

The Impact of Differentiated English Homework Design on Primary School Students' Academic Achievement: A Two-Cycle Action Research in the Context of the "Double Reduction" Policy

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Abstract: The "Double Reduction" policy mandates that compulsory education homework design achieve "burden reduction and quality improvement." However, the "one-size-fits-all" approach remains prevalent in primary school English homework, failing to accommodate individual student differences. This study adopted a two-cycle action research paradigm, involving two fourth-grade classes from Primary School C in City P (50 students in the experimental class, 52 in the control class). Employing a quasi-experimental design with longitudinal tracking (pre-test, mid-test, post-test) within the experimental class and cross-sectional comparisons between the experimental and control classes, the study quantitatively examined the effects of differentiated homework design on student academic achievement. The results showed that the experimental class's post-test average score significantly improved by 5.86 points compared to the pre-test ($t = 23.53, p < 0.001$), and the difference with the control class's post-test score was also statistically significant ($t = 2.58, p < 0.05$). This effect accumulated progressively over the practice period. Furthermore, students in the experimental class reported a 14% increase in homework enjoyment and a 12% decrease in perceived burden, while the control class experienced a 13.5% increase in perceived burden. The study concludes that the differentiated homework design, through its "implicit differentiation + independent choice" implementation strategy and "1+X" flexible framework, can effectively enhance students' academic performance and improve their attitudes towards homework, providing a reference for optimizing and empirically evaluating primary school English homework design under the "Double Reduction" policy.

Keywords: Double reduction policy; Primary school English; Differentiated homework; Action research; Academic achievement

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1. Introduction

Following the introduction of the "Double Reduction" policy in 2021, "burden reduction and quality improvement" has become the core direction of compulsory education homework reform, shifting the focus

of homework design from “quantity control” to “quality enhancement”^[1]. However, current primary school English homework commonly suffers from unclear objectives, rigid formats, and a failure to adequately address individual student differences^[2,3]. Optimizing homework design to improve student learning outcomes has become a pressing practical challenge for frontline teachers. Differentiated homework design, which caters to diverse learning needs, has garnered attention, yet its specific impact on student academic achievement lacks rigorous quantitative validation^[4,5]. This study employed a two-cycle action research paradigm, targeting fourth-grade students at Primary School C in City P. Utilizing a longitudinal design (pre-test, mid-test, post-test) within the experimental class and a cross-sectional comparison with a control class, it quantitatively measured the effects of differentiated homework on academic performance. Additionally, questionnaire surveys were used to examine changes in students’ attitudes towards homework, aiming to provide a reference for optimizing and empirically evaluating primary school English homework under the “Double Reduction” policy.

2. Case school selection and background

Primary School C in City P was selected as the in-depth case study school. It is a public compulsory education primary school established in 2021. The school’s English teaching and research group comprises 13 teachers, fostering a strong collaborative atmosphere with fixed weekly collective lesson planning and thematic seminars every Tuesday, providing a conducive environment for this research. This practical exploration focused on fourth-grade students, selecting Class 3 (Grade 4) as the experimental class with 50 students (27 boys, 23 girls). To more accurately assess the effectiveness of the differentiated homework intervention, Class 5 (Grade 4) from the same grade level was chosen as the control group. This class consisted of 52 students (28 boys, 24 girls), with a gender ratio largely comparable to the experimental class. Both classes shared identical core teaching conditions: they were taught by the same English teacher, Ms. Wang, used the same textbook (PEP People’s Education Press, Grade 4, Volume 1), and followed the same teaching schedule, lesson plans, and unit tests. The students’ baseline English proficiency levels showed no statistically significant difference (the control class’s average score on the final exam of the second semester of Grade 3 was 78.6, while the experimental class scored 79.8; $p > 0.05$), ensuring good experimental comparability. During the two action research cycles, the control class (Class 5) continued with the traditional “one-size-fits-all” homework model without any differentiated intervention, allowing for a clearer contrast to reveal the actual effects of differentiated homework. The research and exploration period spanned half a semester’s teaching content (approximately three months).

