present paper selects the junior high school mathematics textbooks of Zhejiang Education Edition in China and Kite Edition in Vietnam as the research objects, and employs the comprehensive exercise difficulty model to conduct a comparative analysis of the comprehensive difficulty of exercises in the "triangle" section of the textbooks from both countries.The research results show that there is no significant difference in the overall exercise difficulty between the two versions of the textbooks, and both exhibit a distribution characteristic of relatively high exploration and reasoning factors, followed by computation factors and knowledge content factors, with the background factor being the lowest.However, in terms of the computation factor, the Zhejiang Education Edition places more emphasis on "symbolic computation", while the Kite Edition tends to favor "numerical computation" in comparison.These research findings can provide certain references for the two countries in the compilation and use of examples and exercises in mathematics textbooks.

Keywords： Junior High School Mathematics Textbooks；Triangle；Exercise Difficulty；Comparative Study

1 Introduction

Exercises are an important part of mathematics textbooks. The number, type and difficulty of exercises not only reflect the value orientation of textbook writers, but also have an important impact on mathematics teaching[9]. Graphics and geometry are important areas of mathematics learning in junior high school. The content of triangle is particularly important for cultivating students' logical reasoning ability, abstract thinking ability and spatial concept ability[10]. The Mathematics Curriculum Standards for Compulsory Education(2022 Edition) (Hereinafter referred to as the "New Curriculum Standards") [1]has reclassified the content of "Graphics and Geometry" ,with special emphasis on the understanding and application of triangle-related content. Given the fundamental role of triangles in plane geometry, this paper selects exercises on "triangles" as the research topic. Furthermore, both China and Vietnam are Asian countries with some similarities in their education systems[11]. Therefore,

a comparative study of the exercise difficulty in junior high school mathematics textbooks between China and Vietnam holds significant importance.

Many scholars at home and abroad have utilized various difficulty models to analyze the comparative study of exercise difficulty[12, 13]. Nohara[2] first proposed the concept of comprehensive difficulty and analyzed it across four dimensions: extended problems, real-life contexts, calculations, and multi-step reasoning. In 2002, Bao Jiansheng[3] introduced the concept of comprehensive difficulty in mathematics curricula and established a four-factor comprehensive difficulty model for a comparative study of expected junior high school mathematics curricula between China and the United Kingdom. In 2014, Wang Jianpan et al[4] further refined Bao's comprehensive difficulty model by considering five difficulty factors: "Background" "Mathematical Cognition" "Computation" "Reasoning" and "Knowledge Integration" each of which was subdivided into 3-4 specific levels. In 2019, Qin Lin[5] built upon Bao's difficulty model by adding "Exercise Type" and "Degree of Association with Examples" to construct a six-factor exercise difficulty model. In 2023, Zhang Li et al[6], in response to adjustments in the New Curriculum Standards, developed a comprehensive difficulty model that comprehensively summarizes the process of mathematical activities. This model uses five factors: "Exploration" "Background" "Computation" "Reasoning" and "Knowledge Content" to quantitatively assess the level of mathematical exercises across various difficulty factors. The quantitative values for each difficulty factor are then presented in the form of a pentagonal model to visually represent the comprehensive difficulty level and characteristics of mathematical exercises[14, 15].

This paper selects the eighth-grade first semester, ninth-grade first and second semesters textbooks from the Zhejiang Education Edition (Hereinafter referred to as "the Zhejiang Edition") and textbooks from grades 7-2, 8-2, and 9-1 of the Vietnamese CánhDiều (Kite Edition) (Hereinafter referred to as "the Kite Edition") as the research subjects. Drawing on Zhang Li's optimized model of comprehensive exercise difficulty[6], this paper conducts a comparative study of exercises on "triangles" in mathematics textbooks from China and Vietnam, aiming to provide some references for the compilation and use of "triangle" exercises in junior high school mathematics textbooks in China.

2 research design

2.1 Research content

Comparing textbooks from two countries, we found that the "Example" in the Kite Edition serve the same purpose as the "Try It Out" and "In-class Exercises" in the Zhejiang Edition in introducing chapter knowledge points and consolidating new learning. Similarly, the "Exercises" in the Kite Edition and the "Homework" in the Zhejiang Edition are designed to consolidate knowledge points

and evaluate learning outcomes. Given the consistency in the functions of exercises between the two editions, this paper selects the number of exercises from the three sections of the Zhejiang Edition, namely "Try It Out" "In-class Exercises" and "Homework" for comparison and analysis with the number of exercises from the two sections of the Kite Edition, namely "Example" and "Exercises" The statistical results are shown in Table 1.

