

Illustrations in Cross-Disciplinary Education: Cross-Boundary Applications and Research

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Abstract: Cross-disciplinary education is currently a hot topic of research, as the fusion of disciplines can enrich education. The purpose of cross-disciplinary education research is to explore, understand, and improve the implementation and effectiveness of cross-disciplinary education. The objectives of this research are to delve deeply into the theory, methods, and practices of cross-disciplinary education, addressing a range of critical questions, promoting educational reform, and enhancing educational quality. This study examines how to construct an innovative visual classroom in the digital age, seamlessly integrating the art of illustration with other disciplines to support the development of cross-disciplinary education. It explores how illustration and other subjects can be combined to create a novel educational approach that facilitates cross-disciplinary education. With the transformation of educational paradigms, cross-disciplinary education is gaining increasing attention, and visual media plays a crucial role in this process. This research aims to investigate how the expressive power of illustration can break down traditional boundaries between subjects, advance the field of education, stimulate student creativity, critical thinking, and interdisciplinary associations, and enhance student learning experiences and outcomes to better meet the evolving demands of a knowledge-driven society. Such research helps uncover the potential and limitations of cross-disciplinary education, providing support for the creation of innovative and comprehensive educational environments.

Keywords: Illustration; Interdisciplinary education; Visual Education

1. Introduction

This article introduces the importance of illustration in interdisciplinary education, and mainly elaborates on its unique information characteristics. As a powerful tool for information transmission, illustration can play a significant role in interdisciplinary fields. The research on interdisciplinary education is also aimed at better understanding and improving the methods and methods of education. Through the analysis of special cases and the use of interdisciplinary interactions, it is concluded that illustrations can promote students' comprehensive development in interdisciplinary contexts, helping them better understand and apply knowledge from different disciplines, and so on.

2. The Theoretical Foundation of Illustration and Cross-Disciplinary Education

With the continuous changes in training objectives, it is now not only required for students to innovate the application of information technology to solve learning problems, but also for teachers to be able to innovate the application of information technology to solve practical teaching problems^[1]. The theoretical foundation for the integration of illustration into cross-disciplinary education is rooted in a deep understanding of the potential of visual media in education and the principles of cross-disciplinary education. It is built at the intersection of various fields, including visual media, educational psychology, and pedagogy. Illustration, as a powerful visual language, possesses rich expressive capabilities that transcend linguistic and disciplinary boundaries, stimulating students' emotions, creativity, and critical thinking. On the other hand, cross-disciplinary education emphasizes the intersection and fusion of disciplines, encouraging students to apply knowledge from multiple fields to problem-solving, nurturing well-rounded individuals.

The theoretical foundation of "Artificial Intelligence (AI) Illustration and Cross-Disciplinary

Education" is a complex theme that encompasses art, technology, and educational psychology, among other domains. In terms of artistic creation, a deep understanding of different art styles, the creative process, and visual representation methods is crucial. From a technological perspective, mastery of principles and techniques in computer graphics, computer vision, and generative models contributes to achieving high-quality AI illustrations. Educational psychology, on the other hand, focuses on how to incorporate AI illustration into cross-disciplinary education. This involves aspects of instructional design, cognitive learning, and innovative thinking to cultivate students' artistic creativity, technological literacy, and comprehensive abilities. Therefore, the theoretical foundation includes aesthetics in art, computer technology, and educational psychology, collectively forming the support framework for the integration of AI illustration and cross-disciplinary education, facilitating the organic fusion of technology with creativity and disciplines with innovation.

This concept reflects not only the application of AI technology in artistic creation but also the consideration of how to introduce this technology into cross-disciplinary education to provide students with a richer learning experience and skill development. Integrating AI illustration into cross-disciplinary education is a focal point of educational psychology. Educational psychology explores how to effectively teach knowledge, stimulate students' learning interests and creativity. In this field, the theoretical foundation encompasses instructional design, cognitive learning, and the cultivation of innovative thinking. AI illustration offers a new way for education, inspiring students' creative thinking through visual expression and increasing interactivity and engagement across various disciplines. These theoretical foundations intertwine, constructing a support framework that blends AI illustration technology with cross-disciplinary education, offering new possibilities for academic, artistic, and educational innovation.