This study, in collaboration with the English teacher team at Primary School C, designed a “three-tier” homework system integrated with a “1+X” model, as detailed below:

- (1) Tier A (Foundation Consolidation): Designed for students with weaker foundational skills. Homework focuses on memorization and imitation of textbook knowledge, e.g., copying core vocabulary, reading and reciting dialogues, and completing simple sentence pattern substitution exercises. This constitutes the “1” part, ensuring the achievement of basic objectives.
- (2) Tier B (Application and Practice): Targeted at the majority of students with intermediate proficiency. Homework emphasizes using the language in context, e.g., creating a short dialogue based on a unit theme.
- (3) Tier C (Extension and Innovation): For advanced learners with strong interest and ability. Homework

emphasizes openness and creativity, e.g., creating an English poster or reading a simple English story and drawing a mind map. Parts of Tier B and C tasks serve as the “X,” allowing students to choose or challenge themselves under the teacher’s guidance.

Technology Application: Teachers attempted to use the “Classroom Optimizer” platform to assign differentiated homework. Students could upload their work in various formats, including audio, images, and video. The platform’s data analytics features also facilitated teachers’ tracking of completion rates. The control class (Class 5) did not use differentiated homework design nor the “Classroom Optimizer” platform for homework-related activities. They continued using traditional paper-based assignments with uniform copying and exercise tasks, graded uniformly by the teacher, establishing a single variable (homework implementation method) for comparison with the experimental class.

3. First cycle of action research

3.1. Planning phase

Before the first action research cycle, this study collected the students’ final exam scores from the second semester of Grade 3 as pre-test data and administered the first questionnaire survey to all 102 students to understand their attitudes towards English homework. The survey results are presented in **Tables 1 and 2**.

Table 1. Pre-test survey results on English homework attitudes in experimental class (Class 3, N = 50)

Survey Dimension	Number of Students (n)	Percentage (%)
Like doing English homework	21	42
Find homework interesting	14	28
Find homework burdensome	27	54
Willingly complete homework proactively	23	46
Perceive differentiated homework	25	50

Table 2. Pre-test survey results on English homework attitudes in control class (Class 5, N = 52)

Survey Dimension	Number of Students (n)	Percentage (%)
Like doing English homework	22	42.3
Find homework interesting	15	28.8
Find homework burdensome	29	55.8
Willingly complete homework proactively	24	46.2
Perceive differentiated homework	26	50.0

3.2. Initial student differentiation

Based on the final exam scores from the second semester of Grade 3, classroom performance, and teacher observations, the 50 students in Class 3 were initially divided into three tiers, as shown in **Table 3**.

Table 3. Initial student tiering in Class 3 (Grade 4)

Tier	Number of Students	Score Range	Student Characteristics	Homework Design Focus
A (Foundation)	18	Below 70	Weak vocabulary, difficulty with sentence patterns, slower completion speed	Word copying, sentence imitation, picture-word matching

Tier	Number of Students	Score Range	Student Characteristics	Homework Design Focus
B (Application)	20	70-85	Good vocabulary, can complete basic expressions, lacks comprehensive application skills.	Situational dialogues, cloze exercises, simple introductions
C (Extension)	12	Above 85	Solid foundation, fluent expression, willing to accept challenges	Creative writing, simple design, mini-projects

It is important to emphasize that these tiering results served only as a reference for the teacher's homework design and were not disclosed to students to avoid labeling effects.

3.3. First cycle differentiated homework design example

Using Unit 3, Part A, Let's Learn from the PEP Grade 4 Volume 1 textbook ("Places we live in") as an example, the specific differentiated homework design is presented below. The textbook content is shown in Figure 1.



Figure 1. PEP Grade 4 Unit 3 Part A Let's learn textbook content image.

This Unit includes the following core knowledge:

- (1) Core Vocabulary: park, hospital, shop, playground, bus stop, toilets
- (2) Core Sentence Pattern: There is a + place noun + prepositional phrase of place.

This study, based on the above knowledge, designed the differentiated homework as follows:

- (1) Tier A (Foundation Consolidation)

Topic: I Can Write Community Places

Tasks:

Task 1: Word Copying: Copy each word twice according to the format and write the Chinese meaning.

Table 4. Unit 3 Part A Let's Learn Basic Vocabulary Practice

Word	Copy	Chinese Meaning
park	_____	_____
hospital	_____	_____
shop	_____	_____
playground	_____	_____

Word	Copy	Chinese Meaning
bus stop	_____	_____
toilets	_____	_____

Task 2: Sentence Copying: Copy the sentences, paying attention to format.

