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Research on Educational Transformation of Industrial Cultural Resources--Exploration of STEAM Activity Design in Preschool Education

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ABSTRACT

This paper further discusses the key points of industrial cultural transformation (such as symbol adaptability and cultural goal balance), and puts forward some promotion suggestions such as developing resource packages and school-enterprise cooperation. Finally, it is pointed out that the application of digital industrial cultural resources can be expanded in the future, and new ideas can be provided for cultural inheritance and innovation ability cultivation in preschool education.

KEYWORDS

Industrial culture; STEAM Education; Preschool education; Campaign design; Interdisciplinary integration

1 Introduction

1.1 Research background and significance

Under the background of new liberal arts construction, interdisciplinary integration has become an important direction of higher education reform, emphasizing the coordinated development of humanities, science and technology and society. As an important carrier of social production practice, industrial culture contains rich educational values, such as craftsman spirit, technological innovation and labor ethics, and plays a unique role in cultivating children's scientific cognition, cultural identity and social adaptability. However, at present, STEAM education in preschool education mostly focuses on the cultivation of general skills, and activity design often lacks cultural connotation, making it difficult to establish an effective connection with local industrial resources. How to transform industrial cultural resources into STEAM activities suitable for children's cognitive characteristics has become a research topic worth exploring. Industrial resources cover material forms such as factory sites, labor tools and non-material forms such as workers' stories and technological processes, and their transformation potential in early childhood education has not been fully tapped. For example, the history of steel mills can be translated into "bridge building" engineering activities, and the mechanical principles of gears can be reduced to scientific exploration games. This transformation can not only enrich the situational nature of STEAM education, but also enhance children's perception of local culture and achieve the dual goal of "cultural inheritance + ability cultivation". Therefore, this study aims to explore the integration path of industrial cultural resources and preschool STEAM education, and provide theoretical and practical references for kindergarten curriculum development.

1.2 Research questions

This study focuses on two core issues: "How to transform industrial cultural resources into STEAM activities suitable for children's cognition" and "What is the combination of industrial cultural resources and STEAM education". It is found that there is a natural convergence point between industrial cultural resources and STEAM education: material resources (such as gears and bridges) can correspond to scientific principles and engineering technologies, while non-material resources such as craftsman stories and technological processes contain artistic expression and mathematical logic. Based on this, the research constructs a "three-dimensional combination model", which explains the integration mechanism of the two from three aspects: the content dimension such as the transformation of industrial knowledge into subject knowledge, the method dimension such as the combination of cultural experience and inquiry learning, and the value dimension such as the cultivation of craftsman spirit.

In terms of practice transformation, the research puts forward a four-step transformation method of "screening-mapping-design-evaluation": first, screen industrial elements that are in line with children's cognition, such as observable mechanical movements, then map STEAM target areas, and then design multi-sensory participation Gamification activities, and finally evaluate the implementation effect through observation. Taking Little Railway Engineer as an example, through track construction (engineering), speed experiment (science), carriage decoration (art) and other links, children can establish a preliminary cognition of local industrial culture while understanding physical concepts. The

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research confirms that this integration not only makes up for the lack of traditional cultural situation of STEAM activities, but also realizes the age-appropriate transformation of industrial cultural resources through concrete and gamification, which provides a new idea with both theoretical innovation and practical value for the development of preschool education curriculum.

2 Transformation framework of industrial cultural resources into STEAM activities

2.1 Transformation principles

The transformation of industrial cultural resources into STEAM activities should follow the three principles of life, gamification and interdisciplinary integration. Life-oriented emphasizes extracting elements from industrial scenes familiar to children, such as carrying out the "Secret of Wheels" activity in kindergarten middle classes, and guiding children to explore the relationship between friction and movement by observing the rotation of toy car and bicycle wheels; The lower grades of primary schools can combine the theme of "Bridge Engineer" to build simple bridges with straws and adhesive tapes to understand the structure and load-bearing. Gamification is realized through role-playing and construction games. For example, in the situation of "small factory" in kindergarten classes, children play the role of workers to assemble "assembly lines" with building blocks and experience division of labor and cooperation; The "Robot Designer" game can be designed in primary school, and the programming control of industrial robotic arm can be simulated with Lego. Interdisciplinary integration requires breaking the boundaries of domains. For example, in the "Gear Kingdom" activity, children not only explore the scientific principles of gear occlusion (S), but also make gear art paintings with clay (A), and count the number of gear teeth (M) to achieve multi-dimensional learning.