Table 1 The number of exercises on the "triangle" between China and Vietnam

Textbook Version	Grade	Chapter Content	Number of Exercises		
The Zhejiang Edition	Eighth Grade (First Semester)	Introduction to Triangles	104	198	359
		Special Triangles	94		
	Ninth Grade (First Semester)	Similar Triangles	95	95	
	Ninth Grade (Second Semester)	Solving Right Triangles	66	66	
The Kite Edition	Seventh Grade (Second Semester)	Tam giác (Triangle)	107	107	226
	Eighth Grade (Second Semester)	Tam giácđóngdạng. Hình đóngdạng (Similar Triangles, Similar Shapes)	76	76	
	Ninth Grade (First Semester)	Hệthứclượngtrong tam giácvuông (Quantitative Relationships in Right Triangles)	43	43	

2.2 Research method

Drawing on Zhang Li's[6] optimization model of comprehensive exercise difficulty, we assess the difficulty of exercises from five dimensions, denoted by $d_i\left(i=1,2,3,4,5\right)$, which represent the weighted averages of the five difficulty factors: "Exploration" "Background" "Computation" "Reasoning" and "Knowledge Content." The calculation formula is as follows.

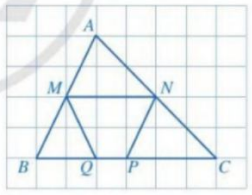
$$d_i=\frac{\sum_j n_{ij}d_{ij}}{n_i}\left(i=1,2,3,4,5;\ j=1,2,3,\cdots\right),$$

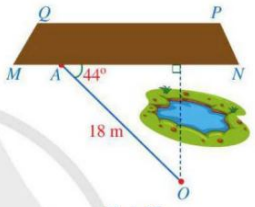
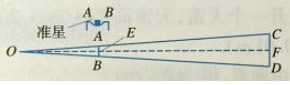
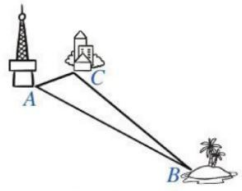
which d_{ij} represents the weight of the jth level of the ith difficulty factor, with weights assigned values of 1, 2, 3, 4 according to the level of difficulty, n_{ij} represents the number of exercises in the textbook that belong to the jth level of the ith difficulty factor, and n_i represents the total number of

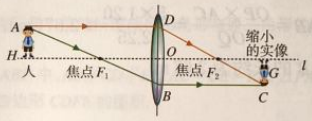
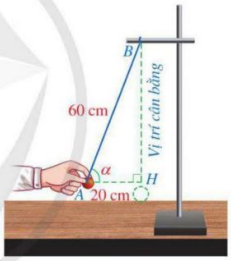
exercises under that difficulty factor.

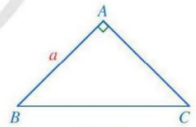
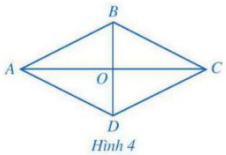
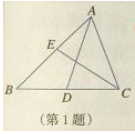
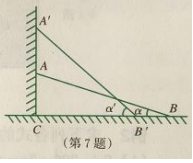
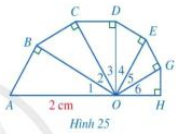
Let the five difficulty factors be denoted as $A_i\left(i=1,2,3,4,5\right)$, and the hierarchical levels of the ith difficulty factor be denoted as $A_{ij}\left(i=1,2,3,4,5;\ j=1,2,3\cdots\right)$. Table 2 provides definitions and examples for the categorization of each difficulty factor's levels.

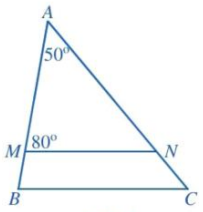
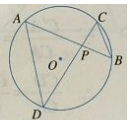
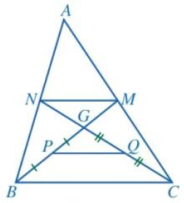
Table 2 Definitions of Exercise Difficulty Factors and Levels

Hierarchical Levels A_{ij}	Description of Definition	Example
Memorize A_{11}	It refers to the memorization and recall of basic knowledge such as mathematical concepts, formulas, theorems, and rules.	1. 说出图中的锐角三角形、直角三角形和钝角三角形. *Ví dụ 4* Sử dụng kết quả của *Ví dụ 2*, tính các tỉ số lượng giác của góc 60°.
Comprehension A_{12}	It refers to a deep understanding and grasp of learned mathematical theories, formulas, methods, and other knowledge, enabling one to clarify their connotations and the logical relationships among them.	（2）若∠A=40°,∠C=60°,求∠ABC 的度数. 4. Bộ ba số đo độ dài nào trong mỗi trường hợp sau không thể là độ dài ba cạnh của một tam giác? a) 8 cm, 5 cm, 3 cm; b) 8 cm, 5 cm, 4 cm; c) 8 cm, 5 cm, 2 cm.
Exploration A_{13}	It refers to innovative thinking and expansion on learned mathematical knowledge, exploring the essence and patterns of mathematical problems, and achieving creative application of mathematical knowledge.	3. 如果两个三角形有两边和一个角对应相等,那么这样的两个三角形一定全等吗? 请说明理由. *Ví dụ 1* Trong các đoạn thẳng *MN*, *MQ*, *NP* ở *Hình 30*, đoạn thẳng nào là đường trung bình của tam giác *ABC*? Vì sao?  *Hình 30*

