

論文 / 著書情報  
Article / Book Information

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Title(English)	An AI-based writing assistant ' s impact on English language learners ' writing proficiency
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種別(和文)	論文要旨
Type(English)	Summary

(博士課程)  
Doctoral Program

## 論文要旨

THESIS SUMMARY

系・コース : Transdisciplinary  
Department of, Graduate major in Science and Engineering  
Global Engineering for Development,  
Environment and Society

系  
コース

申請学位 (専攻分野) : 博士  
Academic Degree Requested Doctor of  
(Philosophy)

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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words )

The dissertation titled, “An AI-based writing assistant’s impact on English learners’ writing proficiency” contains three empirical studies which employed a novel online writing assistant as a treatment condition. In addition, the dissertation gives a brief overview of AI in education policies and trends in Japan and the United States. Lastly, a mixed-methods qualitative study on educators’ views of AI-assistance in the classroom is included to give a better holistic perspective on a potentially disruptive technology.

Chapter 1 (Introduction) gives a background to the reasoning behind this research, the framework developed for the writing application that was used, the research in context of Japan and why English language writing support is needed, and the methodology used for all the experiments and research conducted.

Chapter 2 (Exploring an AI-based writing assistant’s impact on English language learners: A pilot study.) introduces the AI-based web application called “AI KAKU”. The application assists English learners in reducing the cognitive barriers they face when producing written text in English. While there has been much research and discussion on Automated Writing Evaluation (AWE) technologies or older technologies such as spell check and grammar check, few studies have attempted to use AI-based tools as learning aids instead of feedback agents. The application was developed by first making conceptual design wireframes and then launching a usable web-based application. Shortly after, a small group of adult English as a Foreign Language (EFL) participants were recruited in a counter-balanced experiment to evaluate the potential impact of AI KAKU on student writing. The results of the experiment indicated that this is a potentially useful tool for English language learners who need more structured assistance than traditional word processors.

Chapter 3 (Examining the equity of a novel intelligent writing assistant as English language support via cognitive load and writing quality measures) builds upon the positive outcomes of the pilot study. The researcher decided to continue to investigate the impact AI KAKU has on EFL students by conducting a larger study that investigates more aspects of the writing process. The participant’s cognitive functions and how AI KAKU affects participants with different English ability were key research questions in this second experiment. When practitioners introduce new educational technologies into their classrooms, the potential for unintended outcomes from their use might arise. One such potential negative artifact is an increase in the achievement gaps between learners, where high performers tend to benefit more from newly introduced educational technologies than their peers. In the second experiment, the researcher leverages AI KAKU while investigating the equity of the tool. Participants self-reported their EIKEN English proficiency scores, and their performance was analyzed according to three writing factors as well as their perceived cognitive load while using the tool. While we see gains among participants while they are using AI KAKU, analysis on how the tool was impacting participants of different levels was inconclusive.

Chapter 4 (Impact on second language writing via an intelligent writing assistant and metacognitive training) contains the final experiment investigating second language learners’ writing output using AI KAKU in addition to exposure to training and metacognitive prompts in order to improve their critical

thinking. This study employs a randomized control trial with university-level participants using AI KAKU and metacognitive prompting and nudging. EFL participants were given question prompts in the TOEFL iBT independent writing task style, and the outputs were assessed (machine and human) using several measures for writing quality. All participants were shown short explanatory videos for TOEFL writing advice and metacognition training. The treatment group, exposed to the next-word prediction writing aid and metacognitive prompts, performed better than the control group even though both received the same training and writing opportunities. This study indicates there is value in providing writing support and metacognitive thinking practice to improve writing skills and, ultimately, writing output quality. This study was the most involved from a research design perspective and from a data analysis perspective. Over 360 writing samples were evaluated in a timely and reliable manner while using the limited amount of human capital that was available. In addition, a more multidimensional effort was made to improve participant writing by introducing the concepts of metacognitive writing strategies. This third experiment introduces novel solutions in both the design and novel outcomes that can be applied to larger bodies of work in applied linguistics, computational linguistics, and human-computer interface research.

Chapter 5 (Chapter 5 Policies and applications of AI in education: A perspective from two advanced countries.) discusses AI in education policy as a general topic in order to have a wider view of trends and policy level initiatives surrounding artificial intelligence in society. Specifically, the chapter looks at the application of AI and how the United States and Japan have used these systems. Recent trends in educational technology suggest that AI in Education (AIED) is an emerging and potentially disruptive field that will have a vast impact on both learners and educators. How to use AI to make clear pedagogical progress is still in its infancy and at the same time, broader issues such as how AI will impact learning, and the ethical considerations of human-machine output are also unclear.

Chapter 6 (Chapter 6 Artificial intelligence in education: Educators' perspective on an emerging technology) turns its focus to in-service educators to gain some insight into their outlook and opinions of artificial intelligence and its use in the classroom. Increasingly, educators and education policymakers have started to recognize the potential for artificial intelligence to be a disruptive technology in the classroom. However, few studies have investigated educators' knowledge and attitudes surrounding the use of these technologies. This chapter uses a mixed-methods approach to gain qualitative (interviews, open response questions) and quantitative (Likert survey; sentiment analysis) data to gain an understanding of educators' perspective on the concept of artificial intelligence, its use in the classroom, and their outlook on how the technology may impact learning outcomes and teaching practice.

Chapter 7 (Conclusion and Future Work) summarizes the results of the three experiments and notes the constraints and limitations. Issues of equity and how to frame artificial intelligence based applications in educational contexts is also discussed.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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