ABSTRAK

Penelitian ini dilatarbelakangi oleh kesulitan peserta didik dalam memahami materi litosfer yang bersifat abstrak, serta keterbatasan media pembelajaran konvensional dalam memvisualisasikan fenomena keruangan seperti struktur lapisan bumi, dinamika lempeng tektonik, dan proses vulkanisme. Penelitian ini bertujuan untuk: (1) mendeskripsikan proses pengembangan media pembelajaran geografi berbasis Augmented Reality (AR) pada materi litosfer di kelas X SMAN 20 Garut; (2) menganalisis efektivitas penggunaan media pembelajaran berbasis AR dalam meningkatkan keterampilan mental map peserta didik; dan (3) mendeskripsikan respons peserta didik terhadap penggunaan media pembelajaran berbasis AR. Penelitian ini menggunakan metode *Research and Development* (R&D) dengan model 4D (*Define*, *Design*, *Develop*, *Disseminate*), yang pada tahap uji coba produk menggunakan pendekatan deskriptif kuantitatif dengan desain *pre-experimental* jenis *one-shot case study*. Subjek uji coba adalah satu kelas peserta didik kelas X yang dipilih melalui teknik *Purposive Sampling*. Instrumen tes keterampilan *mental map* yang terdiri atas 60 butir soal diujicobakan dan dianalisis validitasnya menggunakan korelasi *Pearson Product Moment*, menghasilkan 31 butir soal valid dengan koefisien reliabilitas *Cronbach's Alpha* sebesar 0,812 (kategori tinggi). Hasil penelitian menunjukkan bahwa media pembelajaran berhasil dikembangkan melalui keempat tahap model 4D dan dinyatakan valid serta layak digunakan berdasarkan validasi ahli materi, ahli media, dan Kepala Sekolah. Hasil *posttest* menunjukkan keterampilan *mental map* peserta didik mencapai persentase sebesar 79,93% (kategori baik), dengan capaian tertinggi pada indikator *Developing Mental Maps* (81,48%) dan capaian terendah pada indikator *Individual Perceptions Shape Mental Maps* (75,00%). Temuan ini didukung oleh data kualitatif berupa penilaian sketsa peta persebaran gunung api dan batas lempeng dunia yang dibuat oleh 18 kelompok peserta didik, dengan rata-rata capaian sebesar 71,88% (kategori baik), memperkuat pembuktian efektivitas media secara triangulatif antara data kuantitatif dan kualitatif. Hasil angket menunjukkan respons peserta didik terhadap media pembelajaran berada pada kategori sangat positif dengan persentase sebesar 83,89%. Penelitian ini menyimpulkan bahwa media pembelajaran geografi berbasis AR efektif digunakan untuk meningkatkan keterampilan *mental map* peserta didik pada materi litosfer, namun bersifat deskriptif-kontekstual pada subjek uji coba karena keterbatasan desain penelitian yang tidak melibatkan kelompok kontrol.

Kata Kunci: *Augmented Reality*, media pembelajaran geografi, model 4D, keterampilan *mental map*, litosfer

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ABSTRACT

This research was motivated by students' difficulty in understanding lithosphere material, which is abstract in nature, as well as the limitations of conventional learning media in visualizing spatial phenomena such as earth layer structures, tectonic plate dynamics, and volcanic processes. "This study aims to: (1) describe the development process of Augmented Reality (AR)-based geography learning media on lithosphere material in Grade X of SMAN 20 Garut; (2) analyze the effectiveness of AR-based learning media in improving students' mental map skills; and (3) describe students' responses toward the use of AR-based learning media." a. This study employed the Research and Development (R&D) method with the 4D model (Define, Design, Develop, Disseminate), in which the product trial stage applied a descriptive quantitative approach using a pre-experimental one-shot case study design. The trial subject was one class of Grade X students selected through Purposive Sampling technique. The mental map skills test instrument, initially consisting of 60 multiple-choice items, was tried out and analyzed for validity using Pearson Product Moment correlation, resulting in 31 valid items with a Cronbach's Alpha reliability coefficient of 0,812 (very high category). The results showed that the learning media was successfully developed through the four stages of the 4D model and was declared valid and feasible based on validation by the material expert, media expert, and the school principal. The posttest results indicated that students' mental map skills reached a percentage of 79.93% (good category), with the highest achievement on the Developing Mental Maps indicator (81.48%) and the lowest on the Individual Perceptions Shape Mental Maps indicator (75.00%). These findings were supported by qualitative data from the assessment of group sketch maps depicting the distribution of volcanoes and world tectonic plate boundaries, created by 18 student groups, with an average achievement of 71.88% (good category), reinforcing the triangulated evidence of media effectiveness through both quantitative and qualitative data. The questionnaire results showed that students' responsses toward the learning media fell into the very positive category, with a percentage of 83.89%. This study concludes that AR-based geography learning media is effective in improving students' mental map skills on lithosphere material; however, the findings remain descriptive-contextual to the trial subjects due to the limitations of the research design, which did not involve a control group.

Keywords: *Augmented Reality, geography learning media, 4D model, mental map skills, lithosphere*

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