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Effects of the Havruta learning method using ChatGPT on pre-service early childhood teachers' AI and creative teaching efficacy

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Abstract

This study aimed to examine the effectiveness of the Havruta learning method using ChatGPT to improve the teaching efficacy of pre-service early childhood teachers. The effects of the Havruta teaching method in classes using ChatGPT on improving teaching efficacy were analyzed in a group of pre-service early childhood teachers to explore the direction of teaching and learning to improve the future educational capabilities required of prospective teachers. The participants were sophomores enrolled in a "Curriculum for Early Childhood Education" course at a university in Korea (Gyeonggi Province). During the 15-week of early childhood curriculum classes course, Havruta classes using ChatGPT were conducted for 12 weeks, excluding midterm and final exams. A paired-sample t-test was performed to verify the effectiveness of enhancing pre-service early childhood teachers' teaching efficacy. The analysis showed that the Havruta learning method using ChatGPT positively affected both AI teaching efficacy and creative teaching efficacy for pre-service early childhood teachers. The findings verify that Havruta classes using ChatGPT are meaningful teaching and learning methods for pre-service early childhood teachers as future educators.

Keywords : *ChatGPT, Havruta, AI teaching efficacy, Creative teaching efficacy*

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Introduction

With the advent of the Fourth Industrial Revolution, people have been experiencing explosive changes and digital evolution, often called the “digital big bang.” Social and cultural changes surrounding education and advances in knowledge and information technology are accelerating the need for innovation in the future educational environment (Ministry of Education, 2019, 2021). Thus, innovation in teaching and learning methods is needed to keep up with this educational paradigm shift. Changes must be made to move from correct answer-oriented education to creativity education and from learning content-oriented education through teaching lectures to problem-solving-oriented education for learners. Furthermore, changes are needed to facilitate self-directed education, cooperative education in the convergence era, and education using artificial intelligence (AI) (Kwon, 2019; Zhang, 2021).

South Korea's entrance examination-based education system for university admission has led to many students lacking the skills future generations will require, such as creativity, communication, collaboration, and problem-solving (Choi & Ju, 2016). Most university classes are lecture-based, with the instructor imparting knowledge and the learner being a one-way receiver. This teaching method is limited in its ability to change students’ attitudes toward learning (Cho et al., 2023); thus, universities must innovate and educate future generations (Korean Educational Development Institute, 2023).

The need to prepare young children for the future has resulted in an international trend to include digital media as a critical component of education (OECD, 2021; UNESCO, 2018). AI competency and creativity are key skills for the future workforce as the Fourth Industrial Revolution rapidly transforms society and is an important part of the curriculum that must be considered. South Korea's “Comprehensive Plan for Digital Human Resources Development,” announced in August 2022, also includes measures to connect early childhood education with digital technology and strengthen the capabilities of prospective and current teachers in using AI and digital technology (A Joint Meeting of Relevant Ministries, 2022). Therefore, the need to develop these competencies must be emphasized in curricula that train the teachers responsible for educating the next generation.

Recently, AI has brought new directions and possibilities to the education field.

Incorporating AI into the classroom can improve the efficiency of education. In response, a growing number of attempts have been made to use ChatGPT (https://chat.openai.com), a conversational AI service operated by Open AI, for education (Kim et al., 2023). ChatGPT proliferated rapidly, with 100 million users registered globally within approximately two months of its launch in November 2022 (Y. Kim, 2023). Some domestic and international universities are paying attention to using ChatGPT, such as declaring a code of ethics for using AI or checking learners' experience.

ChatGPT can be beneficial in the classroom, as it utilizes AI technology to enable questions and answers tailored to the individual student (Choe, 2023; W. S. Kim, 2023). ChatGPT is a scaffolding tool that provides customized hints that fit the student's zone of proximal development and can help realize learner autonomy (Ahn et al., 2023; Shin et al., 2023). However, the limitations of ChatGPT are important to consider when utilizing it in academia, such as finding proper teaching and learning methods, ensuring a lack of issues with ethics or academic integrity such as plagiarism, addressing difficulties in providing up-to-date information caused by limited data learning, and dealing with originality issues (Han, 2023; Kang, 2023). Therefore, designing instructional methods that compensate for these limitations and allow learners to utilize ChatGPT properly as a learning tool is crucial. Learners should be active decision-makers and utilize ChatGPT. Furthermore, the various types of information provided by ChatGPT need to be utilized and combined with learner-led classes that solve problems so that learners can develop AI capabilities.

