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# Research on the development of principles for designing elementary English speaking lessons using artificial intelligence chatbots

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The present study was conducted with the aim of developing principles for designing elementary English speaking lessons using artificial intelligence chatbots. To achieve this, design and development research methods were applied, and initial design principles and detailed guidelines were developed through a review of relevant literature. Subsequently, the design principles were modified and refined through two rounds of expert validation and usability evaluation. The research results yielded a total of 10 principles for designing elementary English speaking lessons using artificial intelligence chatbots, including: 1) principle of media selection, 2) principle of creating a learning environment, 3) principle of content restructuring, 4) principle of stimulating and sustaining interest and motivation, 5) principle of providing guidance, 6) principle of scaffolded learning support, 7) principle of individualized feedback provision, 8) principle of fostering a learning environment that supports growth and development, 9) principle of communication and collaboration, and 10) principle of learning management. Additionally, a set of 24 detailed guidelines necessary for implementing each lesson design principle was developed. Based on the research findings, the principles for designing elementary English speaking lessons using artificial intelligence chatbots, as well as the theoretical and practical implications of the study, were discussed. Finally, the limitations of the research were identified, and suggestions for future research were proposed.

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## Introduction

We are currently living in the era of the Fourth Industrial Revolution. With the rapid advancement of digital technologies such as artificial intelligence, big data, and the Internet of Things, fundamental innovations have occurred in various fields, leading to extensive changes throughout society. Education in schools is no exception. There is a growing trend of actively integrating these cutting-edge technologies into classrooms. Furthermore, with the widespread adoption of online education and remote learning due to the COVID-19 pandemic that began in 2020, there has been increased interest in utilizing various educational technologies (Edu-tech) for teaching and learning. The development of technology plays a catalytic role in changing the paradigm of the education system, and we are entering an era of a major transformation in education. In recent years, there have been various movements reflecting the current trends in English education in South Korea. In an English as a Foreign Language (EFL) environment like ours, students have very limited opportunities to use English in their daily lives. Therefore, it is important to maximize students' speaking opportunities within the regular curriculum time to enable them to naturally acquire English. However, it is currently challenging to achieve this in Korean classrooms. Students only have 2 h per week (for grades 3–4) or 3 h per week (for grades 5–6) dedicated to learning English, which is insufficient for practice. Additionally, with an average class size of 23 students (OECD, 2019), it becomes difficult to provide appropriate feedback for individual speaking practice. Furthermore, there is a wide range of English proficiency levels among students in the classroom. However, assignments are uniformly provided, making it too easy for proficient students to practice the target language in the textbook, resulting in a lack of motivation to participate in the learning process. On the other hand, struggling students find it too difficult to even speak the target language and therefore refrain from verbal participation. Therefore, teachers need to explore the use of various Edu-tech tools in line with the current trends to address these issues and provide personalized lessons tailored to students' levels, while offering effective feedback.

With the recent advancements in machine learning and deep learning, which are key technologies in artificial intelligence, learners now have access to various English programs. Artificial intelligence technologies are considered as alternatives to overcome the physical limitations of the EFL education environment, and there is a growing interest in the potential use of AI chatbots. Various interactive AI English education programs have been developed, and attempts are being made to integrate them into school education. Due to the high interest in AI chatbots, diverse research studies on AI chatbots in English education, both domestic and international, are underway. These studies include analyses of the characteristics of AI chatbots (Coniam D, 2014; Kim et al., 2022; Haristiani N, 2019; Huang et al., 2019; Kılıçkaya F, 2020; Dokukina I and Gumanova J, 2020; Pérez JQ et al., 2020; Yin Q and Satar M, 2020; Yoon and Park, 2020), research on developing AI chatbots (Mondal et al., 2018; Lee, 2018; Muhammad AF et al., 2020; Sung, 2022), and research on the use of AI chatbots in teaching and learning in school settings (Gayathri AN and Rajendran VV, 2021; Lin CJ and Mubarak H, 2021; Jeon, 2022; Yoo, 2021; Wu, 2022; Yang J, 2022; Mendoza S et al., 2022; Abidin et al., 2022). Although many research results have emerged, particularly in 2021, regarding the use of AI chatbots in teaching and learning in school settings, there is still a significant lack of related research. This is because there have not been many cases of utilizing AI chatbots in school settings, and research on the role of teachers and principles of lesson design in AI chatbot-assisted classes has been insufficient. In particular, it

has been challenging to find research targeting elementary school students, likely due to their lower vocabulary level and limited proficiency in using diverse sentence structures, as the regular English curriculum is introduced from the third grade of elementary school in South Korea. However, it is expected that developing and implementing AI chatbots that incorporate vocabulary levels and sentence structures suitable for elementary English education, while stimulating learners' interest, would yield significant effects (Kim and Lee, 2020; Chu and Min, 2019; Xia Q et al., 2023). Therefore, there is a strong demand for research on developing AI chatbots for use in elementary English classes and the principles of lesson design for AI chatbot-assisted classes.

