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学 位 論 文 審 査 の 要 旨

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Proposing a geoeducation framework for China's geoparks through insights derived from
Tokachi-Shikaoi Geopark, Japan

(とかち鹿追ジオパークからの知見にもとづく中国のジオパークに対するジオ教育の枠組み
の提案)

Geoeducation is a critical tool for fostering geoscientific literacy, environmental awareness, and sustainable development among students. As dynamic educational platforms, geoparks provide unique opportunities to bridge classroom learning with real-world geological phenomena. Despite the potential of geoparks to enhance educational outcomes, the efficacy and long-term impact of geoeducation programs remain underexplored, particularly in the Chinese context. This study evaluates geoeducation programs at the Tokachi-Shikaoi Geopark in Japan and the Cuihuashan National Geopark in China, with the aim of enhancing the quality and effectiveness of geoeducation across geoparks in China. The specific aims include (1) to propose a new geoeducation framework in Tokachi-Shikaoi Geopark to maximize the efficacy of geoeducation; (2) to evaluate the current geoeeducational practices at the Cuihuashan National Geopark to understand their efficacy and identify potential improvements; (3) to develop recommendations for enhancing geoeducation at the Cuihuashan National Geopark; and (4) to propose a geoeducation framework for China's geoparks.

A mixed-method approach was employed to ensure a comprehensive evaluation of geoeducation programs. Quantitative data from questionnaire surveys were used to assess students' geo-knowledge comprehension and attitudes before and after participating in geoeducation programs. Qualitative insights were obtained through interviews with educators, geopark staff members, and other stakeholders. Additionally, a content analysis of educational materials, including textbooks and guidebooks, was conducted to evaluate their alignment with geoeducation goals. Statistical tools were used to analyze the findings, ensuring scientific rigor and reliability.

Findings from Tokachi-Shikaoi Geopark demonstrated the notable impact of its 15-year "Geoeducation Program," with 67.0% of participants expressing pride in their local geopark compared to 13.7% of non-participants. Students who participated in the program consistently showed higher geo-knowledge comprehension (mean score: 4.12 vs. 3.53) and a greater interest in geopark-related activities (46.4% vs. 24.2%). However, challenges, such as insufficient teacher training, frequent staff turnover, and

budgetary constraints, limit program continuity and scalability.

At Cuihuashan National Geopark, students participating in study tours exhibited substantial improvements in geo-knowledge. First-time participants' understanding of topics such as "Forces Shaping the Earth's Surface" increased from a mean score of 3.53 to 4.12, with 77.1% reporting heightened environmental awareness post-tour. Familiarity with the geopark increased significantly among both experienced (53.7%) and first-time participants (49.7%). Despite these successes, challenges include the limited integration of geopark content into curricula, large group sizes, and low teacher involvement during tours.

Based on these findings, this study proposes two adaptable models for geoeducation in China's geoparks: (1) a Networked-stakeholder Model for geoparks with robust institutional support, developed based on the Tokachi-Shikaoi Geopark, and (2) a Government-led Model for remote or resource-limited geoparks. The Networked-stakeholder Model can be adopted by many of China's geoparks, whereas the Government-led Model may be adopted by only a few geoparks. Both models emphasize the integration of digital tools, such as e-guidebooks and virtual geotours, to enhance accessibility and engagement. Collaboration with universities and improved teacher training were identified as critical components for advancing geoeducation, even among geoparks under the Government-led Model.

This study concludes with a comprehensive geoeducation framework tailored to the diverse conditions of China's geoparks, designed to maximize the educational impact while promoting sustainability. By leveraging insights from the Tokachi-Shikaoi and Cuihuashan case studies, the proposed framework with the two models addresses critical challenges such as resource limitations, technological adoption, and stakeholder collaboration. This study contributes to the broader goals of fostering geoscientific literacy, environmental conservation, and sustainable development and offers actionable recommendations for policymakers, educators, and geopark administrators.

In addition to the excellent academic knowledge in this research, her academic records throughout the Ph.D. course are outstanding. Based on this evidence, the committee concluded that Shirou Xiang deserves to become a Doctor of Philosophy (Environmental Science).