A Comparative Study on Unit Review Design in Three Editions of Primary School Mathematics Textbooks: Taking "Understanding and Addition & Subtraction of 6–10" as an Example

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Abstract: Unit review is an important part of structured knowledge integration. This study focuses on the units related to "Understanding and Addition & Subtraction of 6–10" in the first-grade (Volume 1) textbooks of the PEP, BNUP, and JEP editions. A three-dimensional framework of "Knowledge Construction – Application and Transfer – Reflection and Development" was constructed, and content analysis was used to compare the unit review designs of the three textbook editions. The results show that: (1) In terms of knowledge construction: the PEP edition emphasizes collaboration and diagrams; the JEP edition focuses on structured expression; the BNUP edition uses a "Question Bank" to drive recall. (2) In terms of application and transfer: the number of exercise tasks varies greatly (JEP: 98 > BNUP: 54 > PEP: 30). Regarding presentation format, the BNUP edition uses meaningful illustrations for all exercises, while the PEP edition has no illustration in 73.3% of its exercises. All three editions mainly use closed-ended questions, but the PEP edition has the highest proportion of semi-open-ended questions (20%). (3) In terms of reflection and development: the PEP and JEP editions form a complete review loop, while the BNUP edition does not have an independent reflection column. The study reveals that the three textbook editions embody three different design orientations: "concise instruction with targeted practice", "application-driven", and "question-led". It is suggested that teachers integrate multiple construction paths, optimize the levels of exercises, and establish formative evaluation mechanisms.

Keywords: Primary school mathematics; textbook comparison; unit review design; content analysis

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1.Introduction

Number and Algebra is a core domain of mathematics learning in compulsory education. The unit "Understanding and Addition & Subtraction of 6–10" continues the organizational structure of the unit "Understanding and Addition & Subtraction of Numbers within 5". It also lays the foundation for later units such as "Understanding 11–20" and "Addition with Carrying within 20". Thus, it serves as a crucial step for subsequent number recognition and computation[1]. Mastery and application of this unit help cultivate students' number sense, symbol awareness, computational ability, as well as preliminary reasoning and problem-solving skills.

The Compulsory Education Mathematics Curriculum Standards (2022 Edition) (hereinafter referred to as the "New Curriculum Standards") emphasizes the structured integration of course content to develop core competencies[2]. Unit review is a key link in achieving this integration. Its design quality directly affects the development of students' number sense and computational ability. However, in current frontline teaching, unit review is often reduced to mechanical practice or a simple listing of knowledge points[3]. This fails to fully realize its value in knowledge integration and ability enhancement. Given this, this study selects three textbook series — the People's Education Press (PEP) edition, the Beijing Normal University Press (BNUP) edition, and the Jiangsu Education Press (JEP) edition — and systematically compares the similarities and differences in their unit review designs for "Understanding and Addition & Subtraction of 6–10". The goal is to reveal the design intentions and provide practical references for optimizing review instruction.

2.Research Content and Methods

2.1 Textbook Selection

This study selects the latest first-grade (Volume 1) mathematics textbooks from the PEP, BNUP, and JEP

editions, all revised according to the New Curriculum Standards. These three textbook series are widely used, have high reference value, and reflect different compilation philosophies and regional characteristics.

2.2 Research Content

To compare the similarities and differences in unit review designs among the three textbook editions, this study constructs a three-dimensional analytical framework: "Knowledge Construction", "Application and Transfer", and "Reflection and Development". The material analysis was determined in two steps. First, identify the analysis units. From the first-grade (Volume 1) textbooks of the three editions, select the teaching units related to "Understanding and Addition & Subtraction of 6–10" (Note: For the BNUP edition, only the exercises related to understanding 6–10 in the "Numbers in Daily Life" unit are analyzed). Second, extract the analysis materials. From the unit review sections of the above units, take the parts that fit the analytical framework as the final analysis sample.

2.3 Research Method

This study compares the three textbook editions across 12 specific dimensions under the above three-dimensional framework. The detailed coding instructions for each dimension are shown in Table 1[4].

Table 1: Coding dimensions for unit review design in three editions of primary school mathematics textbooks

Dimension	Coding Item	Description
Knowledge Construction	Review methods	Question guidance, cue activation, problem solving
	Forms of output	Knowledge diagram, equation form, question form
	Forms of activity organization	Individual activity, group collaboration
Application and Transfer	Hierarchical design	With hierarchy, without hierarchy
	Content assessed	Understanding numbers, number operations
	Presentation format	Meaningful illustrations (concrete objects, abstract objects, both, neither), decorative illustrations, no illustration
	Question structure	Closed-ended questions, semi-open-ended questions, open-ended questions
	Response methods	Symbolic, non-symbolic, oral, hands-on operation
Reflection and Development	Evaluation methods	Chart form, combination of text and images
	Content focus	Knowledge mastery, skill application, ways of thinking, learning attitude
	Writing style	Sentence tone, expressive function, structural density

