

Research on the Design and Implementation of Science Planting and Breeding Homework for Middle Primary School Students

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Abstract: In the context of the "Double Reduction" and the current issues with lengthy science homework, this paper primarily investigates the design and implementation of science planting and breeding homework for middle primary school students. Based on this, several homework design strategies are proposed: tiered design, diversified homework options, scaffolding, guidance throughout the homework process, and interdisciplinary optimization of homework design. These strategies have led to the development of student guidance strategies such as scenario task motivation mechanisms to expand homework forms and derivative inquiry-based homework, enabling students to acquire scientific knowledge and skills, develop observation and analysis capabilities, and deepen their understanding of ecological and environmental protection.

Keywords: Science; Long-term Homework; Planting and Breeding; Design; Implementation

1. Introduction

1.1 Research Background

Under the "Double Reduction" policy, the design of science homework needs to become more "dynamic".

In July 2021, the "Opinions on Further Reducing the Burden of Homework and Off-campus Training for Students at the Stage of Compulsory Education" mentioned the need to "improve the quality of homework design. Utilize homework for diagnosis, consolidation, and analysis of learning situations, integrate homework design into the teaching research system, and systematically design basic homework that matches the age characteristics and learning patterns, reflecting the orientation of quality education." This is a significant measure proposed by the state from the

perspective of national education, aimed at thoroughly solving the utilitarian and shortsighted approach in education and teaching, and promoting high-quality educational development. It is an important decision made to implement the fundamental task of fostering character and civic virtue, improve the quality of education comprehensively, and ensure the healthy growth of students in the compulsory education stage. The implementation of the "Double Reduction" policy is not only a major adjustment to China's educational landscape but also a significant transformation in educational concepts. Against this backdrop, the design of elementary school science homework faces more challenges and opportunities, and teachers need to focus more on the first reduction in "Double Reduction"—reducing the homework burden on students at the compulsory education stage. Only by designing homework that suits the students can we be targeted and functional with homework [1].

1.2 Existing Problems

1.2.1 Problems with current primary school science planting and breeding homework.

Teachers' perspective:

Teachers lack strategies for designing and implementing long-term planting and breeding homework, resulting in poorly designed tasks and inadequate tracking.

Students' perspective:

Students often undervalue long-term planting and breeding homework initially, compounded by a lack of supervision and timely feedback during the homework process, and the necessary materials and resources for planting and breeding are not supported and assisted promptly by teachers and parents. As a result, when students engage in experiments with longer observation periods, they often start strongly but finish poorly. Over time, students' attitudes can shift from initially being quite

interested to feeling that they can complete the tasks without much effort, failing to achieve the learning objectives of the science content related to planting and breeding [2].

1.2.2 The effectiveness of planting and breeding homework at our school needs improvement.

As shown in Table 1, through survey interviews, we found that our school's science teachers struggle to monitor and guide long-term homework effectively. Additionally, homework assessment is one-dimensional, lacking genuine interaction between teachers and students. Teachers merely introduce and assign homework in the classroom without targeted and ongoing guidance, leading to many planting and breeding homework assignments existing in name only. Through a survey of a class in our school, we discovered that only 14% of students could submit complete and high-quality homework. Seventy-one percent of students attempted the homework but gave up midway due to reasons such as lack of parental support, death of plants or animals, or personal persistence issues. Fifteen percent of students ignored the homework altogether, either forgetting about it or deeming it unimportant. Planting and breeding homework encompasses all grade levels in elementary school, and completing such homework can not only enhance students' scientific practical skills but also positively guide their emotions and values towards natural biology. Therefore, improving the quality of completion of planting and breeding homework is imperative.

2. Research Measures

2.1 Investigate the Current Status of Students to Determine the Research Direction

A small subject research team was established. Through interviews and surveys of students, we found that many students are enthusiastic about learning science. However, due to their young age and lack of self-discipline, students often encounter difficulties while completing planting and breeding homework. When they find no solution to a problem and lack teacher support, they easily develop the idea of giving up. Therefore, for planting and breeding homework, teachers should not just skim the surface but should guide students in

developing specific implementation plans, building the main framework according to the topic content, and clarifying the steps and problem-solving approaches for completing such homework.