2.1 The Role of Illustrations in Information Communication

Illustration plays a significant role in information communication, particularly in terms of image memory and conveying information. This is because it combines visual elements with information, making it easier for information to be understood, remembered, and absorbed. Illustrations present information through graphics, colors, shapes, and images, which activate the audience's visual perception. Compared to pure text, illustrations leave a more vivid and lasting impression on the brain, a phenomenon known as the "dual-channel processing theory." Experimental results support this theory, showing that groups exposed to visual information perform better in memory tests and are more likely to recall the provided information. This is because the brain processes images more rapidly and can more easily capture information.

Illustrations help visualize abstract or complex concepts, making them easier to understand. For instance, a textbook explaining scientific principles can use illustrations to depict molecular structures, astronomical phenomena, or ecosystems, making it easier for students to grasp these abstract concepts. Illustrations can transform abstract concepts into intuitive visual representations, helping the audience establish spatial cognition of the concepts. Illustrations can convey various aspects of information, including emotions, background information, and relevant details that text alone cannot convey. They can enrich information through details and elements within the images. For example, in a geographical illustration, in addition to geographical maps, it can include local customs, cultural symbols, and climate information, all of which contribute to a more comprehensive understanding of geographical concepts. The School of Animation and Digital Arts at the Lu Xun Academy of Fine Arts actively seeks interdisciplinary collaborations in artistic design. Illustration students' artwork, such as the visual image design for the "Long March V" cargo spacecraft, was adopted by the China Academy of Space Technology and applied to the appearance of the "Long March V" carrier rocket's transport container, incorporating Chinese aerospace culture and traditional flying culture. This demonstrates significant attempts by the school to apply illustration artwork in cross-disciplinary cooperation. Illustrations can attract the audience's interest, increase interactivity, and engagement. Moreover, the audience is more likely to interact with illustrations, establish emotional connections with them, and delve deeper into the information they convey. This active engagement contributes to better information retention and understanding. Illustration is a universal language that is not restricted by language, making it advantageous for cross-cultural communication. This means that a well-crafted illustration can be understood and remembered by a global audience without the need for translation or cultural interpretation. The role of illustration in image memory and information communication is undeniable. It not only enhances the comprehensibility and memorability of information but also stimulates the audience's interest, encourages interaction, and facilitates cross-cultural communication. This makes illustration a powerful tool in various fields, including education, science communication, advertising,

and social communication.

2.2 The Concept and Significance of Interdisciplinary Education

Cross-disciplinary education is an educational approach and philosophy aimed at seamlessly integrating knowledge, ideas, methods, and skills from different disciplinary fields to foster comprehensive learning and development among students. In cross-disciplinary education, the boundaries between disciplines are dismantled, emphasizing the interconnectedness and intersections among disciplines to address complex problems, challenges, and contexts.

Cross-disciplinary education goes beyond the traditional separation of disciplines and emphasizes the intersection and fusion of knowledge and concepts from different fields. For example, programs like "Interdisciplinary Studies" at Duke University and "Citizenship and Racial Ethnic Identity" at the University of California, Los Angeles (UCLA) integrate knowledge from arts, humanities, and social sciences. UCLA's "Mathematics of the Natural World" program spans mathematics, engineering, and natural sciences. Programs such as the University of Michigan's "Global Change" and the University of Maryland's "Creativity" combine perspectives from humanities, social sciences, engineering, and natural sciences. Cross-disciplinary education can be implemented both in teaching and in students' research projects and practical applications, providing students with a more comprehensive, multidimensional, and holistic perspective.

This educational approach encourages students to acquire knowledge from multiple disciplinary areas and to combine different disciplinary ways of thinking and methods to address complex real-world problems. Cross-disciplinary education aims to cultivate students with a comprehensive perspective and the ability to have a broader impact and success in multiple fields.

