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Research on Interdisciplinary Homework Design of Junior High School English Focusing on the New Curriculum Standards and STEAM Education

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Abstract:

English Curriculum Standards for compulsory Education (2022-year Edition) emphasizes the development of students' core competence and advocates for the establishment of interdisciplinary thematic learning activities, allocating no less than 10% of class time. This initiative aims to strengthen the relation between various subjects, enhancing the comprehensiveness and practicality of the curriculum. Investigations have revealed that current interdisciplinary activities in English predominantly occur within the humanities, with fewer engagements in science and technology disciplines. Therefore, leveraging the STEAM model to devise interdisciplinary homework designs can offer practical guidance and references for educators

Key words: interdisciplinary, STEAM, homework designs, English curriculum

1. Introduction

The directive issued by the Ministry of Education's Office on April 8, 2021, regarding the enhancement of homework in compulsory education schools, explicitly advocates for the implementation of stratified, flexible, and personalized assignments, as well as scientifically designed inquiry-based and practical tasks. Furthermore, it encourages the exploration of interdisciplinary comprehensive assignments. Similarly, the "Compulsory Education Art Curriculum Standards (2022 Edition)" underscores the necessity of reinforcing the organic integration of teaching content aimed at core competencies. This initiative aims to facilitate students' progression from mere comprehension and skill acquisition to the construction of meaning, thereby elevating their capacity for comprehensive problem-solving.

In the "Curriculum Plan and Curriculum Standards for Compulsory Education (2022 Edition)" released by the Ministry of Education in 2022, explicit emphasis is placed on establishing interdisciplinary thematic learning activities centered on students' core competencies. Specifically, the curriculum framework mandates the allocation of no less than 10% of class hours for interdisciplinary thematic learning. This strategic move seeks to augment the interrelation between diverse subjects and enhance the comprehensive and practical aspects of the curriculum (Ministry of Education, 2022). This policy shift signals China's recalibration and in-depth exploration of the value of homework, underlining the significance of interdisciplinary learning. It is evident that interdisciplinary generic skills are being accorded unprecedented prominence.

STEAM education epitomizes the ethos of interdisciplinary pedagogy, offering students holistic development opportunities. By amalgamating science, technology, engineering, arts, and mathematics, STEAM education nurtures students' creativity, collaborative prowess, and problem-solving acumen through project-based learning and hands-on activities. The ascendancy of STEAM education underscores global attention to cultivating students' holistic literacy and interdisciplinary aptitudes, a trend meriting scrutiny and emulation domestically. Consequently, the integration of STEAM education with interdisciplinary design in junior high school English promises a more comprehensive and well-rounded learning milieu, fostering students' multifaceted competencies.

Nevertheless, China's regional developmental disparities and the inherent flexibility of education endow

schools with substantial autonomy in activity implementation (Luo et al., 2023). Thus, notwithstanding the pivotal role of interdisciplinary thematic learning in reshaping English teaching methodologies at the middle school level, educators confront myriad uncertainties and challenges in actual instructional practice.

2. Theoretical Implications of STEAM Education Interdisciplinary Homework Design

Integrating STEAM education with the interdisciplinary homework design advocated by the Ministry of Education in China not only conforms to the trend of international education development but also aligns with the latest direction of domestic education policies. Such integration is expected to provide students with a more profound and comprehensive learning experience, facilitating their comprehensive development in different fields. In summary, integrating STEAM education with interdisciplinary design in junior high school English in China can offer students a more comprehensive and holistic learning experience, nurturing their versatile abilities.

2.1 STEAM Education

STEAM education originated from the STEM concept, which was first proposed by the National Science Foundation in the 1986 report "Undergraduate Science, Mathematics, Engineering Education" (the Neil Report). It encompasses the disciplines of Science, Technology, Engineering, Arts, and Mathematics (Nguyen, 2020). In 2011, Georgette Yakman incorporated Arts into STEM education, leading to the formation of STEAM comprehensive education.

Irgasheva (2021) emphasized the importance of utilizing STEAM education techniques to enhance students' professional speaking skills. Tytarenko (2021) conducted

in-depth research on the effectiveness of STEAM pedagogy in the development of future teachers' English language skills, highlighting the positive role of STEAM education in fostering English language skills, communication, critical thinking, creativity, and collaboration. Azamatovna (2021) explored innovative approaches to applying the STEAM education concept in English classrooms, such as extending English content appropriately to engage students in artistic creation or project design, thereby facilitating deeper understanding and application of learned content.

In summary, STEAM education cultivates students' creativity, collaboration, and problem-solving abilities through

Project-based learning and practical activities, enabling them to independently complete projects in real-life contexts and acquire interdisciplinary knowledge. The ultimate goal of this comprehensive educational approach is to foster the core competencies and abilities required for 21st-century talent (Harris, 2018).