Table1. Statistical Chart of Students' Completion of Feeding Operations

		Essentially Complete	Gave Up Midway	Ignored Homework	Total
Completion Status of Breeding Homework	Number	15	78	17	110
	Percentage	14%	71%	15%	100

2.2 Utilize Teacher Training to Foster Professional Growth

Some frontline teachers sometimes find science difficult to teach, with key issues including:

- 1) Unclear teaching objectives, so the well-prepared classes often remain superficial and ineffective.
- 2) Unscientific design, where teachers still dominate, not giving enough space to students.
- 3) An excessive focus on the formality of the classroom.

To address this, our science department has conducted a series of training and learning activities. The theme of these activities revolves around the "Curriculum Standards," which require teachers to transform their teaching concepts and methods, change learning styles, and advocate for diversified learning methods. Teachers must fundamentally change their teaching methods, aiming to improve students' scientific literacy, using inquiry as the main learning approach, focusing on student-centered teaching activities, and with effective and comprehensive evaluations, providing students with ample opportunities for inquiry-based learning and effective development [3].

2.3 Deepen Theoretical Knowledge, Learn from Excellent Experiences

Most science teachers pay considerable attention to classroom teaching design but often neglect the quality of homework. To address this, our teachers have intensified their theoretical studies and invited experienced teachers, who excel in designing breeding class homework, to share their experiences.

2.4 Optimize Homework Design, Facilitate

Multidimensional Implementation

When designing planting and breeding lessons, teachers should first identify students' interests. The content should be closely related to students' lives, be contextual, and stimulate their curiosity. Additionally, the content of the planting and breeding lessons should consider the differences among students. It should be tailored to each child's unique experiences, and during implementation, the difficulty of the homework should be adjusted based on the actual situations of the students [4]. Finally, ample development space should be provided for students. In the later stages of the planting and breeding homework, students should be able to discover or raise questions independently. There should be multiple possible outcomes to their inquiries, encouraging them to learn how to reflect.

During the process of completing homework, we encourage children and parents to participate in the science planting and breeding homework together. Teachers should involve parents by using platforms like My Cloud School, Meipian, inviting them to attend classes, and participating in results exhibitions, allowing them to appreciate the charm of science during this process. For example, a "Science Activity Invitation" can be sent to parents in the form of a letter from the science teacher, outlining the science activity projects and requirements for a unit, so that students and parents are well-prepared with the teaching materials and understand the procedure for conducting the activities.

2.5 Adapt Homework Design to Student Realities

Based on the completion of student homework, we continually optimize homework design to enhance teaching quality [5]. Reflecting on the implementation of this planting and breeding class homework, we noted an overall increase in students' interest in planting and breeding tasks, and they were more likely to complete the entire process. However, there are differences in students' foundational levels. To focus on these differences and teach students according to their abilities, we continue to adjust the design of the planting and breeding homework. For example, allowing students to conduct experimental inquiries independently provides more growth opportunities for students with higher abilities, emphasizing the

autonomy and openness of the planting and breeding homework. Simultaneously, based on students' talents and personalities, we create more activity opportunities suited to their abilities to meet the psychological needs of children at different levels. We continually adjust and optimize homework design based on feedback from the implementation results to achieve the goal of using homework design to enhance teaching quality [6].

3. Research Outcomes

3.1 Developed a Design Process for Planting and Breeding Homework

Using the example of the first unit of the fourth-grade lower semester science textbook from the Educational Science Edition, "The Growth and Changes of Plants," which requires planting green flowering plants and observing the entire life cycle of plant growth. The chosen plant in the textbook is the impatiens. From sowing to germination, flowering, fruiting, and the process requires extended observation. For this long-term homework, the following process was designed:

Unit Analysis—Thematic Homework—Tiered Design—Scaffolding—Timely Evaluation—Data Integration

3.1.1 Unit analysis, linking to new curriculum standards

- 1) By dissecting, modeling, observing, experimenting, and reasoning, study the structure and function of plant organs, understand the role and function of plant roots, stems, leaves, flowers, fruits, and seeds, and develop an interest in exploring plant growth changes and their structure and function.
- 2) By organizing observation records using tables, statistical graphs, and charts, and based on these records, accurately describe the life growth changes and patterns of impatiens, knowing that green flowering plants typically go through processes of seed germination, growth and development, flowering and fruiting, and aging and death. Develop the ability to draw conclusions using scientific recording, analysis, and comparison methods.
- 3) In the planting process, manage the plants persistently, continue observations, and collect information on plant growth changes using text, charts, drawings, photos, videos, etc. Know that plants need sunlight, air, appropriate

moisture, and temperature to sustain life, and timely reflect on one's planting process and observation and recording methods, making adjustments as necessary.