The Havruta learning method has recently gained traction as an alternative teaching method that embraces self-directed learning (Byon, 2022). Havruta, from the Hebrew word "Haver," is a traditional Jewish study method that means togetherness, friendship, and companionship (https://ko.wikipedia.org/wiki/). Havruta learning allows students to practice autonomous learning through conversations with peers and colleagues rather than with an instructor (Kwon, 2019). Students teach each other, prepare for discussions on their own, and conduct discussions in equal positions among other learners (Kent, 2010). Havruta classes are diverse, including comparison-centered, question-centered, problem-making, and debate-centered Havruta (Jeon, 2014). This method is similar to a traditional debate class but without the competitive communication aspect in which different sides argue for and against a topic and try to persuade others to accept their side. Instead, students are encouraged to listen to,

reaffirm, and rephrase other people's opinions, rather than defend their own, to understand and solve problems through interaction (Kent & Allison, 2012). Through this process, learners experience mutual respect and collaborative communication and develop self-directed learning, critical thinking, and problem-solving skills (Go et al., 2017; Kim et al., 2022; Kwon, 2019).

Questions play a key role in the search for knowledge and problem-solving processes with both ChatGPT and Havruta learning. In both ChatGPT and Havruta, questions are not simply a means of getting answers but tools to broaden the boundaries of thought and explore new perspectives. It refers to the process of leading the learner to explore knowledge and add depth of understanding by becoming the master of his or her learning process through questions in ChatGPT and Havruta (Kim, 2024). Therefore, utilizing ChatGPT in the Havruta learning process enables diverse perspectives, continuous conversation and feedback, and personalized learning. Individual learners can use ChatGPT and check specific examples to receive personalized support through interactions by generating questions on things about which they are curious or find difficult to understand (Kohnke et al., 2023).

The 2019 Revised Nuri Curriculum, the national curriculum for early childhood education in South Korea, emphasizes teacher expertise, autonomy, and collaborative learning to implement a curriculum co-created by teachers and students (Ministry of Education & Ministry of Health and Welfare, 2019). Running a child-centered and play-centered curriculum requires pre-service early childhood teachers to be trained to identify the interests and concerns of young children and respond appropriately to situations in the field (Cho et al., 2023). Teaching efficacy is a belief in one's ability to teach and an important predictor of student motivation and achievement. Therefore, support for the development of teaching efficacy is vital in pre-service teacher education programs. In particular, students must be educated on cultivating AI and creative teaching efficacy to enable future education that reflects the changing times (Lee et al., 2020).

AI teaching efficacy refers to a teacher's beliefs about using AI and includes expectations of teaching outcomes, personal teaching efficacy, and interaction with AI (Yi et al., 2021). Creative teaching efficacy is a teacher's belief in their own capability to use creative teaching methods to influence young children's creative achievement (Kim, 2007). Specifically, it encompasses personal self-efficacy, which is a teacher's belief in their ability to engage in

creative teaching, and outcome expectancy, which is a teacher's belief in their ability to influence young children's creative achievement.

Several studies have shown that teaching with the Havruta learning method facilitates pre-service teachers' creative teaching efficacy (Go et al., 2017; Jeong & Choi, 2020; Lee, 2019; Zhang, 2021). Future of Education-based instruction has also been reported to have a positive impact on teacher efficacy (Hong & Lim, 2020; Song, 2016). However, although previous studies have demonstrated the effectiveness of Havruta and ChatGPT separately, no studies have examined the effectiveness of Havruta classes using ChatGPT. Furthermore, the studies that have examined the effectiveness of AI in teaching have focused on pre-service middle and high school teachers (Lim et al., 2023; Yu, 2023). As early childhood education and digital connections are being actively explored, how to utilize ChatGPT for prospective early childhood teachers must be considered.

Therefore, this study investigated whether the Havruta learning method combined with ChatGPT has a positive effect on AI and creative teaching efficacy among pre-service early childhood teachers. Through this study, we aim to explore the direction of teaching and learning to enhance future educational competencies for pre-service teachers. This study addresses two research questions. First, how does the AI teaching efficacy for pre-service early childhood teachers change after using the Havruta learning method with ChatGPT? Second, how does the creative teaching efficacy of pre-service early childhood teachers change after using the Havruta learning method with ChatGPT?