No Background A_{21}	Without any practical background	2. 已知:如图,$\angle ACD=2\angle B$,CE 平分 $\angle ACD$. 求证:$CE \parallel AB$. **2.** Cho biết $\Delta PQR = \Delta IHK$, $\widehat{P} = 71^o$, $\widehat{Q} = 49^o$. Tính số đo góc K của tam giác IHK.
Personal Life A_{22}	A background that is closely related to students' personal life experiences.	4. 小聪和他的同学利用影长测量旗杆高度(如图),当 1 m 长的直立竹竿的影长为 1.5 m 时,测量旗杆落在地上的影长为 21 m,落在墙上的影长为 2 m. 求旗杆的高度.  (第 4 题) **3.** Trong công việc, người ta cần ước lượng khoảng cách từ vị trí O đến khu đất có dạng hình thang $MNPQ$ nhưng không thể đo được trực tiếp, khoảng cách đó được tính bằng khoảng cách từ O đến đường thẳng MN. Người ta chọn vị trí A ở đáy MN và đo được $OA = 18$ m, $\widehat{OAN} = 44^o$ (*Hình 37*). Tính khoảng cách từ vị trí O đến khu đất (làm tròn kết quả đến hàng phần mười của mét).  *Hình 37*
Public Knowledge A_{23}	It refers to a background that students have little exposure to and involves widely recognized common social knowledge.	如图为步枪在瞄准时的示意图,从眼睛到准星的距离 OE 为 80 cm,步枪上的准星宽度 AB 为 2 mm,目标的正面宽度 CD 为 50 cm. 求眼睛到目标的距离 OF.  **3.** Theo *https://vietnamnet.vn* ngày 01/10/2020, sóng 4G có thể phủ đến bán kính 100 km. Người ta đặt một trạm phát sóng 4G tại vị trí A. Có một đảo nhỏ (tại vị trí B) chưa biết khoảng cách đến vị trí A nhưng lại biết khoảng cách từ đảo đó đến một khách sạn (tại vị trí C) là 75 km và khách sạn đó cách vị trí A là 20 km (*Hình 23*). Sóng 4G của trạm phát sóng tại vị trí A có thể phủ đến đảo đó được không? Vì sao?  *Hình 23*

Scientific Background A_{24}	Using a scientific scenario as the background, which involves certain scientific knowledge.	1. 凸透镜成像的原理如图所示，$AD \parallel l \parallel BC$. 若人到焦点的距离与焦点到凸透镜的中心线 DB 的距离之比为 5:4，则人被缩小到原来的几分之几？  *Ví dụ 9* Treo quả cầu kim loại nhỏ vào giá thí nghiệm bằng sợi dây mảnh nhẹ không dãn. Khi quả cầu đứng yên tại vị trí cân bằng, dây treo có phương thẳng đứng. Kéo quả cầu khỏi vị trí cân bằng một đoạn nhỏ rồi buông ra thì quả cầu sẽ chuyển động qua lại quanh vị trí cân bằng. Khi kéo quả cầu khỏi vị trí cân bằng, giả sử tâm A của quả cầu cách B một khoảng $AB = 60$ cm và cách vị trí cân bằng một khoảng $AH = 20$ cm (*Hình 9*). Tính số đo góc α tạo bởi sợi dây BA và vị trí cân bằng (làm tròn kết quả đến hàng đơn vị của độ). 
No Computation A_{31}	Can be answered directly and without involving any calculation process.	（1）说出图中所有的三角形，以及每一个三角形的三条边和三个内角. *Ví dụ 2* Cho tam giác ABC có $\widehat{B} = 75^o$, $\widehat{C} = 42^o$. So sánh AB và AC.
Numerical Computations A_{32}	It does not involve any arithmetic computations containing alphabetic symbols.	1. 分别计算下列比例式的两个内项的积与两个外项的积. （1）$\frac{0.3}{2} = \frac{0.6}{4}$.　　（2）$\frac{\sqrt{2}}{\sqrt{6}} = \frac{1}{\sqrt{3}}$. *Ví dụ 6* Sử dụng bảng tỉ số lượng giác của các góc nhọn đặc biệt, tính giá trị của mỗi biểu thức sau: a) $\sin^2 45^o + \cos^2 45^o$; b) $\tan 30^o \cdot \cot 30^o$.
Simple Symbol Computation A_{33}	Involves algebraic computations with 1 to 2 steps containing alphabetic symbols.	2. 已知$\frac{a}{b} = \frac{3}{4}$，求$\frac{a+b}{b}$的值. *Ví dụ 3* Cho tam giác ABC vuông cân tại A có $AB = a$ (*Hình 6*). a) Tính độ dài các cạnh AC, BC và số đo góc B. b) Tính các tỉ số lượng giác của góc 45^o.