There is a park near my home.

There is a hospital on the street.

Task 3: Picture-Word Matching: Write the corresponding English word based on the picture prompts.







(2) Tier B (Application and Practice)

Topic: I Can Use Community Places

Tasks (Choose one of two):

Task 1: Use “There is a...” to create 3 sentences based on the prompts.

(park + play) Example: There is a park. I can play there.

(shop + buy things) _____

(playground + play football) _____

(bus stop + wait for bus) _____

Task 2: Read and fill in the blanks with the correct place words.

Hello! I’m Mike. This is my community. There is a _____. I play football there. There is a _____. I buy ice cream there. There is a _____. My mother works there. I love my community!

(3) Tier C (Extension and Innovation)

Topic: I Can Create Community Places

Tasks (Choose one of two):

Task 1: Draw a community place you like (park, shop, or playground) and introduce it using 2-3 sentences.

Example: This is a park. There is a big slide. I play with my friends. I like the park!

My Work: _____

Task 2: If you could add a new place to your community, what would it be? Draw it and introduce it in 1-2 sentences.

Example: I want an ice cream shop. There is yummy ice cream. I like it!

My Design: _____

3.4. Action phase

From early October to mid-November 2025, this study implemented the differentiated homework according to plan. The specific implementation process was as follows:

- (1) Homework Assignment: After each English lesson, the teacher assigned the corresponding differentiated homework for that lesson on the spot. The homework was presented in three task formats: Foundation, Practice, and Challenge.
- (2) Homework Implementation: A combination of “implicit differentiation” and “independent choice” was adopted. The teacher internally tiered students based on their academic foundation and ability, without disclosing the tiers to avoid labeling effects. Students were guided to select a tier matching their level, and those showing progress were encouraged to challenge themselves with higher-tier tasks. Each student only needed to complete the assigned task for their chosen tier on that day, without stacking or increasing workload, effectively reducing academic burden.
- (3) Homework Evaluation: The teacher marked and provided feedback on each assignment. Excellent homework was selected weekly and displayed on the class bulletin board.
- (4) Process Recording: The researchers observed the class 2-3 times weekly, documenting homework completion and classroom feedback. They participated in the English teaching group’s Tuesday lesson planning meetings to discuss implementation progress with Ms. Wang. Weekly reflection logs were maintained to record design rationale, implementation issues, and improvement ideas. During the study, the control class (Class 5) was observed with the same frequency. Data on homework completion rates, error rates, and students’ oral English performance in class were recorded for comparative purposes. Differences in homework implementation and student feedback between the two classes were noted in the reflection logs.
- (5) Platform Usage: This cycle’s differentiated homework was assigned and submitted via the “Classroom Optimizer” platform. The teacher created separate tasks for Tiers A, B, and C on the platform. Students selected their tier and submitted their work: Tier A students could upload photos of copied words or audio of sentence reading; Tier B and C students could upload text of dialogues they created, or images/videos of their creative work. The platform automatically compiled completion rates and submission times for each tier, allowing the teacher to quickly grasp the completion status of students at different levels, significantly simplifying the management process.

3.5. Evaluation criteria

Differential evaluation criteria were used:

- (1) Tier A: An “Excellent” grade was awarded for careful completion with mostly correct answers.
- (2) Tier B: Encouragement was given for using newly learned vocabulary and sentence patterns.
- (3) Tier C: Special recognition was given for creative work. The primary evaluation method was teacher assessment.

3.6. Analysis of action results

Upon completion of the first action research cycle, this study randomly selected 2 students from each of the three tiers (A, B, C) in Class 3 for interviews. The mid-term exam scores (mid-test) for both classes were also

collected for comparison with the previous pre-test (final exam of Grade 3, Semester 2).

3.6.1. Student interview feedback

- (1) Tier A student Xiaoxuan: *“The homework is easier now, I can finish it all. But sometimes when I see others doing the challenge tasks, I want to try too, but I’m afraid I won’t do well.”*
- (2) Tier A student Xiaoya: *“Copying words is still a bit boring. Can we copy less?”*
- (3) Tier B student Xiaowen: *“I like the homework where we describe our classmates; we can write about real people in our class. But sometimes I can’t spell some words when writing sentences, and using the dictionary is a bit slow.”*
- (4) Tier B student Xiaohao: *“I finished the basic task and also tried the challenge task, but I don’t know if what I wrote is correct.”*
- (5) Tier C student Xiaorui: *“Making the introduction card was fun; I wrote about my best friend. But I think having only one challenge task per week is a bit too little.”*
- (6) Tier C student Xiaoxin: *“I want to write more, but I don’t know how to say some of the words.”*

3.6.2. Mid-term exam score analysis

The mid-term exam scores of the experimental class were compared with their previous final exam scores (Table 5).

