



**Development of a Web Application for Enhancing English Vocabulary Learning
Achievement among Secondary School Students Based on Spaced Repetition and Active
Recall**

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Abstract

English plays a vital role in education and communication, with vocabulary serving as a fundamental component of language learning. However, traditional memorization methods are often ineffective for long-term retention, limiting students' ability to recall and apply vocabulary effectively. To address this issue, this project developed a web application based on Spaced Repetition and Active Recall principles. The application includes vocabulary management, interactive flashcards, classroom management tools, pre- and post-test recording systems, and a learning analytics dashboard. The effectiveness of the system was evaluated using a pre-test/post-test experimental design with 40 secondary school students (20 Grade 8 students and 20 Grade 10 students). Data were analyzed using a paired-sample t-test, Cohen's d, Normalized Gain, and the Effectiveness Index (E.I.). The results showed that the mean scores of Grade 8 students increased from 68.8% to 92.3% (Normalized Gain = 0.75, E.I. = 0.7520), while Grade 10 students' mean scores increased from 53.5% to 75.3% (Normalized Gain = 0.47, E.I. = 0.4677). Statistical analysis confirmed that the post-test scores of both groups were significantly higher than their pre-test scores ($p < .001$), with a large effect size (Cohen's $d > 1.00$). These findings demonstrate that this web application effectively improves English vocabulary learning achievement and provides a digital learning tool that supports personalized learning, progress tracking, and educational assessment. Furthermore, this project aligns with Sustainable Development Goal 4 (SDG 4): Quality Education by leveraging digital technology to promote equitable access to quality education.

Keywords: Flashcards, English Vocabulary Learning, Web Application, Spaced Repetition, Active Recall,