Education Reform and Development, 2026, Volume 8, Issue 4
https://ojs.bbwpublisher.com/index.php/ERD
Online ISSN: 2652-5372
Print ISSN: 2652-5364

Incorporating Aesthetic Education into Junior High School Mathematics Teaching: Its Significance, Principles and Approaches

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Abstract: Aesthetic education is an indispensable part of the all-round development education system. Incorporating aesthetic education into junior high school mathematics teaching is not only an inevitable requirement to fulfill the fundamental task of fostering virtue through education and respond to educational policies, but also an effective approach to address current dilemmas in mathematics teaching and improve teaching quality. Junior high school mathematics is rich in aesthetic elements such as symmetry, simplicity, and logic, and has a natural connection with aesthetic education. Based on the "Compulsory Education Mathematics Curriculum Standards (2022 Edition)" and the actual situation of junior high school mathematics teaching, this paper systematically discusses the core significance, basic principles and practical approaches of integrating aesthetic education into junior high school mathematics teaching. It aims to provide theoretical references and practical guidance for front-line mathematics teachers to carry out aesthetic education-integrated teaching, help students master mathematics knowledge and improve mathematics ability, cultivate their aesthetic literacy and sound personality, and achieve all-round development of morality, intelligence, physical education, aesthetic education and labor education.

Keywords: Junior high school mathematics; Aesthetic education; Significance; Principles; Approaches

Online publication: June 3, 2026

1. Introduction

As an important component of the "five educations", aesthetic education has become an important approach to enhance students' core literacy and fulfill the fundamental task of fostering virtue through education by cultivating students' truth-seeking and thinking-improving abilities through aesthetics. The Ministry of Education clearly requires, in relevant notices, to explore the aesthetic education value of various subjects and integrate aesthetic education into all aspects of teaching, pointing out the direction for subject-based aesthetic education practice. Mathematics, which contains aesthetic elements such as symmetry, simplicity and order, is an important carrier for implementing aesthetic education [1]. The "Compulsory Education Mathematics Curriculum Standards (2022 Edition)" clearly puts forward the requirement of "understanding the value

of mathematics and appreciating the beauty of mathematics", providing a specific path for the integration of aesthetic education [2]. At present, front-line mathematics teachers have a weak awareness and a single method in integrating aesthetic education, and relevant academic research is insufficient. Junior high school is a critical period for students' all-around development. Therefore, systematically exploring the significance, principles and approaches of integrating aesthetic education into junior high school mathematics teaching is not only an urgent need to solve practical dilemmas, but also an inevitable requirement to improve the quality of curriculum education.

2. Significance of incorporating aesthetic education into junior high school mathematics teaching

2.1. Stimulate students' interest in learning mathematics and solve the dilemma of tedious teaching

Junior high school mathematics knowledge is highly abstract, and contents such as symbols, formulas and theorems easily lead to students' fear and weariness of learning, which is a prominent problem in current teaching. The integration of aesthetic education can break the single teaching mode, combine abstract knowledge with intuitive aesthetic experience, and make mathematics learning vivid and interesting [3]. Aesthetic elements such as symmetry, simplicity and harmony in mathematics can stimulate students' curiosity and desire to explore, enabling students to actively access knowledge and explore rules while appreciating beauty. In geometry teaching, guiding students to observe the symmetrical characteristics of figures such as rectangles and circles can help them overcome their fear of geometry; in algebra teaching, displaying the simplicity of formulas and the unity of operation rules can enhance students' interest in algebra operations [4]. This beauty-stimulated interest method can effectively reduce students' resistance to learning, enable students to take the initiative to learn in a pleasant experience, and solve the dilemma of tedious teaching.