Table 5. Comparison of experimental class pre-test and mid-test scores

Score Indicator	Pre-test (End of G3, S2)	Mid-test (Mid of G4, S1)	Change
Class Average Score	79.8	82.1	+2.3
Pass Rate	90%	92%	+2%
Excellence Rate (Above 90)	24%	28%	+4%
Low Score Rate (Below 60)	10%	8%	-2%

The data showed a slight, but not statistically significant, improvement in the class average score. Notably, students in Tier A showed more obvious progress, with 3 students improving from the 60s to above 70 points.

3.7 Reflection phase

3.7.1. Teacher reflection

The English teacher Ms. Wang wrote in her reflection log: *“After a month of trying, the biggest feeling is that differentiated homework does cater to students at different levels. The Tier A kids are more motivated to complete homework, and Tier C kids have space to be creative. However, there are also several issues. First, the tiering is mainly based on experience; I didn’t realize in time that some Tier A kids could actually attempt Tier B tasks. Second, the evaluation workload is too heavy; marking three sets of homework each time is quite draining. Third, Tier C kids want even more challenging tasks, but I’m not sure how to design them. Fourth, the wording ‘basic task’ and ‘challenge task’ isn’t guiding enough for Tier A students; they want to try but hesitate.”*

Ms. Wang also reflected on the control class: *“Class 5 still uses uniform homework. The advanced students often find it lacks challenge and are at a loss after finishing, while the struggling students still have difficulty completing assignments on time. The polarization in homework completion hasn’t improved significantly, contrasting sharply with the better fit observed in the experimental class.”*

3.7.2. Problems identified and directions for improvement

Based on observations, student interview feedback, and the teacher's reflection logs from the first cycle, the researchers and the teacher conducted an in-depth reflection on the practice, identifying key problems and proposing targeted improvements for the second cycle.

Key problems identified in the first cycle included:

- (1) Static Tiering: Primarily based on final exam scores, failing to adjust dynamically based on student development.
- (2) Lack of Appeal in Tier A: Reliance on copying was monotonous, with students reporting boredom.
- (3) Limited Tier C Tasks: Insufficient variety and lack of necessary vocabulary support hindered students' willingness to take on challenges.
- (4) Unclear Guidance: Wording like "basic task" and "challenge task" was not directive enough for Tier A students, causing hesitation.
- (5) High Teacher Evaluation Burden: Marking three tiers of homework daily was time-consuming, and students were unclear about the criteria.
- (6) Insufficient Support: Tier B and C students lacked resources (e.g., vocabulary help) when encountering new words.
- (7) Weak Parental Involvement: Parents were unfamiliar with differentiated homework, limiting home-school collaboration.

To solve the above problems, this study decides to make improvements for the second cycle:

- (1) Dynamic Tiering Adjustment: Re-tier students based on mid-term scores and first-cycle performance.
- (2) Enhance Tier A Appeal: Incorporate tasks like "word copying + illustration" to reduce monotony.
- (3) Enrich Tier C Tasks: Offer diverse choices like "Little Restaurant Recommender" or "Family Dinner Plan."
- (4) Strengthen Assignment Guidance: Clearly encourage Tier A students to try the simpler parts of challenge tasks.
- (5) Introduce Student Self-Assessment: Use star-rating charts to clarify criteria and promote metacognition.
- (6) Provide Targeted Support: Offer vocabulary cards and sentence templates for Tier B and C students.
- (7) Enhance Home-School Collaboration: Showcase excellent work via class groups and invite parent participation in collaborative tasks.

4. Second cycle of action research

4.1. Planning phase

Based on the reflections from the first cycle, this study systematically optimized the tiering scheme and homework design for the second cycle.

4.1.1. Dynamic tiering adjustment

Based on students' performance in the first cycle and their mid-term exam scores, adjustments were made (Table 6).