2.2 Resource screening and classification

Industrial resources can be divided into two categories: material and non-material, which need to be accurately matched according to the STEAM dimension. Material resources such as gears, screws and other physical objects can be applied to scientific fields. For example, in the "mechanical exploration corner" of kindergartens, children disassemble and assemble old clocks to observe the gear transmission (S); In the primary school "Tool Measurement" class, students measure bolt size (M) with vernier calipers. Intangible resources such as "Songs of Textile Workers" can be incorporated into artistic activities, young children creating weaving paintings with yarn (A), or understanding technological progress through factory historical stories (E). Pay attention to age adaptability when classification: small classes in kindergartens focus on sensory experience, such as simulating "high-rise building construction" with safety foam building blocks (E); In the middle and upper grades of primary schools, they can explore in-depth, such as analyzing the piping system in the factory sand table (T) or designing the energy-efficient building model (E). In this case, a primary school transformed the local steel plant culture into a "steel art" course. Students welded sculptures (A) with scrap iron pieces and calculated the material weight ratio (M) to realize multi-dimensional utilization of resources.

2.3 No about

Activity Design Model "Industrial Culture-STEAM Activity Four-Step Model" systematically promotes the transformation from culture to education. The first step of cultural extraction needs to focus on typical elements, such as kindergartens choosing the theme of "train track" because it is concrete and easy to interact with; Primary schools can explore the energy problems in "hydropower stations". The second step of goal decomposition needs to clarify the key points in various fields. For example, in the "Carton Factory" activity, the scientific goal is to explore the load-bearing capacity of corrugated paper (S), and the engineering goal is to design the assembly line conveyor belt (E). The third step of situation creation emphasizes real experience, such as using clay to simulate the dough production line after the kindergarten organizes a "bread factory visit"; Combined with the case of "UAV logistics" in primary schools, programming and controlling UAV transportation building blocks (T). The last step of evaluation feedback needs to be diversified. For example, in the "wind turbine" project, comprehensive evaluation is carried out through children's blade design drawings (artistic) and speed record sheets (scientific). When implementing the "Little Architect" unit in a park, children first listen to the story of the bridge (cultural input), then build the cable-stayed bridge with popsicle sticks (engineering practice), and finally use picture books to record the results (artistic expression), completely presenting the closed loop of the four-step model.

3 Practical cases and effect analysis

3.1 Case 1: the secret of gears-exploration of mechanical transmission

Industrial cultural elements and activity background. Gears are core components in industrial machinery and are widely used in clocks, automobiles, factory equipment and other scenarios. In order to let children intuitively understand the principle of mechanical transmission, this activity takes "The Secret of Gears" as its theme, combining scientific inquiry, artistic creation and mathematical observation, to help children perceive the operation mode of gears and their application in life in hands-on operation.

3.1.1 STEAM activity design and implementation

(1) Scientific exploration (S)--gear bite experiment

Teachers provide plastic gears of different sizes, so that children can freely combine them and observe how the gears drive each other to rotate. Through experiments, children found that only when the teeth of gears bite each other, rotating one gear can drive the other gear to move, thus understanding the concept of "force transmission".

(2) Artistic expression (A)--gear rubbing painting

Children dip the gear in paint, roll and rubble it on the paper, and observe the pattern left by the gear teeth. Teachers guide children to think: "Why can the tooth pattern of a gear make it rotate steadily?" At the same time, children are encouraged to create the story of "Gear Kingdom" with rubbings to enhance their artistic expression.

(3) Mathematical measurement (M)-the relationship between gear size and speed

Children's group experiment: When the big gear drives the small gear, the small gear rotates faster; On the contrary, when the small gear drives the big gear, the big gear rotates slower. The teacher guides the children to record the observation results and describes them in simple language: "1 turn of the big gear, how many turns of the small gear?" Helps the children to initially perceive the proportional relationship.

3.1.2 Implementation effect and reflection

Through this activity, children not only understood the bite principle of gears, but also strengthened their cognition of gear structure in artistic creation. The observation records of mathematics have cultivated children's comparative analysis ability. After the activity, many children spontaneously built "small factories" with gear toys in the construction area, which shows that they have a continuous interest in mechanical transmission. In the future, it can be extended to "the application of gears in life", such as bicycles, clocks, etc., to further deepen learning.