2.2. Cultivate students' aesthetic literacy and promote all-round development

Junior high school is a critical period for the formation of students' aesthetic literacy. As an important part of aesthetic education, mathematical aesthetic education can help students establish correct aesthetic concepts and improve their aesthetic perception and creativity. The beauty of mathematics is different from intuitive artistic beauty; it is contained in the knowledge system, logical reasoning and thinking methods, and needs to be gradually perceived and understood by students in learning [5]. In function image teaching, guiding students to observe the fluency of linear functions and the elegance of quadratic functions can cultivate their aesthetic perception ability; in ruler and compass drawing teaching, letting students draw geometric patterns by themselves can exercise their aesthetic creativity. At the same time, mathematics aesthetic education can guide students to pursue the simple and rigorous aesthetic realm, cultivate rigorous and meticulous qualities, and help students' all-round development.

2.3. Deepen students' understanding of mathematics and improve core literacy

Mathematics, aesthetic education and knowledge teaching promote each other and are dialectically unified. The integration of aesthetic education can help students better understand knowledge, master methods and improve thinking, promoting the development of core literacy. The logical and rigorous beauty of mathematics can guide students to develop rigorous thinking habits, pay attention to the rigor of reasoning, and deepen their

understanding of knowledge. In geometry proof teaching, guiding students to appreciate the logical rigor of the proof process can help them master proof methods and understand theorem connotations [6]; in problem-solving teaching, letting students experience the simplicity and cleverness of problem-solving methods can improve their problem-solving ability and innovative thinking. Aesthetic education can also stimulate students to break through traditional thinking, explore new methods, and further improve core literacy, such as mathematical abstraction and logical reasoning, laying a foundation for lifelong learning.

3. Principles of incorporating aesthetic education into junior high school mathematics teaching

3.1. Unity of mathematics and aesthetics

The core of integrating aesthetic education into mathematics teaching is to base it on the mathematics subject itself, without deviating from the core teaching objectives, and not blindly pursue aesthetic experience while ignoring knowledge teaching and ability cultivation. Mathematics is the foundation of aesthetic education integration, and aesthetics is the soul; the two complement each other. The integration of aesthetic education must take mathematics knowledge, methods and thinking as the carrier, naturally integrate aesthetic elements into all aspects of teaching, and let students feel the beauty of mathematics while learning knowledge and improving ability [7]. When teaching axisymmetric figures, it is necessary to combine the definition and properties of axial symmetry to guide students to feel the beauty while exploring symmetrical characteristics and mastering knowledge; when teaching formulas, it is necessary to guide students to understand the derivation process and connotation, and then appreciate their simplicity. Aesthetic education without mathematics will become a mere formality, and ignoring aesthetics will not realize the value of aesthetic education. Only by unifying the two can we achieve the combination of knowledge, teaching and aesthetic cultivation.

3.2. Process and progression principles

The integration of aesthetic education into junior high school mathematics is a long-term and gradual process that should not be done in haste. The process principle requires that aesthetic education run through the whole teaching process, including lesson preparation, teaching, homework and evaluation, so that students can continuously feel the beauty of mathematics and improve their aesthetic literacy. In the lesson preparation stage, it is necessary to explore aesthetic education materials in textbooks and design reasonable teaching plans; in the teaching stage, it is necessary to guide students to perceive aesthetic value through vivid language and intuitive means; in the homework and evaluation stages, aesthetic elements should be integrated to guide students to pay attention to the beauty of mathematics [8]. The progression principle requires that the integration of aesthetic education conform to students' cognitive laws, and gradually increase the difficulty according to students' age and knowledge level. Lower grades focus on guiding students to feel intuitive beauty, such as figure symmetry, while higher grades focus on guiding students to appreciate abstract beauty, such as logical beauty, cultivating aesthetic comprehension and creativity, and ensuring the gradual improvement of aesthetic literacy [9].

3.3. Coordination of emotion and cognition

The integration of aesthetic education should not only pay attention to students' cognitive development, help them master knowledge and improve ability, but also focus on emotional experience, cultivate aesthetic

emotion and learning interest, and realize the coordinated development of emotion and cognition. Emotion is the core of aesthetic experience; only by generating positive emotions can students truly feel the beauty of mathematics. In teaching, teachers should create a relaxed and pleasant atmosphere, guide students to feel beauty with vivid and kind language, and give timely affirmation and encouragement, so that students can gain a sense of achievement in aesthetic experience and enhance learning confidence. Positive emotional experience can stimulate learning motivation and promote knowledge understanding [10]; a solid cognitive foundation can help students deepen aesthetic experience, and the two promote each other. When exploring mathematical rules, students feel the logical beauty in success, and then take the initiative to explore further, realizing the organic unity of emotion and cognition.

