A Study of the Application of New Media and Technology to Innovative Design Education in the Science of Learning

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Abstract. This paper proposes an innovative design education model that effectively combines learning science theory, new technology, and new media to address the problems of serious homogenisation and disconnection from social requirements in design education. The model is based on the Chinese context, in accordance with the three principles of innovative design education summarized in Tim Brown's design thinking, and utilizing the learning science theory, new technology, and new media. Analyzing the relationship between learning science theory, new technology, and new media, providing a reference for the full application of new technology and new media in Chinese modern design education, and promoting the application of learning science theory in Chinese modern design education constitute the construction of the model.

1 Introduction

As a result of the fourth industrial revolution, new technologies and media are reconfiguring the education model further. In the 1990s, embodied cognition became the core of the second generation of cognitive science, the teaching paradigm shifted from "teacher-centered" to "student-centered," and learning science emerged to design and promote learning innovations for scientific comprehension [1, 2]. However, the status quo of art and design education in Chinese colleges and universities in the contemporary new era is still dominated by design theory education, resulting in a significant disconnect between graduates and social design needs. Due to technical and interdisciplinary issues, it is difficult for design students to produce innovative designs through the curriculum, and learning science theories is rarely employed in design education.

This thesis focuses primarily on the learning science theory, analyzes the relationship between the theory development process and new technology and new media, summarizes the three major principles of innovative design education in China's design education context, constructs a classroom model of innovative design education, applies the findings of learning science research to the practice of design education, and offers a new way of thinking.

2 Overview of the science of learning

Learning science is rooted in cognitive science, and its primary research focuses on cognitive theory, methodology, sociology, and other facets. Traditional cognitive science does not include the body in its research scope, thereby ignoring the interaction between humans as an organic whole and their physical and mental environments [3]. Contextuality became one of the foundational concepts of "second-generation cognitive science" in the 1980s, which asserts that cognition is situational because embodied intelligence is embedded within the constraints of natural and social environments [4]. With the internal drive for educational change and the promotion of technology [5], learning science was born from the second generation of cognitive science and gradually developed into a new discipline, which reflects the teaching and learning process, the cognitive subject (students) to the classroom environment, context of the deepening degree of dependence and interaction, learning is no longer merely skill learning, but should be the students continue to select their own learning strategies. "Applied Learning Science" refers to the use of knowledge of how people learn to enhance the effectiveness of instructional design and assist learners in learning authentic tasks; it is the application of the findings of learning science's investigation into how people learn to teaching and assessment.

3 Connotation of Innovative design education

The combined use of new technology and new media has broadened the scope and limits of art and design education and teaching methods. Teachers and students, students and pupils, use various media and disciplines to investigate the diverse expressions of design, which helps to cultivate "design thinking" and conforms the
design to the current economic development while presenting a fresh perspective. Tim Brown believes that the prerequisites for creativity are the social and spatial environments, and that design thinking is a holistic, human-purpose and human-fundamental means of solving innovation's problems.

Based on this understanding, in the context of China's practice of "observing the right and innovating, seeking the truth and making use of it", innovative design in our country should be a design that implements the new development concept, integrates into the new development pattern with the domestic macrocycle as the main body and the domestic and international double cycle promoting each other, conforms to the trend of digital science and technology, and solves the challenge of innovation and is rich in the deep meaning of design. Therefore, in order to enable design students to shift from the "technical" to the "creative", innovative design education should follow the following three principles.

3.1 Student-centered and accurate educational objectives

From the perspective of students, the abundance of high-quality design education resources has increased the flexibility and selectivity of students' independent learning. From the perspective of educators, educators have ideal standards for their own teaching classrooms, and they will subjectively determine what type of teaching situation is most appropriate for design majors. Nevertheless, the actual classroom is still "teacher-centered" one-way knowledge transfer, which is frequently quite distinct from the ideal standard. "Student-centred" refers to the teaching concept of focusing on student growth, student learning, and learning outcomes [6], i.e., according to the teaching goals that educators wish to achieve, they will continue to design the teaching and summarise and reflect on the teaching, prescribe the right medication, and move further towards the goal so as to allow students to construct in different contexts, understand knowledge, and achieve knowledge coherence. A comprehensive educational objective should include: 1. what has been learned 2. applying what has been learned 3 how to evaluate academic performance [7], so that students can comprehend the transition from memorization to knowledge creation after learning. Therefore, innovative design education classroom should be based on solving the problem of what kind of innovative design talents need to be cultivated in the new era for the establishment of objectives, focusing on the four aspects of design professional theory, design professional skills, interdisciplinary knowledge and moral quality of the new era, so that students internalise their knowledge during the teaching process, and teachers are also improved in the process of teaching.