In China, it was not until 2015 that the Ministry of Education first proposed "Exploring New Educational Models such as STEM Education," formally introducing this educational concept. In 2016, the Ministry of Education explicitly stated in the "Key Points of Work for the Education Equipment Research and Development Center of the Ministry of Education in 2016" the need to update educational equipment to provide technical support for the smooth implementation of STEAM courses. Since then, STEAM education in China has made steady and rapid progress.

Zhu, Xianglie (2018), in his study "Exploring Curriculum Innovation through STEM Education," investigated the curriculum system, implementation methods, curriculum evaluation, and other aspects of STEM education. The research aimed to promote the practice and innovation of STEM education at the school level. Chen Zhenhui (2020), in the article "Innovating STEM Theory to Develop Students' Core Literacy," proposed measures for better applying STEM theory in the classroom from three levels: subject, teacher, and technology, with the goal of promoting the development of students' core literacy. In the same year, Xiong Wenjiang (2020) emphasized in "An Analysis of Teaching Design under the Perspective of Activity Theory in STEAM Education" that activity design under the theory of STEAM education should clarify the student's subjective position in the activity, specify the content and objectives of learning, establish collaborative learning groups, integrate and utilize disciplinary resources, complete activities through cooperative exchange, and finally reflect on and evaluate the results of the activities to promote personalized development of students. Cheng Xiaotang (2022) pointed out that implementing experiential and inquiry-based learning helps students delve deeper into subject knowledge while improving their English language proficiency. The greatest value of this learning method lies in constructing

4. Strategies for Interdisciplinary Homework Design in STEAM Education scientific knowledge through English, thereby promoting the development of English language knowledge.

Therefore, under the dual impetus of policy support and academic research, the development of STEM education in China has achieved significant achievements, providing more possibilities for cultivating innovative and comprehensive students.

2.2 Interdisciplinary Homework Design

With the shift of focus from "Three-Dimensional Goals" to "Core Competencies" in the 2022 version of the compulsory education curriculum plan and standards, and the continuous advancement of curriculum reform emphasizing "comprehensiveness" and "practicality," interdisciplinary thematic learning has become an effective way to address this challenge.

Interdisciplinary curriculum integration refers to the conscious application of knowledge, methods, languages, etc., from more than one subject to the investigation of a central theme or topic. It emphasizes the integration of disciplinary structures and requires the establishment of interconnections between different disciplines (Xu, et al., 2019). In this integration, interdisciplinary homework design becomes an important link. Many scholars have proposed operational suggestions for assigning interdisciplinary homework in English through experimental design (Wu, et al., 2022; Wang, et al., 2022; Xiong, 2022; Zhang, et al., 2022; Zhou, 2023). In addition, some scholars have conducted definition analysis and connotation explanation of interdisciplinary homework assignment through literature review and integration (Song, 2022; Zhang, et al., 2023).

3. The Significance of Interdisciplinary Homework Design in STEAM Education

Conducting interdisciplinary homework design in STEAM can enhance the progression and structure between different subjects. It not only effectively strengthens the connection between assignments in different subjects but also reduces the presentation of some low-cognitive level and mechanically repetitive tasks, leaving students with more learning time to develop their thinking abilities and effectively implement "core competencies." By comprehensively considering the connections between different subjects and achieving effective coordination, it realizes the effective progression and interrelation between assignments in different subjects, thereby fully exerting the educational function of assignments.

It helps teachers systematically design and arrange teaching content, homework content, teaching evaluation, resource collection, and processing, thus fulfilling the functions of teaching, assignments, evaluation, and feedback. It enhances teachers' systematic design abilities and their overall understanding and control of English curriculum, continuously monitors students' learning situations, strengthens the construction of high-quality psychological mechanisms for students, stimulates students' interest in English learning, and better leverages the unique educational function of interdisciplinary homework in junior high school English, cultivating students' practical abilities and promoting their development.

Teachers should adopt a holistic perspective when considering the four fundamental elements of "why teach," "what to teach," "how to teach," and "to what extent to teach" (Luo, 2023).

The "New Curriculum and New Standards" explicitly emphasize the need to "focus on cultivating students' core competencies in China, instilling in students the correct values, essential qualities, and key abilities required for future development, guiding students to clarify the direction of their life development, and growing into comprehensive socialist constructors and successors with moral, intellectual, physical, aesthetic, and labor development".