Method

Participants

This study was conducted from September to December 2023 with university students taking a course titled “Curriculum for Early Childhood Education.” The participants were pre-service early childhood teachers in their second year at E University in South Korea. The participants had never utilized ChatGPT or experienced Havruta in their major and liberal arts courses.

Instrument

This study used a questionnaire to measure pre-service early childhood teachers' AI and creative teaching efficacy. To measure AI teaching efficacy, we modified an instrument developed by Lee et al. (2021) to fit this study's purpose. This scale has 30 questions and five subfactors: teaching outcome expectations for AI (7 questions), conceptualization of AI (7 questions), attitudes toward the social impact of AI (4 questions), personal teaching efficacy for AI (8 questions), and interaction with AI (4 questions). Each item is rated on a 5-point Likert scale, with higher scores indicating higher AI teaching efficacy. The AI teaching efficacy scale demonstrated good item construct validity and reliability, with a Cronbach's α coefficient of .89.

To measure creative teaching efficacy, we used an instrument developed by Lee and Choi (2016) and modified and supplemented by Zhang (2021). The scale comprises 18 questions and three subfactors: creative teaching practice efficacy (4 questions), creative teaching strategy efficacy (5 questions), and creative thinking efficacy (9 questions). Each item is rated on a 5-point Likert scale, with higher scores indicating higher creative teaching efficacy. The creative teaching efficacy scale showed good item construct validity and reliability, with a Cronbach's α coefficient of .91.

Data collection and analysis procedures

We applied the Havruta learning method using ChatGPT with a group of pre-service early childhood teachers and examined changes in their teaching efficacy. During the first week of class orientation, the students were informed that the class would be conducted using the Havruta learning method with ChatGPT and that the results would be used for research. Then, the study's purpose and content were briefly explained, and the students confirmed their willingness to participate. We explained that the data collected during their participation would be used only for research purposes, and the participantsthanonymity and confidentiality would be guaranteed. We also explained that they could withdraw at any time if they wanted to stop participating in the study without being punished in any way. Then,

the students were given a pre-test questionnaire on the efficacy of AI education and creative education and asked to complete the pre-test if they agreed to participate in the study. In the second week, we introduced the method and cases using the Havruta learning method with ChatGPT. We then conducted the class using the Havruta learning method with ChatGPT every week, excluding midterm and final exams. We conducted a total of 12 classes using the Havruta learning method with ChatGPT, and at the end of the course, we examined the changes in the teaching efficacy of early childhood teachers. The scales measuring AI and creative teaching efficacy were administered before and after the course to examine any changes. The same instrument was used for the pre-test and post-test, and to minimize the effect of repeated measures, the tests were spaced sufficiently far apart and the items were arranged differently. We examined the differences between participants pre- and post-test scores.

We utilized ChatGPT in conjunction with Havruta lessons in this course. For example, in the comparison-oriented Havruta class, ChatGPT was used when comparing the similarities and differences between two concepts. In the question-oriented Havruta class, questions related to the learning content were created using ChatGPT, which was indicated next to the question. In the argumentation-based Havruta class, ChatGPT was used to refine arguments and organize opinions on general dissent or alternative perspectives on the subject. Before the midterm and final exams, we held a problem-creation Havruta class in which students summarized what they had learned in class and refined the problems they created by discussing them in pairs and then again as a group to create anticipatory questions. Table 1 outlines the lecture content by week.

We used the software program SPSS WIN 23.0 to analyze the effects of the Havruta learning method using ChatGPT on AI and creative teaching efficacy. Descriptive statistics were analyzed to characterize the variables, and a reliability analysis was performed using Cronbach's α coefficient to verify the reliability of the scales. Paired-sample t-tests were used for pre–post analysis to verify the effectiveness of the Havruta class using ChatGPT.

