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Author(s)	MUHAMMAD ZULHILMI, Abdul Azim
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学 位 論 文 内 容 の 要 旨/Dissertation Abstract

博士 (環境科学)

氏 名/Applicant MUHAMMAD ZULHILMI Abdul Azim

学 位 論 文 題 名/Title of Dissertation

Advancing the use of immersive VR in geoscience: Virtual landslide fieldwork for research and education
(地球科学における没入型VRの活用：ランドスライドのバーチャルフィールドワークによる
研究と教育展開)

Immersive virtual reality (VR) is an emerging technology that is gaining attention in the geoscientific community. While preliminary research has explored its applications, its effective integration into geoscientific practice remains fairly limited. Therefore, to add towards this developing field this thesis examines the current trend of VR technology in geoscience followed by an investigation how fieldwork and lectures can be adapted and enhanced through VR technology, with the goal of contributing to both scientific methodology and educational innovation.

The first objective (Chapter 2) is a bibliometric analysis of VR-related geoscience publications over the past eight years (2016-2024) was conducted to identify research trends, synthesizing the academic consensus for such technology, and to forecast its future use in VR Geoscience. This review highlights a growing interest in VR applications for visualization, education, and communication within geoscience. Following that in Chapter 3, the objective is a case study to explore traditional geological fieldwork methods emulation in VR. Focusing on a small-scale landslide, the study showcases how VR can support interactive analysis of such geological landform specimen and also contribute towards the literatures pertaining such topic from a VR-based perspective. Finally in Chapter 4, the thesis examines the use of VR as a medium for geoscience education. Through an outreach project involving middle school students at an international school, the study assesses the usability and motivational impact of VR-based lectures, suggesting that immersive environments can enhance engagement and comprehension of geoscience content.

VR geoscience is still growing, and this thesis believes the considerable potential of this technology to

drive methodological innovation in research and transform geoscience education. To fully harness the potential of VR technology in our science, future research should prioritize the development of diverse, purpose-built tools and frameworks that can support the widespread and effective integration of VR across both scientific investigation and pedagogical practice.

Keywords: *Immersive Virtual Reality, Geoscience, Education, Fieldwork, Systematic Review*