3.2 Utilizing innovative technologies and media for design innovation

Regarding art and design, art is an abstract reflection of human thought activity and experience, whereas design is a deliberate creative act. Modern design education should actively address the innovative challenges of the AI era and assume responsibility for comprehending and communicating the meaning of design as well as cultivating creative abilities.

In 2017, "Deer Class" delivered 400 million images to the group's e-commerce companies during the Double 11 Shopping Festival, overturning the traditional design process and demonstrating the need for innovative design education to keep up with the cutting edge of technology. Platforms such as Ali Data, Tencent Cloud, and FanSoft provide multi-screen data presentation solutions for individuals and businesses to analyze problems using multiple technologies such as big data and artificial intelligence, which is a concrete example of the combination of design and new technologies. Shenzhen University has utilized WeChat, a new media, to communicate in a creative manner. APP is not limited to social activities, but also art and design education services, through the establishment of the University of Shenzhen WeChat brand culture shop sales of cultural and creative products at the same time, the design education and practice, so that the output of the course has a clear destination, to stimulate the creative passion of the students, so that the cultural elements can be further refined and re-designed to meet the needs of innovation. The program is also an excellent illustration of how new technologies and media can assist designers in creating innovative designs. The new technology and new media serve to complete the design, and the design responds to the new technology and new media in such a way that the new technology and new media can be presented and used in various ways.

Innovative design education should utilize all types of educational resources provided by big data, build an innovation and entrepreneurship platform, introduce teaching courses or interdisciplinary courses of new technologies in a timely manner, provide students with the means to independently learn new technologies and interdisciplinary knowledge, realize the freedom of learning and the direct presentation of design education's results, and reduce the number of teaching activities. Ineffective teaching practices resulting from instructors' inability to keep up with new technologies or lack of knowledge in other fields.

3.3 Integration of industry and education to acclimate to the "circular" economy's new pattern of development.

The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China proposed the major strategic plan of "accelerating the construction of a new development pattern with the domestic macrocycle as the main body and the domestic and international double cycle mutually promoting each other." To realize the integration of industry and education, traditional design
education should seize this opportunity to reform and convert into an innovative design education classroom. Through the construction of an innovation and entrepreneurship platform with abundant educational resources, increasing the degree of school-enterprise cooperation, so that students can understand and fundamentally grasp the development of enterprise demand orientation, improving the transformation of design and innovation results at the same time, the enterprise also quickly receives the innovative design of its services, establishing a "small cycle" on the campus, and then outputting in line with the results of this cycle. This will establish a "small cycle" on campus, which will then produce "circular economy"-aligned design works, aid the new development pattern of the domestic large cycle, and enhance the competitiveness of art and design talents.

3.4 New technologies and media for creating "environment" in science theory learning

In 2007, the "4E+S" theoretical model of cognition was proposed for the first time in the learning sciences, where Embodied, Embedded, Enactive, and Extended cognition occur in a particular context emphasized by Situated Cognition. And the process of every action is intrinsically dependent on its physical and social environment[8]. In actuality, the combination of new technologies and new media has always been conducted in three core areas of the field of learning sciences: (1) research on the design of learning environments, (2) research on the underlying mechanisms of learning, and (3) research on learning analytics techniques [9]. By applying to real classroom situations (VR, WeChat, etc.), new media directly influence the traditional educational environment and context, which is no longer limited to the directly perceived physical world, and enrich the biological channels through which we receive information (visual media, auditory media, olfactory media, etc.))[10]. Through resource integration and sharing as a driving force for learning, new technologies subvert the individualisation of cognition and provide means of collecting and processing pedagogical data, enabling educators to realize effective and comprehensive pedagogical assessment and communication, and to create a variety of learning contexts according to the learners, which is in line with the current "student-centred" concept of education. It aligns with the current "student-centered" philosophy of education.

Based on the above summary of innovative design education, its relationship with learning science theory and new technology and new media is sorted out to provide a theoretical premise for the construction of innovative design education model, whose relationship is shown in Figure 1.

![Figure 1](https://www.example.com/figure1.png)

**Figure 1.** A compilation of innovative design education in relation to the study of science theories and the introduction of new technologies and media.

4 Constructing an innovative classroom paradigm for design education

Based on the feasibility analysis of learning science theory combined with new technology and new media applied to innovative design classroom, following the cyclic relationship of "teaching-learning-assessment", combining the three cognitive processes of "selecting, organising, and integrating" of meaningful learning in the theory of learning science with the three assessment modes, constructing the innovation and entrepreneurship platform, and integrating it into the education system, as shown in Figure 2 and Table 1.
Table 1. Innovation and Entrepreneurship Platform Specific Requirements.