The importance of interdisciplinary education, when considered comprehensively, lies in its encouragement of students to break free from the confines of single disciplines, merging knowledge and methodologies from multiple fields to cultivate comprehensive thinking. This aids students in gaining deeper insights into the interconnections among diverse disciplines, thus forming a more holistic knowledge framework. In terms of problem-solving capabilities, real-world issues frequently entail knowledge and factors from various domains. Interdisciplinary education empowers students to comprehensively apply knowledge and methodologies from multiple disciplines, leading to more effective resolutions of intricate problems and the provision of comprehensive solutions. Regarding innovative thinking, interdisciplinary education ignites students' creativity as the convergence and fusion of different fields can spawn fresh perspectives and novel ideas. This helps nurture students' ability to approach challenges creatively from diverse angles. Concerning real-world application, interdisciplinary education emphasizes the practical utilization of disciplinary knowledge, fostering students' proficiency in addressing real-world problems. This prepares them to be better equipped to confront the complexities of real-life challenges in their careers. From a lifelong learning perspective, interdisciplinary education encourages students to engage in continuous learning across various domains, cultivating a mindset of lifelong learning. It equips students with the ability to independently acquire knowledge and adapt to evolving circumstances, enabling them to remain competitive in diverse fields. Interdisciplinary education not only hones students' multifaceted skills but also enhances their understanding of the intricate real world, offering more comprehensive and innovative problem-solving approaches. This educational approach plays a pivotal role in shaping students' competencies that are both influential and adaptable across a wide range of contexts.

3. The Application of Illustration in Interdisciplinary Education

In today's digital age, illustration plays a crucial role in promoting students' holistic development within interdisciplinary education, aiding them in better understanding and applying knowledge from various fields. It sparks creative thinking, visual expression, and interdisciplinary thought, providing students with a richer learning experience. When students face forms, they need to have the original intention and perspective to ask questions, and the stage of expression is similar to the process of continuously improving and answering questions^[2]. So the teaching design plan for this time is for a professor in the interdisciplinary field of architecture and illustration. This integration not only enriches the learning experience but also enhances students' creativity, critical thinking, and interdisciplinary comprehension. The combination of classical Chinese architecture and traditional Chinese painting theory is particularly noteworthy in this context. This synergy is especially evident in classical Chinese gardens.

Traditional Chinese painting emphasizes line and form, values freehand brushwork, depicts essence over form, and juxtaposes the real and the abstract, striving for the "beauty beyond the subject" and the vivid portrayal of spirit. Classical Chinese garden design, on the other hand, emphasizes the interplay of solid and void, balance in architectural layout, and the deliberate blending of the real and the illusionary, all with a sense of order. These gardens convey infinite human sentiments within limited garden spaces, embodying the vitality of traditional Chinese culture and cosmic consciousness. The commonality between classical Chinese gardens and painting lies primarily in their aesthetic ideals. The aesthetic ideal in Chinese garden art is the harmonious integration of man and nature, the unity of heaven and humanity, with a focus on human-centric design. Traditional painting pursues the idea that "the painting comes from the heart," emphasizing the connection between the artist's heart and their work. Throughout history, from the Tang Dynasty onwards, the development of garden aesthetics in China has been closely related to painting. During the Song and Yuan dynasties, garden creations pursued the aesthetics of returning to simplicity, embracing a sentimental connection with nature, and idealizing life, evolving towards a "freehand" style in artistic creation. The Yuyuan Garden in Shanghai, a well-preserved example, is rich in poetic and picturesque rockery designs, exemplifying classical Chinese garden aesthetics. It was created by the Ming Dynasty painter Zhang Nanyang, known by his pen name "Chenshi Sheng." The consistency between traditional architectural aesthetics and the aesthetics of painting is evident. Furthermore, the commonality between architecture and painting is also reflected in the idea that when people appreciate architecture, they should draw on the aesthetic experience and rules of painting art to enrich their own aesthetic imagination, thereby enhancing their aesthetic perception.

Professional practice teaching is an important part of art design teaching^[3]. The curriculum is designed with a total duration of 32 study hours. It includes 8 hours of architecture, 12 hours of illustration, and 12 hours of practical projects and interdisciplinary integration. Architecture content is delivered by specialized instructors, while illustration content is taught by illustration experts. The architecture component primarily focuses on traditional Chinese architecture and is further categorized based on different historical periods. The course assignments require students to initially prepare reports and written materials through research and investigation techniques. They are expected to provide detailed descriptions of their favorite aspects of various historical periods of traditional Chinese architecture. This includes aspects like architectural aesthetics, stylistic characteristics, construction techniques, cultural backgrounds, and symbolic elements. Subsequently, the curriculum covers the origins of illustration and specific techniques for creating illustrations. This equips students with the knowledge and skills necessary to independently create illustrations. Throughout the teaching process, instructors employ a personalized approach, conducting individual case studies and providing one-on-one guidance tailored to each student's needs and characteristics. Various teaching methods are utilized based on the content and the practical requirements of the course. This interdisciplinary approach not only allows students to gain insights into traditional Chinese culture but also promotes the dissemination of Chinese cultural richness. The unique combination of architecture and illustration enhances the learning experience, making it a valuable and distinctive part of their professional education.