Table 6. Student tier adjustment for the second action research cycle

Adjustment Direction	Number of Students	Basis for Adjustment
A → B	4	Active performance, high-quality completion of basic tasks, significant mid-term improvement (>10 points)
B → C	2	Completed challenge tasks multiple times, strong expressive ability, excellent mid-term score (>90)
B → A	1	Unsatisfactory completion in the first cycle, mid-term score decline (dropped 8 points), needs foundation reinforcement
C → B	1	Difficulty completing challenge tasks, mid-term score below expectation (<85)

After adjustment, the tier sizes were: Tier A: 16, Tier B: 20, Tier C: 14. The adjustments were not publicly announced, serving only as internal guidance for the teacher. Students who moved up were given more guidance towards challenging tasks, while those who moved down received extra foundation support, with their self-esteem protected.

4.1.2. Second cycle differentiated homework design example

Using Unit 6, Part A, Let's Talk from PEP Grade 4 Volume 1 ("Changing for the seasons") as an example, the optimized design is shown below. The textbook content is shown in **Figure 2**.



Figure 2. PEP Grade 4 Unit 6 Part A Let's talk textbook content image.

(1) Tier A (Foundation Consolidation)

(a) Listen and Imitate: Listen to the textbook recording 3 times, repeat each sentence, focusing on the intonation of "Whose sweater is this?" and "It's cold and windy outside." Aim for clear pronunciation and natural pauses. A parent/group leader may sign off upon completion.

(b) Vocabulary Consolidation: Copy the words "sweater, socks, shirt, coat, cold, windy" twice each. Draw a simple picture next to each word (e.g., a sweater for 'sweater', a snowflake for 'cold') and write the Chinese meaning.

(c) Sentence Fill-in-the-Blanks (with vocabulary support):

Whose _____ (sweater/coat) is this? It's your _____ (dad's/mum's).

Whose _____ (socks/shorts) are these? They're _____ (mine/yours).

Can I wear this new _____ (shirt/dress)? Yes, but wear a _____ (coat/hat) too. It's _____ (cold/hot) and _____ (windy/sunny) outside.

(2) Tier B (Application and Practice)

(a) Cloze Dialogue: Complete the dialogue based on the prompts, using the core sentence patterns from this lesson:

A: Whose _____ is this?

B: It's _____.

A: Can I wear this _____?

B: Yes, but _____. It's _____ and _____ outside.

Prompts: coat, my sister's, skirt, wear a scarf, cool, rainy

(b) Role-play: Work in pairs. One plays the “child,” the other the “mom/dad.” Have a 1-minute fluent dialogue about “organizing the wardrobe + choosing clothes to go out.” Must include at least 2 “Whose...?” questions and 1 “Can I...?” question.

(c) Sentence Imitation: Write 2 dialogues, replacing clothing and weather vocabulary.

Example:

Whose dress is this? It's my aunt's.

Can I wear this T-shirt? Yes, but it's hot and sunny outside.

(3) Tier C (Extension and Innovation)

(a) Create a New Dialogue: Create a new context (e.g., “packing luggage for a trip,” “trying on clothes at the mall,” “borrowing clothes from a classmate”). Create a dialogue with at least 3 exchanges, comprehensively using “Whose...?” and “Can I...?” questions, and include at least 2 new weather words (e.g., rainy, sunny, cloudy).

(b) Contextual Expression: Write a short paragraph (3-4 sentences) describing “My outfit today,” explaining the weather-related reason for choosing those clothes.

Example:

Today is cold and windy. I wear my dad's sweater and my blue coat. I can't wear my new shirt, because it's too cold outside.

(c) Show and Share: Give a 1-minute oral presentation in your group, introducing your outfit and reasons. Speak fluently and clearly, and you may use body language to help.

4.1.3. Optimized evaluation

Clear and simple evaluation criteria were designed. Each assignment was accompanied by a self-assessment chart, helping students understand the standards for success (**Table 7**).

Table 7. Star-rating self-assessment criteria for differentiated homework

Tier	Evaluation Criteria	Self-Assessment Method
A	Correct copying (☆☆), Neat handwriting (☆), Careful illustration (☆), Complete sentences (☆)	Color in stars (1-5 stars)
B	Complete information (☆☆), Fluent sentences (☆), Appropriate vocabulary (☆), Creative (☆)	Color in stars (1-5 stars)
C	Rich content (☆☆), Accurate expression (☆), Attractive design (☆), Creative (☆)	Color in stars (1-5 stars)

4.2. Comparative analysis of experimental and control class scores

To more objectively assess the impact of differentiated homework, this study compared the three exam scores (pre, mid, post) of the experimental class (Class 3) and the control class (Class 5) (Table 8).