4. Approaches to incorporating aesthetic education into junior high school mathematics teaching

4.1. Deeply explore aesthetic education materials and consolidate the foundation of aesthetic education integration

Textbooks are the core carrier of junior high school mathematics teaching and an important source of aesthetic education materials. Deeply exploring aesthetic education materials in textbooks is the premise and foundation of realizing aesthetic education integration. Junior high school mathematics textbooks are rich in aesthetic elements covering figures, formulas, theorems and thinking methods, which require teachers to carefully sort out and explore during lesson preparation, and organically combine these aesthetic elements with teaching content to provide strong support for aesthetic education integration. In the field of graphics and geometry, there are abundant elements such as symmetry, harmony and simplicity. Teachers should explore these aesthetic materials and guide students to feel the beauty of graphics [11]. For example, when teaching special quadrilaterals such as rectangles, rhombuses and squares, explore the symmetrical characteristics of their sides, angles and diagonals to guide students to feel the symmetrical beauty of figures; when teaching knowledge related to circles, explore the perfect symmetry of circles and the harmonious unity of the circumferential angle theorem to let students experience the harmonious beauty and logical beauty of circles. In the algebra field, there are elements such as simplicity, regularity and logic. Teachers should focus on exploring these aesthetic materials and guide students to feel the beauty of algebra. For example, when teaching addition and subtraction of integral expressions and factorization, explore the simplicity and rigor of operation rules to let students experience the simple beauty of algebra operations; when teaching function-related knowledge, explore the rhythmic beauty of function images and the regular beauty of function relationships to guide students to feel the beauty of functions.

4.2. Carefully design aesthetic education classes and realize the integration of aesthetic education and teaching

Class is the main front for integrating aesthetic education into junior high school mathematics teaching. Carefully designing aesthetic education classes can naturally integrate aesthetic education into all aspects of teaching and realize the deep integration of aesthetic education and mathematics teaching. In the class introduction link, teachers can use aesthetic elements to design vivid and interesting introduction methods to stimulate students' learning interest and aesthetic interest. For example, when teaching golden section, show the golden section ratio in buildings such as the Palace Museum and the Eiffel Tower, play relevant

pictures and videos to let students intuitively feel the beauty and application value of golden section, and naturally introduce teaching content [12]; when teaching graphic translation, show the beautiful patterns formed by floor tiles and wallpaper in life to guide students to feel the aesthetic value of translation and stimulate students' desire to explore. In the class exploration link, teachers should guide students to feel the beauty of mathematics in the process of exploring mathematics knowledge and cultivate students' aesthetic perception ability and exploration ability. For example, when exploring the triangle interior angle sum theorem, guide students to obtain the theorem through cutting and splicing, reasoning and other methods, and feel the rigorous beauty of reasoning and the harmonious beauty of rules in the exploration process; when exploring the properties of axisymmetric figures, let students find the symmetrical characteristics of figures through folding and observation, feel the symmetrical beauty of figures, and master the knowledge related to axial symmetry [13]. In the class summary link, teachers should focus on sorting out the aesthetic elements in teaching content, guide students to review the beauty of mathematics felt in class, and deepen students' aesthetic experience. For example, at the end of class, guide students to summarize the beauty of mathematics felt in this lesson, such as the simple beauty of formulas, the symmetrical beauty of figures, and the rigorous beauty of reasoning, so that students can improve their aesthetic literacy while reviewing knowledge.

