Research on the Educational Functions of Museums and Their Impacts on Cognitive and Social Development of Primary School Students: A Case Study of Shaanxi Natural History Museum

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Abstract. Against the backdrop of China's deepening education reform, oriented towards core competencies and the implementation of the "double reduction" policy, basic education has gradually shifted from a "knowledge-oriented" model to a "competence-oriented" one. The educational value of museums, often referred to as the "second classroom," has become increasingly prominent. In 2021, the National Cultural Heritage Administration and the Ministry of Education jointly issued a document providing policy support for the integration of museums and schools. As a significant natural science venue in Northwest China, the Shaanxi Natural History Museum, with its rich physical exhibits and immersive experiences, has become a key informal learning site for primary school students. However, there is a lack of specialized research on the impact of this museum on the cognitive and social development of local primary school students aged 6-12. This study focuses on the offline exhibition and education scenarios of Shaanxi Natural History Museum, targeting primary school students aged 6-12. Based on the theories of constructivism and situated learning, this study examines the impact of the museum's educational functions on students' cognitive and social development, as well as the key factors that restrict it. The results show that through the integration of physical exhibits, context construction, and task-driven approaches, the museum effectively promotes the transformation of students' cognition from a superficial "naming-classifying" understanding to an in-depth "evidence-explaining" scientific thinking. Additionally, the dual models of "peer collaboration" and "parent-child co-learning" significantly enhance students' communication and collaboration abilities as well as their social quality. Meanwhile, the study reveals several problems in the museum, including the imbalanced utilization of exhibition and educational resources, a lack of hierarchical design in academic activities, underutilization of parental guidance, and an incomplete evaluation system for educational effects. In conclusion, museum education plays a positive role in promoting the cognitive and social development of primary school students. It is necessary to optimize educational functions by implementing age-appropriate and tiered courses, strengthening museum-school collaboration, and improving parents' participation capabilities. The research results can serve as a reference for educational innovation in similar natural history museums in China.

Keywords: Museum education, Primary school students, Cognitive development, Social development

1. Introduction

With the deepening of educational reform, the core competence-oriented philosophy has promoted the diversification of educational scenarios, and the educational value of museums as the "second classroom" has become increasingly prominent. In 2021, the National Cultural Heritage Administration and the Ministry of Education jointly issued a document that explicitly integrates museum education into the teaching systems of primary and secondary schools, providing policy support for the integration of museums and schools.

This study focuses on the offline exhibition and education scenarios of Shaanxi Natural History Museum, targets primary school students aged 6-12, and excludes online virtual exhibitions. Leveraging the museum's strengths in rich specimen collections and immersive exhibition design, the research aligns with the cognitive characteristics of primary school students in the concrete operational stage. Based on the theories of constructivism and situated learning, this study examines the role of museum education in facilitating students' cognitive transition from superficial to in-depth levels, as well as its value in cultivating students' social competence, thereby bearing both theoretical and practical significance.

The research is conducted across three dimensions: the cognitive development of primary school students, their social interactions, and the key design elements of exhibition and educational activities. It finds that Shaanxi Natural History Museum supports the development of students' abilities through contextual scaffolding and dual interactions between peers and parents. Meanwhile, the museum faces multiple challenges in localized implementation, including ineffective integration between the museum and schools, insufficient resource utilization, poor adaptability of exhibition tools, and disparities in parents' guidance capabilities.

Currently, there is a lack of specialized research on this topic in Shaanxi, resulting in a noticeable gap in the existing literature. Future research should aim to address these localized dilemmas, optimize the design and implementation paths of exhibition and educational activities, strengthen museum-school collaboration, fully leverage the regional educational value of the Shaanxi Natural History Museum, and provide a reference for similar venues across the country.

2. Significance and theoretical basis of museum education

2.1. Prominent value of museum education in the context of curriculum reform

China's educational reform is advancing in depth towards a core competence-oriented direction. The deepening of quality-oriented education, the development of a core competence framework, and the implementation of the double reduction policy have collectively driven the transformation of basic education from a traditional knowledge-oriented model to a competence-oriented one. This transformation not only requires classroom teaching to break through the limitations of knowledge indoctrination but also emphasizes cultivating students' comprehensive competencies, such as scientific inquiry ability, social communication skills, and cultural perception. Restricted by space, resources, and teaching formats, traditional classrooms can hardly meet such demands fully, making the diversification of educational scenarios an inevitable trend.

As public cultural institutions that integrate cultural, scientific, and historical resources, museums have become an important second classroom for basic education, thanks to their abundant physical exhibits and immersive experience scenarios. Their educational value has become increasingly prominent amid curriculum reform. On the one hand, the double reduction policy has alleviated the academic burden on primary school students, providing them with time and space to step out of

classrooms and participate in off-campus practical learning. Museum programs and field trips that popularize science are now an important part of after-school activities, essentially plugging the gap in on-campus after-school educational resources.Meanwhile, the train of thought and existence objective of core competencies such as scientific inquiry, humanistic attainments, hence human individuality communication are highly similar to museums' educational characteristics. Taking natural history museums as an example, their exhibited specimens, models, and interactive experience programs enable primary school students to overcome the constraints of abstract knowledge in textbooks. Instead, students can observe, question, and practice in real scientific contexts, realizing the transformation from passive knowledge reception to active cognitive construction. Meanwhile, students can also develop their social skills through team activities, an educational effect that is often difficult to achieve in traditional classrooms [1].