Table 1. *"Curriculum for Early Childhood Education" content overview*

Schedule	Class management	Learning topics	Content of the learning activities
Week 1		- Orientation	- Introduction to the course - A guide to assignments and evaluation methods - Havruta learning method guide - Administer pre-test
Week 2	- ChatGPT	- Foundations of Early Childhood Curriculum	- Concepts in the Early Childhood Curriculum - Introduction to ChatGPT - How to use ChatGPT
Week 3	- Havruta - ChatGPT	- History of Early Childhood urriculum 1	- Formation and Development of the Early Childhood Curriculum - Comparison-oriented Havruta using ChatGPT - Write a reflection journal
Week 4	- Havruta - ChatGPT	- History of Early Childhood Curriculum 2	- Re-conceptualization of the early childhood curriculum - Comparison-oriented Havruta using ChatGPT - Write a reflection journal
Week 5	- Havruta - ChatGPT	- National Early Childhood Education Curriculum	- Korean and foreign national early childhood education courses - Question-oriented Havruta using ChatGPT - Write a reflection journal
Week 6	- Havruta - ChatGPT	- Child, Play, Teacher	- Understanding toddlers, play, and teachers - Question-oriented Havruta using ChatGPT - Write a reflection journal
Week 7	- Havruta - ChatGPT	- Organization of Early Childhood Curriculum	- Early Childhood Education Curriculum Organization - Understanding the composition of Nuri courses - Problem-creation Havruta using ChatGPT -Write a reflection journal
(Omission in the middle)			
Week 15		- final exams	- perform final exams - perform post-test

Results

Changes in pre-service early childhood teachers' AI teaching efficacy

To investigate the learning effect of the Havruta learning method using ChatGPT, we analyzed whether the pre-service early childhood teachers' AI teaching efficacy changed after the course. As Table 2 shows, participants AI teaching efficacy increased after using the Havruta learning method with ChatGPT. Furthermore, the scores for the sub-factors, such as AI concept recognition, attitude toward the social impact of AI, personal teaching efficacy toward AI, and interaction with AI, all increased. Thus, the Havruta learning using ChatGPT facilitated a positive change in the development of AI teaching efficacy.

Table 2. *Differences in AI teaching efficacy (Pre–post test results) (N=22)*

Classification	Test	Mean	Standard deviation	*t*
Teaching outcome expectations for AI	Pre-test	2.86	.46	-11.63***
	Post-test	4.38	.31	
AI concept recognition	Pre-test	3.27	.39	-10.59***
	Post-test	4.61	.36	
Attitudes toward the social impact of AI	Pre-test	2.26	.48	-13.52***
	Post-test	4.30	.56	
Personal teaching efficacy for AI	Pre-test	2.66	.49	-11.31***
	Post-test	4.38	.41	
Interacting with AI	Pre-test	2.66	.39	-11.77***
	Post-test	4.39	.36	
Total	Pre-test	2.66	.39	-13.80***
	Post-test	4.39	.36	

****p* < .001

Changes in pre-service early childhood teachers' creative teaching efficacy

To investigate the learning effect of the Havruta learning method using ChatGPT, we

analyzed changes in participants' creative teaching efficacy after the course compared with the scores from the pre-test. Table 3 shows the results. The mean scores increased for overall creative teaching efficacy and the subfactors of creative teaching performance efficacy, creative teaching strategy efficacy, and creative thinking efficacy after participants completed the Havruta class using ChatGPT. These findings indicate that using the Havruta learning method combined with ChatGPT can have a positive influence on the development of creative teaching efficacy.

Table 3. *Differences in creative teaching efficacy (pre–post test results) (N=22)*

Classification	Test	Mean	Standard deviation	*t*
Creative teaching practice efficacy	Pre-test	3.07	.50	-15.93***
	Post-test	4.75	.30	
Creative teaching strategy efficacy	Pre-test	3.13	.55	-14.45***
	Post-test	4.77	.36	
Creative thinking efficacy	Pre-test	2.90	.41	-17.76***
	Post-test	4.66	.39	
Total	Pre-test	3.03	.44	-18.55***
	Post-test	4.73	.33	

****p* < .001

Discussion

This study explored directions in teaching and learning to enhance pre-service teachers' future teaching competencies. Accordingly, we examined whether a Havruta learning method utilizing ChatGPT was effective in enhancing pre-service early childhood teachers' AI and creative teaching efficacy. The conclusions of the analysis are discussed below.

First, the Havruta learning method utilizing ChatGPT was found to have a positive effect on pre-service early childhood teachers' AI teaching efficacy. When examining the subfactors, positive changes were found in participants' efficacy in teaching outcome expectations for AI, conceptualization of AI, attitudes toward the social impact of AI, personal teaching

efficacy for AI, and interaction with AI. These results align with the findings of Zhang (2021) and Jang and An (2019), who found that training in AI technology utilization had a positive effect on pre-service teachers' AI technology utilization. AI teaching efficacy is a teacher's beliefs about using AI, including expectations of teaching outcomes, personal teaching efficacy, and interactions with AI (Lee et al., 2021). Our results show that a class in which students can use ChatGPT in various discussion situations is a meaningful way to increase their awareness and ability to utilize AI. Since the COVID-19 pandemic, early childhood education and AI have become more closely related. AI is being used in educational settings, with an increasing number of young children using it as a convenient tool for daily life and play (Lee & Jeun, 2024; Valadas et al., 2024). Pre-service early childhood teachers need to cultivate capabilities to educate the next generation. Therefore, we will guide you on the cautions of using ChatGPT in the classroom, and if applied appropriately, it will be effective for training prospective teachers.