		 Hình 6
Complex Symbol Computation A_{34}	It refers to algebraic computations with more than 2 steps involving alphabetic symbols, or the flexible application of formulas.	6. 已知在△ABC中，$AB=5$ cm，$AC=4$ cm，AB和AC的夹角为α. 设△ABC的面积为S(cm^2). （1）若α为锐角，求S关于α的函数表达式. 若α为钝角呢? （2）何时△ABC的面积最大? 最大面积为多少? 7. Cho góc nhọn α. Biết rằng, tam giác ABC vuông tại A sao cho $\widehat{B} = \alpha$. a) Biểu diễn các tỉ số lượng giác của góc nhọn α theo AB, BC, CA. b) Chứng minh: $\sin^2\alpha + \cos^2\alpha = 1$; $\tan\alpha = \frac{\sin\alpha}{\cos\alpha}$; $\cot\alpha = \frac{\cos\alpha}{\sin\alpha}$; $\tan\alpha \cdot \cot\alpha = 1$. Từ đó, tính giá trị biểu thức: $S = \sin^2 35^\circ + \cos^2 35^\circ$; $T = \tan 61^\circ \cdot \cot 61^\circ$.
No Reasoning A_{41}	Pure numerical or symbolic computations that do not require logical reasoning to draw conclusions.	**1.** 计算： （1）$\cos 30^\circ \cdot \sin 60^\circ$. （2）$\sin^2 45^\circ - 2\sin 45^\circ \cdot \cos 60^\circ$. （3）$\sin^2 30^\circ + \cos^2 30^\circ$. *Ví dụ 1* Cho hình thoi $ABCD$ có hai đường chéo cắt nhau tại điểm O (*Hình 4*). a) Tỉ số $\frac{OB}{AB}$ là sin của góc nhọn nào? Tỉ số $\frac{OB}{BC}$ là côsin của góc nhọn nào? b) Viết tỉ số lượng giác của mỗi góc nhọn sau: tan $\widehat{OCD}$, cot $\widehat{OAD}$.  Hình 4
Simple Reasoning A_{42}	Mathematical problems involving 1 to 2 steps of reasoning.	 （第 1 题） A 1. 如图，AD，CE分别是△ABC的中线和角平分线，则： BD=_____=$\frac{1}{2}$_____； $\angle ACE$=_____=$\frac{1}{2}$_____. **3.** Cho $\Delta ABC = \Delta MNP$ và $\widehat{A} + \widehat{N} = 125^\circ$. Tính số đo góc P.
Complex Reasoning A_{43}	Mathematical problems involving more than 2 steps of reasoning.	7. 如图，一根 3 m 长的竹竿AB斜靠在墙上，当端点A离地面的高度AC长为 1 m 时，竹竿AB的倾斜角α的正切 tanα的值是多少?当端点A位于A'，离地面的高度$A'C$为 2m 时，倾斜角α'的正切 tanα'的值是多少? tanα的值可以大于 100 吗?  （第 7 题） 6. Tính độ dài đường gấp khúc $ABCDEGH$, biết các tam giác OAB, OBC, OCD, ODE, OEG, OGH là các tam giác vuông tại các đỉnh lần lượt là B, C, D, E, G, H; các góc O_1, O_2, O_3, O_4, O_5, O_6 đều bằng 30° và OA = 2 cm (*Hình 25*).  Hình 25

A Knowledge Point A_{51}	Involves only one knowledge point.	2. 由下列长度的三条线段能组成三角形吗？请说明理由. （1）1 cm，2 cm，3.5 cm. （2）4 cm，5 cm，9 cm. （3）6 cm，8 cm，13 cm. *Ví dụ 1* Cho tam giác ABC có $AB = 5$ cm, $BC = 7$ cm. So sánh hai góc A và C.
Two Knowledge Points A_{52}	Involves two knowledge points.	3. 在Rt△ABC 中，$\angle C=90°$，$AC=5$ cm，$BC=2\sqrt{6}$ cm. 求$\angle A$，$\angle B$ 的正弦、余弦和正切的值. 3. Trong *Hình 11*, MN // BC. Tính số đo góc C.  *Hình 11*
Two Knowledge Points And Above A_{53}	Involves more than two knowledge points.	4. 已知：如图，在⊙O 中，弦 AB 与弦 CD 交于点 P. （1）求证：△ADP ∽ △CBP. （2）判断 $AP \cdot BP = DP \cdot CP$ 是否成立，并给出证明.  （第 4 题） *Ví dụ 5* Cho tam giác ABC có hai đường trung tuyến BM và CN cắt nhau tại trọng tâm G. Gọi P và Q lần lượt là trung điểm của GB và GC. Chứng minh: a) $\Delta GMN = \Delta GPQ$; b) MN // PQ.  *Hình 106*

3 Research process and analysis

3.1 Research process

According to the definition inTable 2, we selected 359 and 226 triangle exercises from the Chinese and Vietnamese textbooks, and calculated the number of exercises at each level of the difficulty factor, the proportion, the score, and the weighted average. The results are shown in Table 3.