Interdisciplinary teaching that combines architecture and illustration offers numerous advantages, positively impacting students' overall development and fostering creative thinking. Illustration, being a powerful visual medium, helps students develop their visual thinking abilities. Through illustration, students can better observe, analyze, and express complex architectural concepts and design ideas. Illustration encourages students to unleash their creativity and present their ideas in unique ways, which is crucial for both architectural design and artistic creation, as they emphasize innovation and individuality. The integration of architecture and illustration in interdisciplinary teaching incorporates visual and manual skills, catering to the multisensory learning needs of different students. Students deepen their understanding of architectural concepts through drawing, observation, and model-making, which enhances their memory and comprehension. This teaching method encourages students to establish connections between architecture and art, cultivating a holistic skill set. Students become not only architects but also artists, equipped with interdisciplinary skills and thinking processes. The combination of illustration and architecture enables students to engage in real projects and transform their design concepts into visual representations. This practical education helps students gain a better understanding of the complexity of architectural practice. Throughout the course, students learn to blend architecture and art, technology, and creativity, developing interdisciplinary thinking skills. This ability is invaluable for solving real-world problems. In the long run, this integration also helps transcend language and cultural barriers. Illustration, as a universal visual language, bridges students from different linguistic and cultural backgrounds, aiding them in better understanding the uniqueness of each culture. In university-level creative courses, teachers may require students to understand, analyze, and express a work from multiple perspectives, applying more suitable methods and providing individualized guidance,

which also serves as a comprehensive assessment for teachers.

In summary, interdisciplinary teaching that combines architecture and illustration provides students with a comprehensive educational experience that blends visual arts, design thinking, and architectural principles. This helps cultivate students with a broad skill set and knowledge base, enabling them to excel in both the fields of architecture and creativity.

4. How Illustration Facilitates Cross-Interactions Between Disciplines

Illustration can promote cross-disciplinary interaction because it possesses the expressive ability to transcend language and disciplinary boundaries, allowing it to convey information, concepts, and ideas across multiple disciplines.

Firstly, the significance of illustration in interdisciplinary education lies in its status as a multimodal communication tool that can visually and symbolically represent various concepts. It can visualize abstract concepts, aiding students in better understanding and memorizing them. This helps in conveying common concepts across different disciplines, such as science, mathematics, literature, and more. It also contributes to creating an environment conducive to multidisciplinary understanding and collaboration. Educators can design interdisciplinary projects and tasks that require students to use illustration to integrate knowledge from different disciplines. For example, students can use illustrations to demonstrate the connections between historical events and literary works or to visualize scientific principles as graphical representations.

Secondly, as a visual language, illustration can help students overcome the barriers of disciplinary specialization, enabling students from different disciplines to more easily understand each other's viewpoints and concepts. Students can use illustrations to explain their knowledge in their respective fields, making it accessible to students from other disciplines. These illustrations can serve as visual aids to help them communicate information to team members, especially those less familiar with the subject matter. The younger generation needs to rediscover and develop creativity with the flexibility of thinking and the joy of experimentation^[4]. Students can collaborate across disciplines, co-creating illustrations that reveal the connections between various disciplines such as society, environment, and health. This collaborative approach helps address real-world issues by integrating their knowledge and perspectives. Such collaboration requires students to work together to solve problems or explore topics, deepening their understanding of multidisciplinary content. Students from different disciplines may possess varying skills and specialized knowledge. Interdisciplinary collaboration allows them to complement each other, leveraging their respective strengths to explore and address issues more comprehensively. During collaboration, students need to assess and review each other's work, which fosters critical thinking and enables students to evaluate and improve their own work.