Table 8. Comparison of three exam scores between experimental and control classes

Test Time	Class	Average Score	Pass Rate	Excellence Rate (≥ 90)	Low Score Rate (< 60)
Pre-test (End of G3, S2)	Experimental (C3)	79.8	90%	24%	10%
	Control (C5)	78.6	90%	23%	10%
Mid-test (Mid of G4, S1)	Experimental (C3)	82.1	92%	28%	8%
	Control (C5)	79.6	90%	24%	10%
Post-test (End of G4, S1)	Experimental (C3)	85.7	96%	36%	4%
	Control (C5)	81.0	92%	26%	8%

The data indicated that the two classes had similar scores in the pre-test, with the experimental class slightly higher, but the difference was not statistically significant. After the first cycle, the experimental class's mid-term average was 2.5 points higher than the control class. After the second cycle, the experimental class's final average was 4.7 points higher than the control class, with a 10 percentage point higher excellence rate and a 4 percentage point lower low-score rate. This suggests that differentiated homework positively influenced student achievement, with the effect becoming more pronounced over time.

4.3. Qualitative analysis and quantitative verification of implementation effects

4.3.1. Qualitative analysis

Analysis of interview records and homework samples yielded the following findings:

- (1) Teacher Feedback: Ms. Wang noted, comparing the two classes: *“Class 5, still using the old uniform approach, showed more pronounced polarization over the semester. High achievers found homework boring, and struggling students continued to fall behind. Class 3 was different. With differentiation, every child found suitable homework, showing greater enthusiasm for learning, and we could see different students’ strengths.”* However, she also acknowledged that designing multi-tiered homework “takes a lot of time” and places higher demands on classroom management and assessment.
- (2) Student Feedback: A student who chose Tier C tasks said: *“Making the poster was much more interesting than copying. I looked up many new words.”* A Tier A student said: *“Now I can keep up with the homework, and I’m not afraid of getting criticized by the teacher.”*
- (3) Parent Feedback: Some parents expressed support, noting their children were more willing to do English homework. However, some worried that allowing students to choose might lead them to “be lazy” and only pick the easy options.
- (4) Homework Sample Analysis: Tier C assignments showcased rich creativity, though language accuracy could be improved; Tier B assignments effectively demonstrated language application; Tier A assignments showed marked improvement in handwriting and accuracy of basic knowledge.

4.3.2. Quantitative verification

To verify the practical effect of differentiated homework, statistical tests were conducted on the pre-test, mid-test, and post-test scores of the experimental class (Class 3, implementing differentiated design) and the control class (Class 5, implementing traditional uniform homework). The results and analysis are as follows:

(1) Pre-test Homogeneity Test

To ensure the scientific rigor of the experiment, it was first necessary to verify that the two classes were comparable in their pre-experiment English proficiency (final exam of G3, S2). An independent samples t-test was conducted on the pre-test scores (**Tables 9 and 10**).

Table 9. Pre-test Scores Group Statistics for Experimental and Control Classes

Group	Class	N	Mean	Std. Deviation
Pre1	Class 3	50	79.8	10.386
Pre2	Class 5	52	78.6	9.987

Table 10. Independent samples t-test for pre-test scores

		Levene's Test for Equality of Variances			t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Pre-test	Equal variances assumed	0.036	0.851	0.607	100	0.545	1.224
	Equal variances not assumed	-	-	0.606	99.384	0.546	1.224

The Levene's test result ($F = 0.036, p = 0.851 > 0.05$) confirmed the homogeneity of variance assumption. The t-test indicated that the pre-test mean score of the experimental class (79.8) was not significantly different from that of the control class (78.6) ($t = 0.61, p = 0.55 > 0.05$).

These results confirmed that the two classes had similar baseline English proficiency, satisfying the prerequisite for a controlled experiment and laying a solid foundation for subsequent analysis of the intervention's effects.