Interdisciplinary homework design, like instructional design, must follow certain procedures, and only through scientifically standardized design can the unique value of assignments be realized. Based on STEAM education, interdisciplinary homework design in junior high school English should comprehensively consider various aspects and elements, and proceed according to a certain procedure. In the preliminary design phase, teachers need to analyze the content of homework design based on curriculum standards, textbooks, and teacher resources, considering both the needs of teaching literacy and ensuring the feasibility of practical methods. At the same time, STEAM interdisciplinary homework design should have behavioral guidance for students. While referring to unit objectives and lesson objectives, teachers should

consider student situations and teaching objectives to jointly determine the goals. In the mid-term design phase, based on students' existing knowledge, teachers should design teaching content with reference to target knowledge, achieving the learning of teaching key points and difficulties.

When implementing homework design, teachers should design pre-homework, mid-homework, and post-homework according to the actual situation. In the late-stage design phase, assessment of homework should be conducted through both static and dynamic presentations. Additionally, multiple dimensions and perspectives, such as student self-assessment, peer assessment, and teacher assessment, should be considered to form a comprehensive assessment system for homework, achieving both specificity and sustainability.

4.1 Analyzing Unit Content to Prepare for Interdisciplinary Homework Design

Designing interdisciplinary homework in junior high school English is a complex process based on in-depth analysis of unit content. Only through accurate understanding of unit content can teachers create high-quality interdisciplinary homework within the framework of English subjects, providing students with deep and rich academic experiences. When designing homework, teachers should use English curriculum standards as a guide and textbooks and teacher resources as the basis for design. By conducting a thorough analysis of the English literacy, practical behaviors, and related behavior modes contained in the entire unit, ensure that interdisciplinary homework not only conforms to the subject content but also contributes to the cultivation of comprehensive literacy, providing students with a more profound academic experience. Taking Unit 5 "Why do you like pandas?" from the New Concept English textbook Go For It 7th Grade as an example, this unit belongs to the theme category of "People and Nature." It revolves around preliminary perceptions of the zoo, using teaching carriers such as observing pictures, listening texts, and group cooperation to output language. This allows students to gradually accumulate language knowledge, form language skills, learn learning strategies, experience emotions and attitudes, and improve cultural awareness through diverse learning forms such as independent learning, cooperative communication, and task completion.

4.2 Setting Homework Objectives and Clarifying the Direction of Interdisciplinary Homework Design

Objectives serve as direction and action guidelines, as well as the basis for evaluation (Peng Guoqing, 2023). The objectives of interdisciplinary theme learning not only guide the smooth conduct of learning activities but also provide visual judgment criteria for the final evaluation of learning activities.

Reasonable and effective interdisciplinary theme learning objectives should be able to reflect real situations, guide activity implementation, carry subject knowledge, and predict learning performance. As part of the teaching process, interdisciplinary homework design in junior high school English should have clear homework objectives that align with the overall learning objectives.

This objective design should cover three aspects: knowledge and skills, process methods, and emotional attitudes and values, ensuring that students develop comprehensively in multiple aspects. For example, knowledge and skills require students to master specific content, process methods guide students on how to learn effectively, and emotional attitudes and values focus on cultivating students' positive emotional attitudes and correct values. By comprehensively considering these aspects, more comprehensive and specific guidance can be provided for setting the objectives of subject theme learning.

The design of objectives for junior high school English interdisciplinary homework includes overall unit objectives and lesson objectives. The overall unit objectives refer to the unit learning objectives or belong to the unit learning objectives. The unit homework objectives are relatively independent overall objectives, which ultimately need to be broken down into specific lesson homework objectives.

When designing lesson interdisciplinary homework objectives, it is essential to consider the timing of homework implementation. Junior high school English interdisciplinary homework is divided into three types according to the timing of implementation: pre-lesson interdisciplinary English homework, mid-lesson interdisciplinary English homework, and post-lesson interdisciplinary English homework.

Pre-lesson interdisciplinary English homework is homework assigned before learning a new lesson, also known as pre-class preview or preparation homework, and its objective setting should be slightly lower than the learning objectives.

Mid-lesson interdisciplinary English homework runs through the new knowledge learning content and its

objective setting can be equivalent to the learning objectives. Post-lesson interdisciplinary English homework is a continuation of classroom teaching, focusing on the application of knowledge to help students develop skills, so its objective setting can be appropriately higher than the learning objectives for new knowledge acquisition.

4.3 Grasping Homework Elements and Scientifically Designing Interdisciplinary Homework Content

Unit 5 "Why do you like pandas?" from the 7th-grade English textbook "New Targets for Junior High School English" by People's Education Press revolves around the natural category of humans and nature, naturally integrating English with biology, geography, chemistry, and other disciplines for interdisciplinary homework design. Starting from different disciplines, students explore the reasons for the endangered status of pandas and other animals, seek solutions, and advocate for students to put them into practice, thus exercising their critical thinking skills and providing feasible opportunities for students to improve their practical skills.

From the perspective of biology, students can understand the ecological habits of pandas, the food chain, genetic factors, etc., research the food choices of pandas, the impact of habitat loss on the panda population, the decline in panda reproduction rates, and how the loss of genetic diversity affects panda survival.