4.3. Innovate the design of aesthetic education homework and extend the chain of aesthetic education integration

Homework is an extension of mathematics teaching and an important link in aesthetic education integration. Innovating the design of aesthetic education homework can let students continuously feel the beauty of mathematics and improve their aesthetic literacy while completing homework, extending the chain of aesthetic education integration [14]. Traditional mathematics homework is mostly calculation and application problems, with a single form and tedious content, which makes it difficult to realize the educational value of aesthetic education. Therefore, teachers should break the traditional homework mode, design aesthetic, practical and innovative aesthetic education homework according to teaching content and students' cognitive characteristics, and make homework an important carrier for students to feel and create beauty. Design aesthetic experience homework to guide students to feel the beauty of mathematics. For example, after learning graphic symmetry, assign the homework of "finding symmetrical graphics in life", let students go into life to find and record symmetrical graphics such as buildings, plants and daily necessities, then share their findings in class and exchange the symmetrical beauty they feel; after learning golden section, assign the homework of "measuring the golden section ratio in life", let students measure the golden section ratio in human body, buildings and books, and feel the aesthetic value and application value of golden section. Design a practical creation homework to cultivate students' aesthetic creativity. For example, after learning ruler and compass drawing, assign the homework of "designing beautiful patterns with ruler and compass drawing", let students use the method of ruler and compass drawing, combined with knowledge such as symmetry, translation and rotation, design patterns with aesthetic value [15]; after learning function images, assign the homework of "creating mathematical paintings with function images", let students use images such as linear functions and quadratic functions to create vivid and interesting mathematical paintings, and cultivate students' aesthetic creativity and innovative thinking.

4.4. Expand aesthetic education-themed activities and enrich the forms of aesthetic education integration

In addition to classroom teaching and homework assignments, expanding aesthetic education-themed activities

can enrich the forms of aesthetic education integration, allowing students to feel the beauty of mathematics and improve their aesthetic literacy in diverse activities. Junior high school mathematics aesthetic education themed activities should be designed according to teaching content and students' age characteristics, with fun, practicality and innovation, so that students can take the initiative to participate and explore in activities, and realize the organic integration of aesthetic education and mathematics teaching [16]. Carry out mathematics aesthetic education exhibition activities to provide a platform for students to display their aesthetic achievements. For example, regularly hold activities such as "Display the Beauty of Mathematics", let students display their designed mathematical patterns, mathematical paintings, handwritten newspapers and other works, invite other students to visit and exchange, so that students can learn from and inspire each other in the display and exchange, and improve their aesthetic literacy; hold activities such as "Mathematics History Picture Exhibition", display pictures and materials of mathematicians' deeds and mathematics achievements, let students feel the cultural charm and rigorous beauty of mathematics in the visit, and cultivate their cultural confidence and patriotism. Carry out mathematics aesthetic education practical activities to let students feel the beauty of mathematics in practice [17]. For example, organize students to carry out "Explore the Beauty of Mathematics on Campus" activities, let students go into the campus to find mathematical elements such as symmetry in buildings, geometric figures in roads and golden section in greening, record their findings and write exploration reports, so that students can feel the close connection between mathematics and life in practice, and improve their aesthetic perception ability and exploration ability; organize students to carry out "Mathematics Handicraft Making" activities, let students make three-dimensional geometry models and mathematics teaching aids using mathematical knowledge, feel the structural beauty and logical beauty of mathematics in the production process, and cultivate their hands-on ability and aesthetic creativity.

5. Conclusion

Incorporating aesthetic education into junior high school mathematics teaching is an important measure to fulfill the fundamental task of fostering virtue through education, improve teaching quality and promote students' all-round development, with important educational and practical value. At present, the integration of aesthetic education into junior high school mathematics still faces problems such as teachers' weak aesthetic education awareness and a single method. Front-line teachers need to improve their own aesthetic education literacy, explore effective strategies, and naturally integrate aesthetic education into all aspects of teaching. This can enable students to feel the beauty of mathematics and improve their aesthetic literacy while mastering mathematics knowledge and ability, achieve all-round development, give play to the educational value of the mathematics subject, and promote the high-quality development of junior high school mathematics education.

Funding

2026 Aba Teachers College College-Level Undergraduate Research Project: A Study on the Distribution of Aesthetic Education Elements in the People's Education Press Middle School Mathematics Textbooks: A Case Study of the Junior High School Stage (20262001071).

Disclosure statement

The authors declare no conflict of interest.

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