3.Results Analysis

3.1 Column Design

The unit reviews of the three textbook editions can all be classified into three dimensions: "Knowledge Construction", "Application and Transfer", and "Reflection and Development". In the PEP and JEP editions, the unit "Understanding and Addition & Subtraction of 6–9" fully covers all three components, while the BNUP edition has no separate reflection column. In the JEP edition, the unit "Understanding and Addition & Subtraction of 10" removes the "Review and Organization" section and adds an extended column titled "Do You Know?". Looking at the proportion of each dimension, the PEP edition has the highest proportion of Knowledge Construction, while the proportion of Application and Transfer exceeds 60% in both the BNUP and JEP editions.

3.2 Knowledge Construction

3.2.1 Review Methods

The PEP edition uses an open-ended question — "What knowledge have you learned in this unit?" — combined with multiple cues such as number lines and situational pictures to activate recall. The JEP edition uses restricted

questions — "What numbers have we learned? What calculations have we learned?" — to focus on core knowledge points, supplemented by example demonstrations. The BNUP edition relies on a "context-question" approach to drive recall, integrating knowledge review into daily life and mathematical contexts.

3.2.2 Forms of Output

The PEP edition presents a mixed structure of a knowledge diagram and a table of equations in random order. The JEP edition focuses on organizing equations in ascending order. The BNUP edition uses a "Question Bank" to construct an open-ended chain of questions.

3.2.3 Forms of Activity Organization

The PEP edition designs group collaboration to organize all addition and subtraction equations. The JEP edition adopts a peer-sharing mechanism. The BNUP edition has students complete the task independently.

3.3 Application and Transfer

This study coded a total of exercise tasks: 30 for the PEP edition, 54 for the BNUP edition, and 98 for the JEP edition. The number of tasks in the JEP edition is approximately 3.3 times that of the PEP edition and 1.8 times that of the BNUP edition.

3.3.1 Hierarchical Design

The exercises in the PEP and BNUP editions are both arranged in parallel with no explicit hierarchy. The JEP edition is divided into two levels: "Practice and Application" and "Exploration and Practice".

3.3.2 Content Assessed

In the PEP edition, the numbers of exercise tasks for "understanding numbers" and "number operations" are 12 and 18 respectively, accounting for 40% and 60% of the total. In the BNUP edition, the numbers are 15 and 37, accounting for 28.8% and 71.2% respectively. In the JEP edition, the numbers are 39 and 57, accounting for 40.6% and 59.4% respectively. In terms of the ratio between "understanding numbers" and "number operations", the PEP and JEP editions are similar, approximately 2:3. In contrast, the BNUP edition has "number operations" accounting for more than 70%.

In the "understanding numbers" part, the PEP edition focuses on "comparing quantities" and "overall understanding of 6–10". The BNUP edition covers all sub-topics. The JEP edition mainly focuses on "comparing quantities" and does not cover "understanding 7 and 9". In the "number operations" part, the PEP edition does not include "addition and subtraction of 6 and 7". The BNUP edition does not include "consecutive subtraction" or "mixed addition and subtraction". The JEP edition covers all operation types.

3.3.3 Presentation Format

The PEP edition only includes two forms: illustrations of concrete objects and no illustration. The JEP edition adds illustrations of abstract objects, increasing the presentation formats to three. The BNUP edition abandons the "no illustration" form and adopts four types of "meaningful illustrations", among which the numbers of "abstract objects", "concrete objects", and "neither of the two" are similar. None of the three textbook editions uses "decorative illustrations".

In the PEP edition, exercises with no illustration account for 73.3%. The BNUP edition uses meaningful illustrations for all exercises. In the JEP edition, exercises with no illustration account for 55.1%, while those with meaningful illustrations account for 44.9%. From the PEP edition to the JEP edition to the BNUP edition, the proportion of no illustration decreases successively, while the proportion of meaningful illustrations increases successively.

3.3.4 Question Structure

All three textbook editions primarily use closed-ended questions, with open-ended questions accounting for the

smallest proportion. The proportion of semi-open-ended questions in the PEP edition is 20%, which is significantly higher than that in the BNUP edition (11.1%) and the JEP edition (11.2%).

3.3.5 Response Methods

Single-type response methods serve as the common basis for all three textbook editions, supplemented by mixed-type response methods. Among single-type responses, "symbolic" responses dominate all three editions, but their proportions differ. The proportions in the PEP edition (73.3%) and the JEP edition (80.6%) are significantly higher than that in the BNUP edition (46.3%). In addition, the BNUP edition has the most diverse response methods. It is the only edition that includes "hands-on operation" tasks, while "oral" responses are found only in the BNUP and JEP editions. Among mixed-type response methods, "symbolic + oral" and "symbolic + non-symbolic" are the main forms. Other mixed types do not appear in any of the three textbook editions.