Table 3 Comparison of Difficulty Factors in Textbook Exercises Between China and Vietnam

Level	Zhejiang Edition	Kite Edition

Hierarchy with Different Difficulty Factors A_{ij}	The number of exercises n_{ij}/questions	Proportion /%	d_{ij}/score	weighted average d_i	The number of exercises n_{ij}/questions	Proportion/ %	d_{ij}/score	weighted average d_i
A_{11}	25	6.96	1	2.05	21	9.29	1	2.00
A_{12}	290	80.78	2		185	81.86	2	
A_{13}	44	12.26	3		20	8.85	3	
A_{21}	295	82.17	1	1.26	182	80.53	1	1.26
A_{22}	41	11.42	2		34	15.04	2	
A_{23}	18	5.01	3		6	2.65	3	
A_{24}	5	1.39	4		4	1.77	4	
A_{31}	146	40.67	1	1.93	91	40.27	1	1.81
A_{32}	110	30.64	2		94	41.59	2	
A_{33}	84	23.40	3		35	15.49	3	
A_{34}	19	5.29	4		6	2.65	4	
A_{41}	50	13.93	1	2.00	22	9.73	1	2.09
A_{42}	259	72.14	2		161	71.24	2	
A_{43}	50	13.93	3		43	19.03	3	
A_{51}	255	71.03	1	1.36	138	61.06	1	1.47
A_{52}	80	22.28	2		69	30.53	2	
A_{53}	24	6.69	3		19	8.41	3	

From Table 3, it can be seen that the exercise difficulty of the two editions of the textbook performs well in explore and reasoning factors, and the Zhejiang Edition scores slightly higher in explore and computation, while the Kite Edition scores slightly higher in reasoning and knowledge content factors, but the overall difference is not significant.

3.2 Analysis of various difficulty factors

In order to further explore the differences between different difficulty factors, next we will draw the line chart and the radar chart of weighted average of each level under each difficulty factor, and at the same timeanalyze the characteristics of the two textbooks in terms of exercise difficulty.

(1) Explore Factors

Explore factors mainly reflects the cognitive requirements of exploration and innovation, which can be divided into three levels: memorization, comprehension and exploration.According to statistics, in the triangle content of Zhejiang Edition and Kite Edition, the proportion of exercises that belong to the “memorization” level is 6.96 % and 9.29 %respectively ; the proportion of exercises that belong to the “comprehension” level is 80.78 % and 81.86 % respectively ; the proportion of exercises belonging to the level of “exploration” is 12.26 % and 8.85 % respectively, as shown in Figure 1.

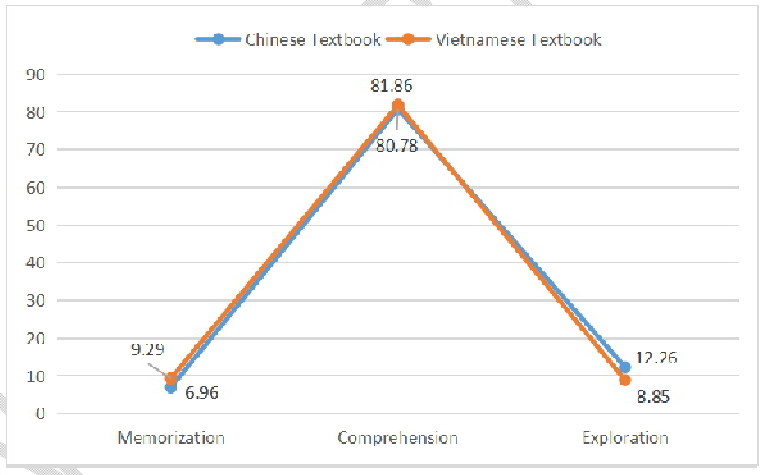


Figure 1 Comparison of Chinese and Vietnamese Exercises on Explore Factors

From Figure 1, it can be seen thatthe proportion of the two textbooks in the three levels of explore factors is relatively similar, and they both focus on the level of “comprehension”, while there are fewer exercises on the level of “memorization” and “exploration”.Although comprehension is a key part of the student learning process, it is also necessary to notethe increasing importance of creative thinking and practical skills in teaching and learning mathematics today.

(2) Background Factors

Background factors mainly reflect the degree of application of mathematical knowledge in different situations, which can be divided into four levels: no background, personal life, public

knowledge and scientific background.According to statistics, in the triangle content of Zhejiang Edition and Kite Edition, the proportion of exercises belonging to “no background” is 82.17% and 80.53% respectively. The exercises related to “personal life” accounted for 11.42% and 15.04% respectively. The exercises related to “public knowledge” accounted for 5.01% and 2.65% respectively. The proportion of exercises belonging to “sciencebackground” is 1.39% and 1.77% respectively, as shown in Figure 2.

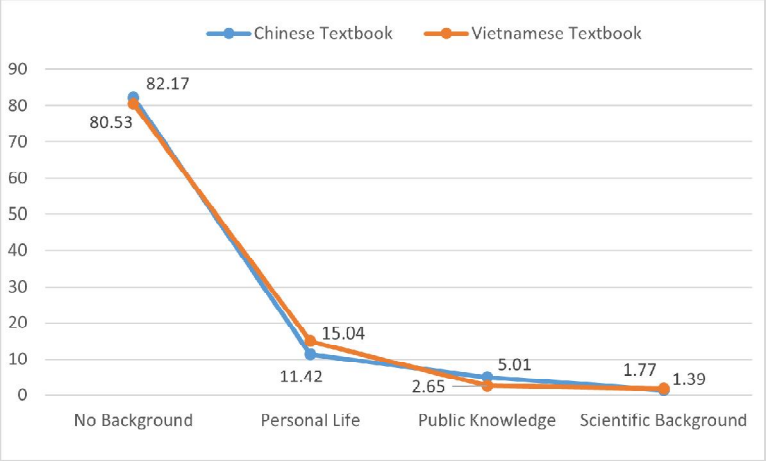


Figure 2 Comparison of Chinese and Vietnamese Exercises on Background Factors

From Figure 2, it can be seen that the proportion of the four levels of distribution of background factors in both editions of the textbook is relatively similar, and both of them show a gradual decreasing trend from low level to high level.In the textbooks of the two countries, more than 80% of the exercises are without background, and fewer involve personal life, public knowledge and scientific background.The Zhejiang Edition is slightly higher than the Kite Edition in the proportion of no background and publicknowledge exercises, while it is slightly lower in personal life and scientific background, but it is generally conservative.