For primary school students aged 6-12, who are in the concrete operational stage as defined in Piaget's cognitive development theory, the perception and experience of concrete objects are the key to their cognitive development. The physical exhibits and contextualized design of museums are precisely suited to such cognitive characteristics. As an essential natural science venue in Northwest China, the Shaanxi Natural History Museum, with its resources such as dinosaur fossils and Qinling ecological specimens, has built a bridge connecting abstract scientific knowledge with concrete perception, emerging as a crucial informal learning venue that facilitates the development of primary school students' core competencies against the backdrop of curriculum reform.

2.2. Social constructivism theory

Vygotsky posits that social interaction constitutes the core driver of cognitive development. Children's learning needs to be supported through interactions with others (peers, teachers, and museum staff) within the Zone of Proximal Development (ZPD)—the gap between a child's current ability level and potential ability level [2]. From a constructivist perspective, learning is a process in which learners actively construct meaning in specific contexts. Exhibits, scenarios, and interpretations in museums provide primary school students with numerous clues to meaning.

For instance, in the Little Docent program at Shaanxi Natural History Museum, primary school students are required to introduce exhibit-related knowledge to visitors. During this process, guidance from museum staff and feedback from peers help them improve their expression skills. Meanwhile, the knowledge organization conducted to complete the interpretation task also promotes cognitive enhancement, achieving the synergistic development of social skills and cognition.

Integrating research with professional sci-pop instruction courses and specialist language training. On the one hand, explanatory comments from the star-rated docents in the museum are organized and professional. They help children to have a comprehensive understanding of things, broaden their field knowledge, stimulate their learning interest, create role models for study and motivation for it as well. On the other hand, feedbacks from broadcasting instructors for specialized pronunciation training can enhance the expressive abilities of children.

Under the guidance of teachers, children present their own understanding of the knowledge. The program incorporates a variety of interactive elements, such as mind mapping, physical etiquette training, handcrafting, simulated TV news reporting, group development activities, and rotating class monitor roles. These elements effectively realize the expected teaching outcomes and facilitate the construction of children's knowledge frameworks.

2.3. Situated learning theory

Situated learning theory posits that learning occurs when individuals interact with others, the environment, or cultural tools in real or simulated contexts [3].

Shaanxi Natural History Museum generally embeds abstract scientific knowledge into perceptible and experiential contexts through contextual exhibitions, ecological restoration, and task-driven approaches, enabling primary school students to understand concepts and form attitudes through immersive experiences. For example, in the exhibition area for rare animals of Qinling Mountains in Shaanxi, students can not only view specimens, but also see simulated habitats and conservation publicity content, thus intuitively perceiving biological diversity and the importance of ecological protection. The museum's physical exhibition, along with interactive tasks (e.g., simulated dinosaur fossil excavation), provides primary school students with authentic natural science contexts. By touching specimens, conducting hands-on operations, and discussing with peers, students transform abstract textbook knowledge (such as the geological periods when dinosaurs lived) into perceptible concrete experiences, thereby promoting cognitive deepening. Meanwhile, peer interactions within these contexts also offer a natural setting for social development.

3. Analysis of the current situation of educational functions of shaanxi natural history museum

3.1. Educational resources and activity design

The museum comprises the Natural Exhibition Hall, the Kenneth E. Behring Exhibition Hall, the Science Exploration Center (under construction), the Dome Theater, and the Outdoor Science Popularization Experience Zone. Each exhibition hall features themed displays that integrate specimens and immersive experiences, while the outdoor zone encompasses diverse experience sections. The educational activity system is structured as "regular activities + customized courses": regular activities include Weekend Science Popularization Classes (explanation + small experiments) held 1-2 times a week, and monthly Role-playing Activities (training - practice - feedback); customized courses target primary school students, with study tours centered on the core links of "knowledge introduction - field exploration - group tasks - achievement sharing" and lasting from half a day to one day.

3.2. Advantages of educational functions

It boasts strong resource adaptability: physical exhibits meet the primary school students' demand for concrete learning, stimulate their inquiry-driven desire, and help resolve difficulties in grasping abstract concepts. It has distinct regional characteristics, highlighting themes of Qinling Ecology and Shaanxi Paleontology to facilitate students' cognition of local knowledge. Additionally, its diversified activity forms—such as group tasks and the "Little Docent" program—promote peer interaction and realize the synergistic development of students' cognitive and social abilities.