From the perspective of geography, students can explore the relationship between the reduction of panda habitats and human activities. They can study the impact of deforestation, urbanization, and climate change on panda habitats and analyze how these factors lead to the endangered status of pandas.

From the perspective of chemistry, students can study the environmental pollution problems faced by pandas. They can investigate factors such as industrial emissions, pesticide use, and water pollution on pandas and their habitats, and propose corresponding solutions.

Based on their research results in different disciplines, students can propose solutions to the problem of pandas facing extinction. These solutions may involve habitat protection, conservation education, promotion of environmental protection regulations, and implementation of artificial breeding projects. Finally, students can put forward practical actions, such as organizing environmental protection activities, participating in volunteer projects, or writing environmental protection proposals. Through practical actions, they can not only contribute to the protection of pandas and their habitats but also enhance their practical skills and abilities.

Such interdisciplinary homework design can not only help students integrate English with knowledge from other disciplines but also cultivate their comprehensive literacy and problem-solving abilities, making them future leaders in environmental protection.

4.4 Determining Presentation Methods and Optimizing Interdisciplinary Homework Evaluation Mechanisms

The key to consistency in "teaching - learning - evaluation" lies in establishing clear teaching objectives and using curriculum thinking rather than teaching thinking to understand teaching, learning, and evaluation issues under the guidance of objectives. The objective of interdisciplinary thematic teaching is to generate interdisciplinary literacy, which means having powerful applicability when encountering practical problems and being able to transfer from one context to another.

Determining presentation methods and optimizing interdisciplinary homework evaluation mechanisms are crucial steps to ensure the effectiveness of interdisciplinary teaching. In this process, teachers need to focus on ensuring the clarity of teaching objectives and the comprehensiveness of evaluation, as well as how to use curriculum thinking to promote the generation of students' interdisciplinary literacy. First, regarding the clarity of teaching objectives, teachers should establish clear interdisciplinary objectives, which should directly address the interdisciplinary literacy required by students in solving practical problems. For example, in the example given, teachers can clearly state the biological, geographical, chemical, and other disciplinary knowledge that students need to possess and apply to solve the problem of pandas facing extinction.

Secondly, when designing interdisciplinary homework, teachers should pay attention to using curriculum thinking rather than just traditional teaching thinking. Curriculum thinking emphasizes being goal-oriented,

problem and context-centered, enabling students to transcend disciplinary boundaries and integrate various disciplinary knowledge and

skills when solving practical problems. Therefore, teachers can design a series of challenging questions or scenarios, requiring students to apply their knowledge for analysis and

problem-solving across disciplinary boundaries when addressing these questions or scenarios.

Finally, when evaluating interdisciplinary homework, teachers need to establish a comprehensive evaluation mechanism to ensure the objectivity and fairness of the evaluation. This includes diverse evaluation methods such as examining students' written assignments, oral expressions, field investigations, teamwork, etc. At the same time, teachers should also comprehensively evaluate the generation of students' interdisciplinary literacy based on their overall performance, rather than just evaluating their performance in a particular subject.

In conclusion, establishing clear teaching objectives, using curriculum thinking to design teaching activities, and establishing a comprehensive evaluation mechanism are crucial steps to ensure the effectiveness of interdisciplinary teaching. Only through these measures can we achieve consistency in "teaching - learning - evaluation" and promote the comprehensive development of students' interdisciplinary literacy.

5 Conclusion

Interdisciplinary homework design in middle school English based on STEAM emphasizes the integration of science, technology, engineering, arts, and mathematics, aiming to provide students with comprehensive learning experiences and homework designs. Such designs not only combine English with STEM knowledge but also focus on cultivating students' comprehensive literacy and promoting their harmonious unity in various aspects such as thinking quality and language ability. Through interdisciplinary homework design, students can fully utilize knowledge and skills from various disciplines to solve real-world problems, thereby fostering their interdisciplinary thinking abilities. For example, when discussing the issue of pandas facing extinction, students need to understand not only the ecological habits of pandas (biology), geographical factors leading to habitat loss (geography), and the impact of environmental pollution on pandas (chemistry), but also need to express their views and solutions in English. Additionally, STEAM interdisciplinary homework design can also promote the development of students' language skills. In interdisciplinary contexts, students need to use English for communication, discussion, and expressing opinions, thereby enhancing their English listening, speaking, reading, and writing abilities. In conclusion, interdisciplinary homework design in middle school English based on STEAM not only emphasizes the integration of STEM knowledge but also focuses on cultivating students' comprehensive literacy and language abilities.

Through such designs, students can achieve harmonious unity in various aspects such as thinking quality and language ability, providing them with excellent support and guidance for comprehensive development.

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