(3) Computational Factors

Computation is a bridge between theoretical knowledge and practical application, and is one of the essential basic skills in mathematics learning. The computational factors of the exercises can be divided into four levels: no computation, numerical computations, simple symbol computation and complex symbol computation.According to statistics, in the triangle content of Zhejiang Edition and Kite Edition, the proportion of exercises that “no computation” is 40.67% and 40.27% respectively. The number of exercises belonging to “numerical computations” accounted for 30.67% and 41.59% respectively. The number of exercises belonging to “simple symbol computation” is 23.40% and 15.49% respectively. The proportion of exercises belonging to “complex symbol computation”is 5.29% and 2.65% respectively, as shown in Figure 3.

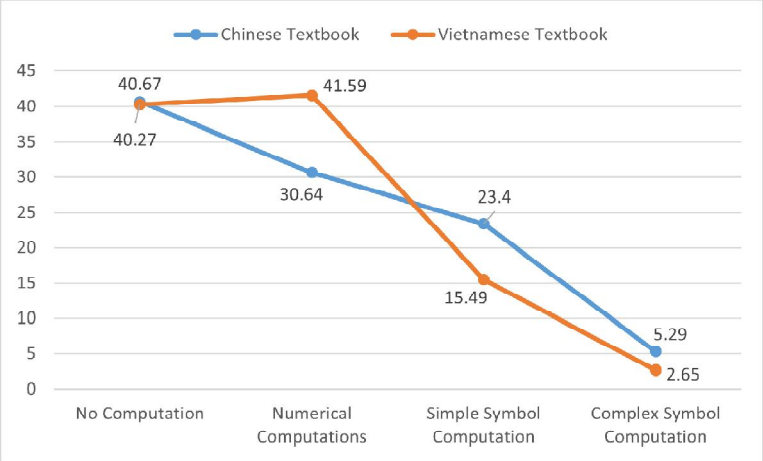


Figure 3 Comparison of Chinese and Vietnamese Exercises on Computational Factors

From Figure 3, It can be seen thatthe distribution of arithmetic factors in the exercises of triangle in the two editions of the textbook has its own characteristics. In the “no computation”, the two editions of exercises account for nearly 40 %, showing the importance of direct understanding of theoretical knowledge.Zhejiang Edition is more evenly distributed in “numerical computation” and “simple symbol computation”, while Kite Edition focuses on “numerical computation”.Zhejiang Edition is more organized at these two levels. Both of them account for a low proportion of “complex symbol computation”, indicating that the cultivation of advanced computing skills is insufficient.

(4) Reasoning Factors

Reasoning is an important way to promote students' understanding, exercise their thinking and solve practical problems, and the reasoning factors of the exercises can be categorized into three levels: no reasoning, simple reasoning and complex reasoning. Statistically, in the content of triangle in the Zhejiang Edition and the Kite Edition textbooks, the proportion of exercises “no reasoning” is 13.93% and 9.73% respectively; the proportion of exercises belonging to “simple reasoning” is 72.14% and 71.24% respectively; The proportion of exercises belonging to “complex reasoning” is 13.93% and 19.03%, respectively, as shown in Figure 4.

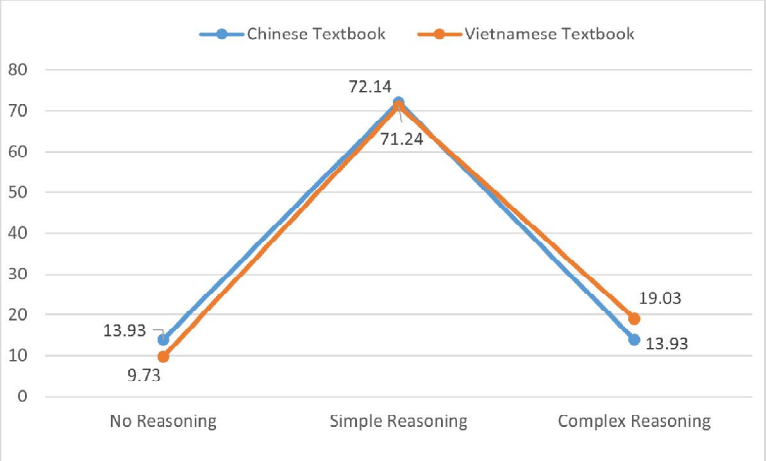


Figure 4 Comparison of Chinese and Vietnamese Exercises on Reasoning Factors

From Figure 4, it can be seen that there is little difference in the distribution of reasoning factors between the two editions of the textbook. The two editions of the textbook focus on the training of basic reasoning ability in the setting of reasoning factors in the content of triangle, while the requirement of complex reasoning is relatively low.