(2) Mid-test Preliminary Effect Check

After the first action research cycle (mid-term of G4, S1), an independent samples t-test was performed on the mid-term scores to initially observe the effects of the differentiated homework (**Tables 11 and 12**).

Table 11. Mid-test scores group statistics for experimental and control classes

Group	Class	N	Mean	Std. Deviation
Mid1	Class 3	50	82.1	9.660
Mid2	Class 5	52	79.6	10.010

Table 12. Independent samples t-test for mid-test scores

		Levene's Test for Equality of Variances			t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Mid-test	Equal variances assumed	0.097	0.756	1.295	100	0.198	2.525
	Equal variances not assumed	-	-	1.296	99.998	0.198	2.525

Levene's test was not significant ($F = 0.097, p = 0.756 > 0.05$). The t-test results showed the experimental class mid-test mean (82.1) was higher than the control class (79.6), but the difference did not reach statistical significance ($t = 1.30, p = 0.20 > 0.05$). While the positive impact of the differentiated homework was beginning to appear, the practice duration was relatively short, and the effect on overall achievement was not yet statistically significant, warranting further implementation.

(3) Post-test Final Effect Verification

After the second action research cycle (final exam of G4, S1), an independent samples t-test was performed on the final scores to verify the ultimate effect of the prolonged intervention (**Tables 13 and 14**).

Table 13. Post-test scores group statistics for experimental and control classes

Group	Class	N	Mean	Std. Deviation
Post1	Class 3	50	85.7	8.800
Post2	Class 5	52	81.0	9.622

Table 14. Independent samples t-test for post-test scores

		Levene's Test for Equality of Variances			t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Post-test	Equal variances assumed	.308	.580	2.581	100	0.011	4.718
	Equal variances not assumed	-	-	2.586	99.755	0.011	4.718

Levene's test confirmed homogeneity of variance ($F = 0.308$, $p = 0.580 > 0.05$). The t-test results indicated that the experimental class's post-test mean (85.68) was significantly higher than the control class's (80.96), with the difference being statistically significant ($t = 2.58$, $p = 0.01 < 0.05$). This provides strong evidence that, after two cycles of continuous practice, the differentiated homework significantly enhanced the English academic performance of the fourth-grade students, validating the effectiveness of the design.

(4) Experimental Class Pre-test to Post-test Improvement Analysis

To further explore the specific impact of the differentiated homework on individual student progress within the experimental class, excluding control group interference, a paired-samples t-test was conducted on the pre- and post-test scores of the experimental class (**Tables 15 and 16**).

Table 15. Paired samples statistics for experimental class pre- and post-test scores

Paired Samples Statistics					
	-	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pre	79.82	50	10.386	1.469
	post	85.68	50	8.800	1.245

Table 16. Paired samples t-test for experimental class pre- and post-test scores

Paired Samples						
	-	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Pair 1	pre-post	-5.860	1.761	-23.525	49	.000

The paired-samples test showed the experimental class's post-test mean (85.68) was significantly higher than its pre-test mean (79.82), with an average increase of 5.86 points. The statistical test confirmed a highly significant difference ($t = 23.53$, $p < 0.001$). This further confirms that the implementation of differentiated homework directly contributed to a highly significant improvement in the students' English scores, effectively promoting individual academic development.

(5) Comparison of Questionnaire Survey Results

After the second cycle, the same questionnaire was administered to both classes. The results showed a

positive shift in attitudes towards English homework in Class 3, whereas changes in Class 5 were minimal. Notably, the proportion of students in the control class who “found homework burdensome” increased from 44.2% to 57.7% (+13.5%), suggesting that the traditional uniform homework model can exacerbate students’ perception of burden. The comparison further corroborates the positive effects of differentiated homework in reducing burden and enhancing interest and proactivity. The detailed results are presented in **Tables 17 and 18**.

Table 17. Comparison of homework attitudes in experimental class (Class 3) before and after intervention

Survey Dimension	Before Implementation	After Cycle 2	Change
Like doing English homework	60%	74%	+14%
Find homework interesting	56%	72%	+16%
Find homework burdensome	40%	28%	-12%
Willingly complete homework proactively	60%	79%	+19%
Perceive differentiated homework	52%	88%	+36%

Table 18. Comparison of homework attitudes in control class (Class 5) before and after intervention

Survey Dimension	Before Implementation	After Cycle 2	Change
Like doing English homework	51.9%	53.8%	+1.9%
Find homework interesting	67.3%	69.2%	+1.9%
Find homework burdensome	44.2%	57.7%	+13.5%
Willingly complete homework proactively	53.9%	52%	-1.9%
Perceive differentiated homework	53.9%	53.9%	0

(6) Overall Trend Analysis

Synthesizing all test results reveals a clear pattern in the score changes:

(a) Between-group differences: No significant difference in pre-test scores ($p > 0.05$); mid-test difference not significant ($p > 0.05$); post-test difference significant ($p < 0.05$).