<table>
<thead>
<tr>
<th>Missions</th>
<th>Objectives</th>
<th>Problem solving</th>
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<tbody>
<tr>
<td>Publication of pre-coursework</td>
<td>Determine the technical and disciplinary knowledge necessary for the design based on the project context, design requirements, design objectives, and the student's design vision.</td>
<td>1. Who should this course be designed for? 2. What is the intent of the design of this course output? 3. What techniques and related disciplines must students master in order to implement the design concept (including depth, specific chapters, etc.)?</td>
</tr>
<tr>
<td>Provide technical and multidisciplinary resources, as well as communicate with businesses.</td>
<td>Provide pertinent and helpful technology (IoT, data analytics, 3D printing, VR, AR, etc.) and interdisciplinary resources for the student's design's completion and future development.</td>
<td>1. Can students utilise technology and interdisciplinary resources in design? 2. How should students' access to technology and interdisciplinary resources be incorporated into design? 3. Do the technology and interdisciplinary resources provided to students positively influence their future paths?</td>
</tr>
<tr>
<td>Provide a venue for the display of works and facilitate school-business collaboration.</td>
<td>The labour is creative and meets societal needs.</td>
<td>1. Is the design of this course's final project innovative? 2. What societal needs are fulfilled by the design of this course's final product?</td>
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New technologies and media build a platform for innovation and entrepreneurship

Figure 2. Innovative Design Education Model.

4.1 Using assessment theory and new technologies and media to guide cognitive processing in the science of learning

Assessment, teaching, and learning are a cyclical system in the innovative design education classroom, and assessment should not be a distinct task tacked on after the classroom. The learning objectives of a course not only lead to student success, but also enhance group effectiveness and cohesion, and effective assessment can reveal whether students internalise knowledge to construct meaning and accurately move towards the set learning objectives. Cognitive processing is the process through which learners select pertinent material during learning, organise the selected material and form a coherent representation, and integrate the selected material with the original knowledge activated in long term memory [7]. In design education, teacher-student communication is of the utmost importance; teachers can control the progress of students’ works through
evaluation; they can influence students' cognition from the social world; they can prevent students from producing "ineffective design"; and they can adjust design professional classroom teaching methods in a timely manner. Presently, the emergence of WeChat applets and big data education platforms enables the implementation of comprehensive evaluation.

The innovative design classroom carries out pre-assessment, formative assessment and summative assessment in the three phases before, during and after the class, combining the three assessment methods with the process of choosing, organising and integrating the three meaningful learning processes. In pre-assessment, pre-course tasks are released by the platform to make students pay attention to the information related to the specialised courses of this design and make the first step of effective selection based on the given information; in formative assessment, students make consistent mental representations of the selected information and the corresponding technologies and interdisciplinary resources provided by the platform to form the students' knowledge structure corresponding to the design; and in summative and formative assessment, each time the new technology and new media are actually intervened to help students to connect the represented knowledge with the original knowledge extracted from long term memory.

By completing the corresponding teaching assessment according to the requirements of different time points in the curriculum, teachers can adjust their teaching strategies in time, so as to make students go through the process of transforming from sensory memory to long-term memory through a complete cycle, so that students can complete the process of pre-study, learning and reviewing as well as informal learning outside the classroom in school, and to help students to reduce irrelevant cognitive processing, make good use of the basic cognitive processing, and promote the generation of cognitive processing.

4.2 The Function of New Technologies and Media in the Classroom for Innovative Design Education

New technologies and new media should not be used separately in innovative design education classrooms, but rather in tandem. The innovation and entrepreneurship platform is the result of combining new media and new technology. From the teacher's point of view, the combination of new technology and new media is a tool for teaching, through the construction of the platform, the introduction of new technology, interdisciplinary and other curriculum resources, and to build a bridge for school-enterprise co-operation, to show the final results of the teaching. From the student's point of view, the combination of new technology and new media is a tool for learning and completing the design, which demonstrates the final results of the teaching. And by applying new technology and new media in reverse to the design process.

5 Conclusion

This paper analyses the current situation of design education and new technology and new media, summarises the concepts of innovative design and innovative design education in the Chinese context, and constructs a classroom model of innovative design education by combining new technology and new media under the guidance of the theory of learning sciences, which offers a new approach to the reform of design education and a real shift to a "student-centered" teaching classroom. The model represents a new approach to designing education reform and a genuine transition to a "student-centered" classroom. The model is currently constructed from the general direction of design education; however, it can also be used in design education of a specific profession or specific design skills, etc., which is not described in detail in the text; however, future scholars can be based on the design education from all directions and perspectives of the design education to explore and further improve the model, the theoretical model into the design education, to promote the application of the model. In the future, scholars can investigate and further improve the model from a variety of perspectives, implement the theoretical model into design education, promote the application of learning science theory in design education, and find a suitable path for the development of design education in China so as to better meet the social demand for innovative talents and innovative design.

References