4) Through observation, investigation, practice, and inquiry, understand the relationship between the environment and plant survival and reproduction, fostering an awareness of environmental protection.

3.1.2 Thematic homework, designing new approaches to homework

Based on the requirements and content of the new curriculum standards, design thematic homework for planting impatiens. This includes a series of tasks such as caring for plants, keeping natural journals, creating mind maps, drawing plant albums, and reading scientific newsletters to encourage students to observe the growth and changes in plants carefully, understand the morphological structures and functions of various plant organs, and independently discover and solve problems during plant growth. Allow students to explore the processes of plant growth and reproduction in practice, and master relevant knowledge and skills through theoretical learning [7].

3.1.3 Tiered design, diversifying homework choices

To ensure development for all students and facilitate the successful implementation of tiered homework, design different tasks suited to students at various levels based on their individual needs. This approach fully engages students' enthusiasm for learning, enabling students at different levels to effectively complete their homework and contributes to the diversification of homework.

3.1.4 Providing scaffolding, offering guidance throughout the homework process

In the practical components, it is necessary to provide appropriate support for students to ensure the success of experiments. For example, teachers can guide students to follow standardized steps in experiments and introduce planting methods to help students better understand the procedures and cultivate their practical abilities. This also stimulates students' interest in learning, as they discover knowledge through practice, sparking their curiosity and enhancing the appeal and sustainability of planting.

3.1.5 Interdisciplinary optimization of homework design

Integrate content that connects different disciplines, conducting interdisciplinary integrated homework with "silkworms" as the main theme. For instance, by integrating science homework with art, with science as the main discipline, explore the growth changes of silkworms combined with art homework, using lines and color gradients to represent each stage of the silkworm's metamorphosis. Another example is integrating science homework with expository writing in language arts, asking language arts teachers to guide how to write good observational journals about silkworms.

3.2 Strategies for Implementing Planting and Breeding Unit Homework

3.2.1 Student guidance strategies for long-term planting and breeding unit homework

During the implementation of long-term planting and breeding unit homework, students need to undergo a lengthy completion cycle after acquiring specific knowledge about planting and breeding [8]. This presents a significant challenge for middle primary students. Therefore, we have set guidance priorities for each stage of the homework completion process based on potential problems and difficulties students may encounter, ensuring that students can complete their planting and breeding unit homework with quality.

3.2.2 Scenario task motivation mechanism

During the planting and breeding unit homework period, comprehensive guidance and support are needed for the students, along with timely feedback and evaluation. Using original cartoon characters and the perspective and tone of "Science Kid Four" that resonate with students, scenario settings are used to introduce and weave through the entire homework completion journey. This effectively stimulates students' inquiry interest and enthusiasm and utilizes task-driven challenge modes to help students improve the completion rate and quality of their homework [9].

3.2.3 Expanding homework formats, developing derivative inquiry-based homework
In the process of completing the silkworm breeding observation homework, some students asked how silkworm silk is transformed into silk. To encourage students to continue silkworm breeding, they were asked

to bring some of the cocoons they raised to school to experience the silk reeling process. Some students mentioned their previous knowledge about the Silk Road and wanted to learn more. Seizing this opportunity, teachers encouraged capable students to conduct investigations about the Silk Road, leading to various investigative homework assignments.

3.2.4 Developed Evaluation Strategies for the Planting and Breeding Unit

During the silkworm unit, we adopted teaching evaluation methods suitable for younger students through practice and discussion. Throughout the unit, both offline and online evaluation modes were used with the aim of fostering student development, encouraging those who earnestly participated in the homework exhibition, and simultaneously monitoring student feedback to optimize the evaluation process [10].

4. Conclusion

By designing engaging and practical science planting and breeding homework, students' interest and participation have significantly increased. This type of homework not only allows students to engage in hands-on planting and breeding activities but also enables them to observe and record the growth processes of plants and animals, thereby deepening their understanding and retention of scientific knowledge. Through the implementation of such homework, students have gained mastery over scientific knowledge and skills, developed observation and analysis capabilities, enhanced their cooperative and communicative abilities, and deepened their understanding of ecological and environmental protection. These outcomes are not only beneficial for the holistic development of students but also help in fostering their scientific literacy and sense of social responsibility.

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