(5) Knowledge Content Factors

The content of knowledge points refers to the degree of comprehensive knowledge points in a single topic, which is divided into three levels according to the number of one knowledge point, two knowledge points and two knowledge points and above. Statistically, in the “triangle” content of the Zhejiang Edition and the Kite Edition textbooks, the exercises involving only one knowledge point accounted for 71.03% and 61.06% respectively; the exercises containing “two knowledge points” accounted for 22.28% and 30.53% respectively; and the exercises containing “two knowledge points and above” accounted for 6.69% and 8.41% respectively, as shown in Figure 5.

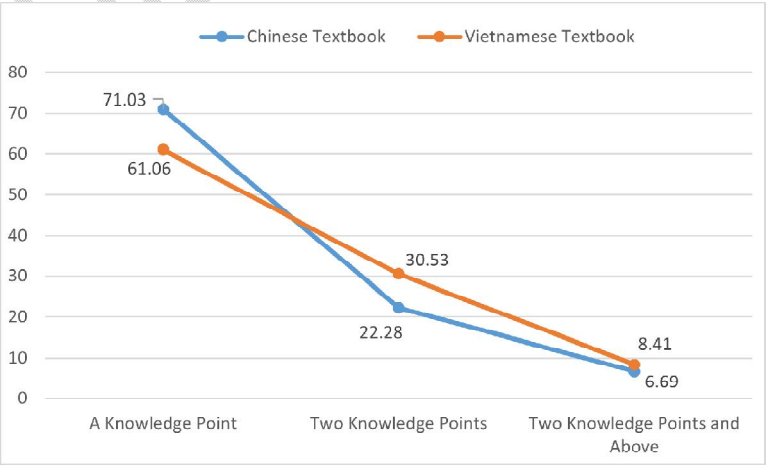


Figure 5 Comparison of Chinese and Vietnamese Exercises on Knowledge Content Factors

From Figure 4, it can be seen that the two editions of the textbook “Triangle” content in the

distribution of knowledge content of the exercises have their own characteristics. Both editions of the textbook emphasize the basics, the proportion of exercises decreases with the increase of knowledge points, and the proportion of exercises containing two or more knowledge points is low, reflecting their efforts in improving the difficulty and integrating the knowledge points. However, the percentage of exercises containing two or more knowledge points is slightly lower in the Zhejiang edition than in the Kite Edition, indicating that the Kite edition pays more attention to the comprehensive application of knowledge.

3.3 Analysis of comprehensive difficulty

According to the data in Table 3, the radar chart of the combined difficulty of the exercises of “Triangle” in the textbooks of the Zhejiang Edition and the Kite Edition is shown in Figure 6.

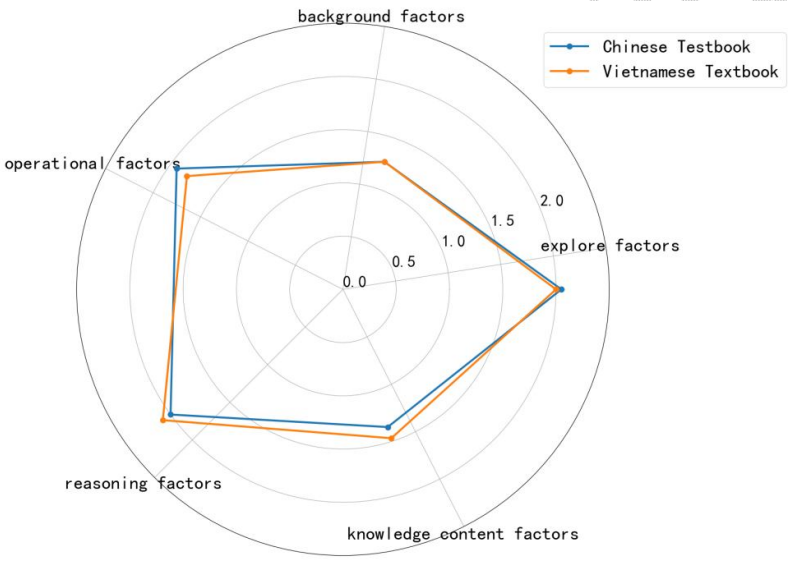


Figure 6 Comparison of Comprehensive Difficulty of Textbook Exercises

As can be seen from Figure 6, the two editions of the textbook are basically the same in terms of background factors, indicating that there is not much difference in the actual contextualization of the topics. The Zhejiang Edition is slightly higher in the explore factors and computational factors, focusing on cultivating students' ability of abstraction, reasoning, intuitive imagination, etc., which coincides with the cultivation objectives of the “four bases” (basic knowledge, basic skills, basic ideas and basic activity experience) and core literacy emphasized in the new curriculum[7]; the Kite Edition is slightly stronger in reasoning factors and knowledge content factors, which reflecting its efforts in developing students' logical reasoning ability.