3.2 Case 2: little architect-steel bridge construction

Industrial cultural elements and activity background. Steel bridge is an important symbol of industrial civilization, and its solid structure and exquisite design reflect the wisdom of engineering technology. In order to let children understand the principles of architectural engineering, this activity combines the bridge cases of local steel plants to organize the "Little Architect" project, so that children can experience the work of engineers and cultivate engineering thinking and teamwork ability by building, testing and decorating bridges.

3.2.1 STEAM activity design and implementation

(1) Engineering practice (E)--building block bridge construction

Teachers first show pictures of local steel plant bridges, and guide children to observe the characteristics of piers, bridge decks, supporting structures, etc. Subsequently, children tried to build their own bridge models by using wooden building blocks, cardboard, straws and other materials in groups. During the construction process, young children need to think: "How to make the bridge more stable?" "How to design to make the bridge deck wider?" By constantly adjusting the structure, they can understand basic engineering concepts such as triangular stability and load-bearing distribution.

(2) Technical test (T)-bridge load-bearing test

After the bridge is completed, the children undergo the load-bearing test, and gradually place small weights or toy cars on the bridge deck to observe the bearing capacity of the bridge. If the bridge collapses, the team needs to discuss the causes and improve the structure, such as adding piers and strengthening connection points. This process cultivates children's scientific inquiry ability and problem solving ability.

(3) Artistic creation (A)--bridge decoration and beautification

After ensuring that the bridge structure is stable, children decorate the bridge with colored paper, paints, stickers and other materials to make it more aesthetic. Teachers guide children to think: "Besides being strong, how can bridges become more beautiful?" Children are encouraged to combine artistic elements such as color matching and pattern design to enhance the ornamental value of works.

3.2.2 Implementation effect and reflection

This activity not only allows children to understand the basic structure of bridges, but also exercises their hands-on ability, logical thinking and teamwork spirit. During the construction process, the children constantly tried, adjusted and optimized, and experienced the engineer's way of thinking. The decorative link stimulates their creativity and combines engineering with art. In the future, it can be extended to "comparison of bridges of different materials" (such as wooden bridges, iron bridges, suspension bridges), or combined with field visits to deepen children's understanding of architectural engineering.

4 Conclusion

4.1 Key points of industrial cultural resources transformation

In the process of transforming industrial cultural resources into STEAM activities, special attention should be paid to two core issues: the child-friendliness of cultural symbols and the balance between STEAM goals and cultural goals. First of all, concepts such as mechanical principles and architectural structures in industrial culture are relatively abstract for children, so it is necessary to choose intuitive and operable elements, such as "the rotation of gears" and "the shape of bridges", to avoid involving too complicated technical terms. For example, in the "Secret of Gears" activity, children understand the transmission of force by touching and assembling gears, instead of directly learning concepts such as "torque" or "transmission ratio". Secondly, STEAM activities should take into account scientific inquiry and cultural inheritance, and avoid over-emphasizing technical operations and ignoring cultural connotations. For example, in the "Little Architect" project, in addition to building bridges, teachers can also tell the history of local steel mills, so that children can feel the value of industrial culture in hands-on practice.

4.2 Promotion suggestions

In order to promote the popularization of STEAM education in industrial culture, it is suggested to start from the following two aspects: developing the resource package of STEAM activities in industrial culture: integrating cases, teaching aids, instruction manuals, etc., and lowering the threshold for teachers to implement it. For example, the "Gear Exploration Toolbox" is designed, which contains gears of different sizes, experimental record sheets, expanded picture books, etc., which is convenient for teachers to directly apply it in the classroom. Strengthen the cooperation between kindergartens and local industrial resources: Invite industrial museums to carry out "mobile classrooms", or organize children to visit enterprises (such as bakeries and automobile factories), and combine real industrial scenes with STEAM activities. For example, a kindergarten cooperates with a community bicycle repair shop. Children learn the principle of chain transmission (S) while observing the maintenance process, and create collages (A) with waste parts.

4.3 Research limitations and future directions

This research still has certain limitations: First, practical cases are mostly concentrated in traditional industrial fields such as machinery and construction, and can be expanded to diversified topics such as textiles and energy in the future; Second, the sample is mainly kindergarten, and it is necessary to further verify the adaptability of activities in the lower grades of primary school. Subsequent research can explore the application of digital industrial cultural resources, such as using AR technology to simulate factory assembly lines, so that children can understand the production process through virtual operations; Develop interactive industrial culture games, such as "Little Power Engineer" programming tasks, and learn energy knowledge in interesting situations. Through diversified resources and technical support, industrial culture STEAM education will be more sustainable and characteristic of the times.

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