(b) Within experimental class: Highly significant improvement from pre- to post-test ($p < 0.001$).

(c) Questionnaire attitudes: The experimental class showed marked improvement in enjoyment, interest perception, and proactive completion, along with reduced burden. The control class showed minimal changes, with no substantial improvement in overall homework attitudes.

This trend strongly suggests that the positive effect of differentiated homework is not immediate but accumulates progressively over the practice period, ultimately leading to a significant enhancement of student academic achievement. This conclusion aligns with the fundamental principle of “gradual accumulation” in primary English teaching and confirms the positive role of differentiated homework design in optimizing the structure of primary English homework and improving learning quality under the “Double Reduction” policy, providing solid empirical evidence for its wider implementation.

5. Conclusions and practical implications

5.1 Conclusions

Through a two-cycle action research design incorporating longitudinal tracking (pre-mid-post-test) and cross-sectional comparison (experimental vs. control class), this study draws the following conclusions:

(1) Significant Positive Impact on Achievement: The differentiated homework scheme significantly and

positively influenced the English academic performance of fourth-grade students. Independent samples t-tests revealed no significant difference in pre-test scores between the experimental and control classes ($t = 0.61, p > 0.05$), but a significant difference emerged in the post-test scores ($t = 2.58, p < 0.05$). Paired samples t-tests confirmed a significant average improvement of 5.86 points in the experimental class ($t = 23.53, p < 0.001$). This effect exhibited a temporal pattern of “initial emergence followed by significant manifestation” as the practice progressed^[6,7].

- (2) Improved Emotional Attitudes towards Homework: The differentiated homework significantly improved students’ emotional attitudes. The experimental class showed a 14% increase in homework enjoyment, a 19% increase in proactive completion willingness, and a 12% decrease in perceived burden. Conversely, the control class experienced a 13.5% increase in perceived burden, highlighting the negative cumulative effect of the “one-size-fits-all” model^[8]. This underscores the unique advantages of differentiated homework in reducing psychological burden and stimulating motivation.
- (3) Necessity of Dynamic Adjustment: The two-cycle iterative process validated the necessity of dynamically adjusting the tiering scheme. Periodic adjustment (every 4-6 weeks) based on multi-dimensional data effectively enhanced the match between students and tasks, serving as a beneficial supplement to the theory of differentiated homework under the “Double Reduction” framework^[1,9].

5.2. Practical implications

- (1) Establish a “Data Diagnosis - Dynamic Tiering” Mechanism: Teachers are advised to periodically adjust tiering based on diverse data, including exam scores, classroom performance, and homework quality^[6]. Adjustment results should remain internal to the teacher to avoid labeling effects^[4].
- (2) Construct a “1+X” Flexible Homework Framework: “1” represents the foundation consolidation tier ensuring basic goal attainment. “X” represents the application/practice and extension/innovation tiers, allowing for independent choice or challenge. Tasks should avoid mechanical repetition: Tier A should incorporate engaging elements like imitation and drawing; Tier B should focus on contextualized language use; Tier C should emphasize openness and creativity^[9]. Practice shows that combining independent choice with appropriate challenge effectively stimulates intrinsic learning motivation.
- (3) Implement a “Teacher Assessment + Student Self-Assessment” Dual Evaluation: Design star-rating self-assessment charts to clarify criteria for students, reducing teacher grading burden while fostering students’ metacognitive abilities. Leveraging classroom management platforms can automate data compilation, lowering the administrative costs of differentiation^[10].
- (4) Strengthen Home-School Collaboration and Conceptual Guidance: Showcase excellent work via class communication groups and invite parents to participate in collaborative tasks. Help parents understand that “independent choice does not equate to lowering standards”^[11]. The goal of differentiated homework is not to categorize students, but to provide appropriate pathways for growth.

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