4 Conclusion and Revelation

4.1 Conclusion

To sum up, the following conclusions can be obtained.

In terms of overall difficulty, the difference in the difficulty of exercises between the Zhejiang Edition and the Kite Edition of the textbook is not significant. In terms of the five difficulty factors, both editions of the junior high school mathematics textbooks have relatively high levels of inquiry and reasoning factors, followed by arithmetic and knowledge content factors, and finally background factors.

In terms of the specific levels of each difficulty factor, the two editions of the textbook have a high degree of consistency, with the lowest levels dominating the two factors of inquiry background and knowledge content, and the levels of “understanding” and “simple reasoning” dominating the inquiry and reasoning factors, respectively, and the level of “understanding” and “simple reasoning” dominating the arithmetic factor of the Zhejiang edition. In the arithmetic factor, the Zhejiang Edition favors “symbolic arithmetic”, while the Kite Edition favors “numerical arithmetic”.

4.2 Revelation

The findings of this study can provide valuable references for us in the compilation and use of examples and exercises in mathematics textbooks.

Core literacy is the keyword of curriculum reform[8], and the new curriculum standard emphasizes the cultivation of core literacy, which requires us to focus not only on logical reasoning and arithmetic skills, but also to strengthen the ability of practical application and problem solving in teaching. Therefore, the design of exercises in textbooks should integrate the core literacy and the innovation of educational concepts, equalize the distribution of the difficulty of exercises, and pay attention to the connection between the contextual design and the knowledge points, in order to promote the comprehensive development of students' core literacy in mathematics. At the same time, Chinese textbooks can learn from the advantages of Vietnamese textbooks in reasoning factors, optimize the exercise system, enhance students' comprehensive application ability and ability to solve practical problems, and better adapt to the needs of mathematics education in the new era.

References

[1] Ministry of Education of the People's Republic of China. Mathematics Curriculum Standards for compulsory Education (2022-year Edition) [M]. Beijing: Beijing Normal University Publishing Group; 2022.

[2] NOHAR A D, GOLDSTEIN A A. A comparison of the national assessment of educational progress (NAEP), the third international mathematics and science study repeat (TIMSS-R), and the

program for international student assessment (PISA) [R]. US Department of Education, National Center for Education Statistics (NCES). 2001;97−110.

[3] Bao Jiansheng, A Comparison of the Comprehensive Difficulty of Mathematics Expectation Curriculum in Chinese and English Junior High Schools[J]. Global Education, 2002,31(9):48-52.

[4] Wang Jianpan, Bao Jiansheng. An international comparison of the synthesized difficulty of example problems in high school mathematics textbooks[J]. Global Education, 2014,43(8):101-110.

[5] Qin Lin. “A comparative study of the difficulty of statistics exercises in high school mathematics textbooks from mainland China, Japan and Taiwan[J]. Journal of Mathematics Education, 2019,28(01):55-60.

[6] Zhang Li, Yi Xiaomei. Difficulty analysis of “fractions” exercises in elementary school mathematics textbooks since the new century--an example of three sets of Renjiao edition[J]. Journal of Mathematics Education, 2023,32(01):47-54.

[7] Cao Yiming,Liu Bing. Mathematics curriculum standard (2022 edition):Starting a new journey of mathematics curriculum reform[J]. School Administration, 2022,(06):20-23.

[8] Liu Zuhi. Nurturing people as the foundation and literacy as the soul--Interpretation of the changes in the Compulsory Education Mathematics Curriculum Standards (2022 Edition)[J]. Journal of Mathematics, 2023,62(01):1-4.

[9] Van Den Ham AK, Heinze A. Does the textbook matter? Longitudinal effects of textbook choice on primary school students’ achievement in mathematics. Studies in Educational Evaluation. 2018 Dec 1;59:133-40.

[10] Jäder J, Lithner J, Sidenvall J. Mathematical problem solving in textbooks from twelve countries. International Journal of Mathematical Education in Science and Technology. 2020 Oct 2;51(7):1120-36.

[11] Van Den Ham AK, Heinze A. Does the textbook matter? Longitudinal effects of textbook choice on primary school students’ achievement in mathematics. Studies in Educational Evaluation. 2018 Dec 1;59:133-40.

[12] Li L-M, Yang Z. Research on the Reasons for Incomplete Learning of Mathematics Textbooks by Undergraduate Mathematics Students. Asian J. Educ. Soc. Stud. 2023 Apr. 13;42(3):24-31.

[13] Chen Z, Zhang Z, Ji Z, Kang Q, Jia S. A Comparative Study on the Exercises of "Linear Equation with One Unknown" in the Middle School Mathematics Textbooks between China and the United States Based on Core Literacy. J. Adv. Math. Com. Sci. 2023 Nov. 22;38(11):1-17.

[14] Usmanova OS. National curriculum and new generation mathematics textbook. Asian Journal of Multidimensional Research. 2022;11(2):11-6.

[15] Johar R, Yusniarti S. The Analysis of Proportional Reasoning Problem in the Indonesian Mathematics Textbook for the Junior High School. Journal on Mathematics Education. 2018 Jan;9(1):55-68.