4.Results and Discussion

4.1 Column Design

The three textbook editions present different orientations toward the functions of review lessons in their column structures. The PEP and JEP editions both construct a complete closed loop of "Knowledge Construction – Application and Transfer – Reflection and Development" in the unit "Understanding and Addition & Subtraction of 6–9", treating review as a complete learning cycle. The BNUP edition does not have a separate reflection column, but it "problematizes" reflection within "My Questions", reflecting a constructivist tendency of "learning led by questions".

In the JEP edition, the unit "Understanding and Addition & Subtraction of 10" removes "Review and Organization", possibly because of the special nature of "10" as a counting unit, shifting the focus toward practice and cultural expansion. Through its distinctive columns such as "Exploration and Practice" and "Do You Know?", the JEP edition enriches the meaning of review lessons: the former creates explicit exercise stratification, providing space for exploration by students who have mastered the content; the latter introduces mathematical culture and knowledge extension, moving review beyond consolidation toward stimulating interest and broadening horizons.

4.2 Knowledge Construction

In the knowledge construction stage, the review methods, forms of output, and activity organization in the three textbook editions jointly shape different cognitive paths. The PEP edition adopts "open-ended questions + multiple cues + group collaboration", requiring students to collaboratively organize equations in random order. Through the collision of ideas and negotiated revision, students achieve deeper understanding and knowledge transfer. However, it should be noted that group activities for first-grade students require teachers to provide clear instructions to avoid becoming a mere formality. The JEP edition uses "restricted questions + ascending-order equations" to guide students in systematic review. The highly structured output reduces cognitive load and helps students quickly grasp the core system, but it may constrain divergent thinking. The BNUP edition relies entirely on a "context-question" approach, using the "Question Bank" as an open-ended vehicle, focusing on the awareness of discovering and posing problems. However, for young students, the lack of structural support may lead to unsystematic knowledge organization. These three models point respectively to collaborative exploration, systematic construction, and question generation. Teachers can flexibly choose among them based on students' learning conditions.

4.3 Application and Transfer

The three textbook editions differ greatly in the number of exercise tasks. This difference is not merely quantitative; it reflects two different paths: "high proficiency" versus "concise instruction with targeted practice". The nearly 100 tasks in the JEP edition reflect an expectation of "high input and high proficiency". However, under the "double reduction" policy, whether such a large number of tasks is appropriate is worth questioning. The "concise instruction with targeted practice" approach of the PEP edition needs to be evaluated for whether it is sufficient for

all students to achieve automaticity in basic skills. The "effectiveness" of practice is more important than its "quantity".

In terms of assessed content, the BNUP edition has a strong operation orientation, with operations accounting for 71.2%. The PEP and JEP editions maintain a balanced ratio of approximately 2:3. In terms of knowledge coverage, the JEP edition is the most comprehensive, while the omissions of certain question types in the PEP and BNUP editions may be based on an overall consideration of their spiral curriculum system. This reflects different understandings by the compilers of the core competencies of this unit: the JEP edition pursues comprehensive coverage, while the PEP and BNUP editions have some selective emphasis, reserving space for subsequent learning.

In terms of presentation format, the three editions form a gradient from concrete to abstract. The BNUP edition uses meaningful illustrations for all exercises to support understanding. The PEP edition has no illustrations in 73.3% of its exercises, accelerating abstraction, but this may pose challenges for struggling students. The use of illustrations should follow a sequence from intuitive to abstract, gradually removing scaffolds.

In terms of question structure, the proportion of semi-open-ended questions in the PEP edition is 20%, higher than the other two editions. Such questions promote reasoning awareness and orderly thinking. In terms of response methods, the BNUP edition includes hands-on operation and oral responses, making it the most diverse, reflecting the idea of promoting concept internalization through multiple representations. The PEP and JEP editions focus more on symbolic, written expression. This suggests that review lessons should become a stage where students "do mathematics" and "talk about mathematics".

5.Suggestions

5.1 Strengthen holistic design to promote knowledge structuring

When designing unit reviews, teachers should follow the "large unit teaching" concept, transcend the limitations of single class periods, and treat review as a complete learning event. It is suggested that teachers design inquiry themes covering "knowledge organization – transfer and application – reflection and evaluation" around core concepts such as "the meaning of numbers and the consistency of operations". This guides students to integrate fragmented knowledge into a cognitive network through coherent experiences, achieving a leap from "knowing a point" to "understanding a category".

5.2 Enrich construction paths to deepen conceptual understanding

Knowledge construction should aim to form transferable cognitive frameworks. It is suggested that teachers comprehensively use multiple strategies such as question guidance and cue activation, and encourage students to use tools like mind maps for self-organization. Dynamic visualization techniques may be introduced when appropriate to transform abstract relationships into embodied experiences, supporting students in understanding calculation principles and number concepts through multiple senses.

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