3.3. Deficiencies of educational functions

Some exhibition resources have weak interactivity, with a predominance of static displays, resulting in underutilized educational value. There is a lack of hierarchical design in activities, failing to consider the cognitive differences among primary school students aged 6-12; the unified content affects educational precision. The role of parental guidance is underutilized, as some parents lack access to scientific guidance methods, and the museum provides no systematic training or

supporting tools (e.g., parental guidance manuals) for parents. Moreover, the educational effect evaluation system is incomplete, relying solely on student participation and subjective feedback forms, with a lack of quantitative and qualitative evaluations of students' cognitive and social development, making it difficult to support the optimization of exhibitions and education.

4. The impact of museum activities on primary school students

4.1. The impact of museum activities on primary school students' cognitive development

By virtue of authentic specimens, restored scenes, and interactive exhibits, museums provide primary school students with tangible and operable learning tools, which can effectively stimulate students' interest in actively observing the details of exhibitions [4]. For instance, the simulated archaeology exhibit allows students to complete the entire inquiry process of fossil excavation and species identification, directly reinforcing their reasoning and scientific inquiry abilities [5]. Meanwhile, this learning model drives students' cognition of natural science knowledge to evolve from superficial memorization of naming and classifying to in-depth scientific thinking that involves logical interpretation through the analysis of physical evidence. It can further stimulate students' interest in scientific exploration and their sense of self-efficacy.

The interactive simulated archaeology exhibit—where students use small brushes, magnifying glasses, and soft bristles to excavate plaster fossil models in the "simulated fossil pits"—serves as a core scenario for cultivating inquiry ability. Students need to go through the complete process of "cleaning fossils → observing shapes → identifying species by referring to illustrated guides → recording the excavation process", and independently infer the "paleontological types corresponding to the fossils" and their "living environments".

4.2. The impact of museum activities on primary school students' social development

The dual models of peer collaboration and parent-child co-learning in museums significantly enhance the social competence of primary school students. Linguistic interaction itself also constitutes a key component of knowledge construction [6].

In team tasks (e.g., group-based specimen surveys), students are required to divide tasks, cooperate, and complement each other through communication. This not only ensures a more equitable distribution of speech turns but also effectively fosters their communication and collaboration capabilities. In parent-child interactions, parents' effective guidance (such as posing questions to inspire thinking and encouraging the sharing of ideas) helps students develop an evidence-based communication style. It enables students to resort to rational explanations more readily during communication conflicts, enhances the effectiveness of conflict resolution, and thus further optimizes their overall social competence.

5. Key factors affecting the exertion of museums' educational functions

(1)Child Appropriateness of Educational Activity Design

Whether the difficulty, format, and duration of activity design align with the cognitive characteristics and psychological needs of primary school students directly affects the actual effectiveness of educational functions [7].

(2)Depth and Sustainability of School-Museum Cooperation

It isn't easy to achieve cognitive deepening and cultivate social habits through one-off study tours, so schools and museums must establish a mechanism for curriculum linkage and long-term

collaboration. At present, the cooperation between Shaanxi Natural History Museum and most schools is plagued by three deficiencies: the lack of curriculum alignment (museum activities do not accurately match the knowledge points of school science courses); the lack of long-term plans (no semester- or academic year-based cooperation schemes have been formulated); and the lack of extended feedback mechanisms (schools fail to carry out knowledge consolidation or practical activities after the study tours).

(3)Guidance and Support Level of Family Participation

The family serves as an extended learning scenario for museum education, and parental guidance approaches directly determine whether the educational effectiveness is enhanced or diminished. Students who are accompanied and proactively guided by their parents demonstrate better knowledge absorption and a stronger willingness to engage socially.

Specifically, effective guidance includes three dimensions: asking targeted questions during visits (e.g., "What differences do you think exist between this fossil and the dinosaurs we learned about in class?"), encouraging social interaction (e.g., "You can ask the kid next to you how he or she found this specimen"), and conducting post-activity reviews (e.g., "What do you think was the best part of collaborating with your classmates today?"). In contrast, ineffective accompaniment—such as parents taking photos or scrolling through phones the entire time and only urging their children to "hurry up; there is another exhibition area to visit"—not only reduces students' learning engagement and concentration, but also misses the opportunity to foster their social skills through family-based extended education.

6. Conclusion

This study investigates the effects of Shaanxi Natural History Museum's educational functions on the cognitive and social development of primary school students (ages 6-12) and identifies key findings: The museum facilitates students' cognitive growth by integrating physical exhibits, context-based learning, and task-driven methods, bridging abstract knowledge and real-world experience, advancing scientific thinking, and fostering interest and self-efficacy in science. Peer teamwork and parent-child co-learning significantly improve students' social competence, communication, and conflict resolution skills. However, challenges remain regarding age-appropriate activity design, depth of school-museum collaboration, and family engagement, limiting educational outcomes. Solutions include developing tiered curricula, integrating museum content into schools, extending educational activities, and improving parental participation.

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