Thirdly, illustration can also help students understand the commonalities and differences between different cultures. It can be used to showcase intersections between multiple disciplines such as culture, history, and sociology. Illustration, as a widely appealing visual art form, can convey cultural information and ideas. Through illustration, students can learn about the visual symbols, images, and stories of different cultures, leading to a better understanding of cultural diversity. It helps students broaden their cultural perspectives beyond their own cultural backgrounds. For example, a student can use illustration to express their interest in various cultural customs, using illustrations to depict their understanding of various cultural celebrations such as the Chinese New Year, Christmas, Halloween, and more. This helps students understand different ways of celebrating and traditions in various cultures, fostering better understanding and respect for other cultures. Students can also reinterpret cross-cultural stories and fables through illustrations to convey the wisdom and values between different cultures, such as illustrating similarities between Western fairy tales and Eastern fables. Through these illustrative examples, students can enhance their understanding of different cultures, cultivate cross-cultural communication skills, and build cultural sensitivity, all of which are crucial in the era of globalization. Illustration, as an intuitive and emotionally rich form of expression, can deeply convey cultural information and stimulate students' interest and respect for cultural diversity.

Fourthly, illustration encourages students to engage in visual thinking and creative expression, which is crucial for fostering their creativity and interdisciplinary thinking skills. Illustration is a concrete manifestation of visual thinking, which encompasses the perceptual and cognitive processes involved in creating and interpreting illustrations. By practicing and learning illustration, students can develop skills in visual thinking. They learn to observe and understand visual elements such as lines, shapes, textures, and spatial relationships, which helps them apply visual thinking more effectively in academic and

creative fields. It's also a powerful tool for cultivating creativity. Through illustration, students can explore various creative thinking approaches, including experimenting with new image concepts, materials, and techniques, which helps them become creative thinkers and creators across various domains. Students are tasked with expressing an emotion like "joy" through illustration. They are free to choose colors, lines, and images to convey this emotion, allowing them to unleash their creativity. Each student's work can be unique, reflecting their individual creativity and imagination. Visual thinking and creativity are important concepts closely associated with illustration, and they play a critical role in interdisciplinary education. Through illustration, students can cultivate and showcase their visual thinking and creativity, which are essential for problem-solving, innovation, and interdisciplinary understanding.

Visualization education is a teaching method that conveys knowledge and information using visual elements such as images, illustrations, charts, animations, and more. This educational approach has become increasingly important in today's information age. Illustration, as a core element of visualization education, plays a crucial role in interdisciplinary education. It not only transmits knowledge but also fosters cross-disciplinary interaction and understanding, contributing to the cultivation of students with multidisciplinary literacy. Therefore, in educational practice, educators can actively utilize illustration as a teaching tool to promote cross-disciplinary interaction and collaboration among subjects.

5. The Potential of Illustration as a Visual Medium in Interdisciplinary Education

Illustration, as a visual medium, holds vast and profound potential in interdisciplinary education. It has the capability not only to integrate knowledge and concepts from multiple disciplines into a single image but also to stimulate creativity, deepen understanding of abstract concepts, and foster the development of interdisciplinary thinking. Illustration, as a visual medium, has enormous potential in interdisciplinary education. It can promote students' interdisciplinary thinking, creativity, visual thinking, and problem-solving skills. Firstly, illustration can visualize abstract concepts, making it easier for students to understand and remember them. In interdisciplinary education, many concepts may span across multiple subjects, and through illustration, students can express these concepts in visual forms, enhancing their understanding. Secondly, multimodal learning, as illustration combines visual and textual elements, can cater to different learning styles of students. Interdisciplinary education aims to integrate multiple subjects, and multimodal learning methods help students explore and understand knowledge diversely. Illustration plays a role in inspiring creativity. Students can express their ideas and viewpoints through drawing illustrations, which contributes to cultivating their creative thinking and expressive abilities. Additionally, illustration can spark students' imagination, encouraging them to think from different perspectives and explore potential solutions. Furthermore, in interdisciplinary education, illustration can promote the development of interdisciplinary thinking. It can blend concepts and knowledge from different disciplines, helping students see connections and interactions between various fields. This interdisciplinary thinking ability is crucial in solving complex problems and facing real-world challenges, and illustration serves as an effective tool to stimulate students to think in a connected manner across different disciplines.

6. Conclusion

Interdisciplinary education is the content to be studied in every era, and education is to constantly break through the convention, conduct new experiments and explorations, and find educational methods suitable for the development of the times. Illustration, as a visual medium, has a broad application prospect in interdisciplinary education. It can not only help students better understand and remember knowledge but also stimulate creativity, foster interdisciplinary thinking, and enhance the enjoyment and engagement in learning. Through illustration, students can gain richer and deeper experiences in interdisciplinary learning, laying a solid foundation for future comprehensive skills and innovative abilities.

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