Second, the Havruta learning method using ChatGPT was found to have a positive effect on pre-service early childhood teachers' creative teaching efficacy. When examined by subfactors, positive changes were found in participants' efficacy in creative teaching practices, creative teaching strategies, and creative thinking. These results are consistent with those reported in several previous studies showing the effectiveness of the Havruta method in improving prospective teachers' creative teaching efficacy (Go et al., 2017; Lee, 2019). Thus, the findings suggest that the Havruta learning method can provide meaningful instruction to prepare pre-service teachers for university and early childhood settings, as it promotes beliefs and practice efficacy in teaching strategies for creative classroom practices that reflect recent changes in the field of education.

The implications and suggestions for follow-up research on the curriculum operation and class operation direction of pre-service early childhood teacher training derived from this study are as follows.

First, the application of the Havruta learning method using ChatGPT needs to be expanded to various subjects that require practical knowledge for pre-service early childhood teachers. The 2019 revised Nuri Curriculum emphasizes the importance of supporting a child-centered, play-centered curriculum through teachers' professionalism. Education to enhance teaching efficacy is necessary to critically analyze various situations that teachers encounter while

operating a child-led, play-centered curriculum in the field and provide appropriate support. Teachers with high teaching efficacy are willing to make continuous voluntary efforts to increase students' learning efficiency (Ramey-Gassert, 1993), and teacher education is the most important influencing factor for teaching efficacy. Through this study, we were able to verify that a Havruta class using ChatGPT can effectively increase pre-service teachers' professionalism, autonomy, and teaching efficacy to practice collaborative learning for implementing a curriculum that teachers and children create together. Havruta classes are centered around learning through cooperation, and ChatGPT acts as a virtual partner with which students can cooperate, helping to achieve common learning goals through discussion and debate. Utilizing the Havruta learning method and ChatGPT together enables continuous conversation and feedback and personalized learning from various perspectives. Therefore, if the Havruta learning method using ChatGPT is applied to a wider range of subjects, we expect it will be possible to foster prospective early childhood teachers' professionalism by improving learner-led classes and understanding of the field.

Second, in addition to classes using ChatGPT, innovative teaching methods that can foster various future education capabilities should be developed for and applied with pre-service early childhood teachers. Introducing ChatGPT to Havruta classes is meaningful in that it applies a new form of education that combines ancient traditional learning methods with modern cutting-edge technologies. In addition, it helps prospective early childhood teachers stay current with the changing paradigm of the times (Ministry of Education, 2021) and strengthen their AI and digital capabilities (A Joint Meeting of Relevant Ministries, 2022; OECD, 2021; UNESCO, 2018). ChatGPT can help broaden one's thinking and encourage the pursuit of deeper understanding by providing opportunities to ask various questions, participate in problem-solving discussions, and explore new perspectives. In addition, ChatGPT can continuously interact with students regardless of time and place, creating a sustainable learning environment. In addition, it can provide questions and answers tailored to each student's educational level and needs, so it can provide personalized learning support. Therefore, classes that utilize AI, such as ChatGPT and integrate Havruta, need to be developed and implemented. In the current pre-service teacher training course, AI utilization education is partially taught through specific subjects such as educational technology. AI convergence classes for improving AI teaching efficacy need to be expanded to general

teacher training rather than only covering specific classes. Thus, a virtuous cycle is crucial to fostering AI future talents, starting with pre-service teacher training. Accordingly, education for professors on various innovative teaching and learning methods and the operation of a flexible academic system need to be supported.

Third, this study used quantitative analysis to examine the effectiveness of the Havruta learning method using ChatGPT. The findings indicated that this is an effective teaching and learning method that provides an opportunity to improve the educational efficacy necessary for high-quality education among pre-service early childhood teachers. However, given the small number of participants, the generalization of the findings is limited. Therefore, multi-faceted analyses need to be conducted in future research to examine the differences in effectiveness according to the characteristics of each learner and the process of change in learner perception and to seek the meaning of the class and direction of high-quality operation.

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