The aim of this study is to develop principles for designing elementary English speaking lessons using AI chatbots and validate their effectiveness. Through this research, the developed principles for designing elementary English speaking lessons using AI chatbots will guide teachers in effectively incorporating AI chatbots into their English classes at the elementary school level, enabling students to achieve cognitive and affective goals in the English subject. In other words, the objective of this study is to develop design principles that guide the instructional design of elementary English speaking lessons using AI chatbots from an educational technology perspective. The specific research questions set to achieve these objectives are as follows:

1. What are the principles for designing elementary English speaking lessons using AI chatbots?
2. Are the principles for designing elementary English speaking lessons using AI chatbots valid?

## Theoretical background

**Elementary English curriculum in South Korea.** In Korean elementary schools, English education was introduced as a new subject in the 6th national curriculum (1992–1997) and became an official subject in 1997. Since the 7th national curriculum (1997–2007) until the present, the overarching goal of the English curriculum has been to enhance English communication skills. In the revised curriculum announced by the Ministry of Education in December 2022, fostering communicative competence was presented as the comprehensive core competency of the English subject. It explicitly stated the intention to maximize the efficiency of learning by utilizing various media, information and communication technologies in line with the digital and AI educational environment in order to adapt to the changing times (Ministry of Education, 2022, p.6).

There is increasing interest among researchers in exploring teaching methods that provide learners in the EFL context, such as in South Korea, with opportunities to understand discourse or writing and express their own thoughts and emotions. One of the prominent approaches is Communicative Language Teaching (CLT), which has been widely utilized (Richards, 2005). Within the CLT framework, various teaching methods have emerged, including the Natural Approach, Content-Based Instruction, and Task-Based Learning. Among them, Task-Based Learning has garnered significant attention from domestic researchers, particularly since Prabhu (1987) first proposed it in 1987. Task-Based Learning involves providing tasks that allow learners to naturally acquire and use the language while performing the tasks. Learners engage in interaction with their peers during task performance, using and acquiring the target language more efficiently (Nunan, 1999). In this study, we aim to develop principles for designing elementary English speaking lessons using AI chatbots, with a focus on Task-Based Learning as the underlying teaching approach.

**A study on the use of chatbots in English education.** Since 2019, there has been active research both domestically and internationally on the potential of using AI chatbots in foreign language education. These studies have primarily focused on examining the effects of using chatbots in English classes, particularly in terms of cognitive and affective aspects. Many studies have investigated the effects of chatbots on speaking skills, and most of them have shown statistically significant positive effects. Specifically, AI chatbots have been found to increase learners' exposure to English language environments, provide more opportunities for English language use, and enhance their communication abilities (Yang, 2022). Learners have also benefited from immediate and effective spelling and grammar feedback from AI chatbots, leading to improved fluency (Haristiani, 2019), and the authenticity and accuracy of the English provided by chatbots have been effective in enhancing learners' conversational skills (El Shazly, 2021; Muhammad et al., 2020).

Studies comparing and analyzing the interactions between chatbots and high- and low-achieving learners have shown some differences. It has been found that proficient learners are more engaged in conversations with chatbots and tend to have higher satisfaction, while struggling learners may discontinue the conversation prematurely (Xia et al., 2023). Similarly, according to Chiu et al. (2023), beginner-level students require teacher support for effective motivation, whereas advanced learners may be hindered by teacher intervention. According to Shin (2019), lower-achieving students tend to produce more utterances when sentences are shorter, while higher-achieving students engage in more extensive conversations and use verb phrases more diversely when presented with less challenging texts. These findings highlight the importance of considering learners' English proficiency levels when designing English classes that incorporate chatbot interactions.

Learners have also shown a high interest in AI chatbot-assisted lessons in the affective domain, experiencing a sense of comfort. Particularly in speaking skills development, the anxiety often associated with traditional language learning methods has been reduced (Kılıçkaya, 2020; Mageira et al., 2022), and students have demonstrated a high level of interest and engagement with AI chatbots. These emotional stability, high interest, and attention have been found to enhance learners' confidence and improve their learning immersion (Huang et al., 2019). However, learners' motivation can decline over time, so it is necessary to design lessons that incorporate specific learning tasks to maintain consistent motivation (Yin and Satar, 2020).

**Teaching and design of English speaking using artificial intelligence chatbots.** As the results of utilizing AI chatbots in classroom settings have shown positive effects in cognitive and affective domains, the need for systematic principles in designing lessons using AI chatbots has been emphasized. To develop principles for designing elementary English speaking lessons using AI chatbots, it is necessary to analyze previous research related to principles and guidelines for designing English speaking lessons using AI chatbots, both domestically and internationally.

First, it is necessary to consider the selection of appropriate media. Teachers should choose diverse and multidimensional media, taking into account the learning conditions and content (Yu, 2022). Selecting a medium that allows learners and the chatbot to engage in conversations by changing the order of questions and answers can encourage learners to produce more utterances. Therefore, it is important to select a medium that is suitable for learners' proficiency levels and enables meaningful interaction (Chapelle, 2001). In the context of designing English

speaking lessons using AI chatbots, the medium refers to the selection of a chatbot builder.

Second, it is important to design the learning content and assign tasks considering the learners' proficiency levels and specific situations. It is crucial to construct the content that is appropriate for learners' levels and personal characteristics (Lin and Mubarak, 2021). Careful consideration should be given to various factors such as family structure, social norms, and financial circumstances when designing activities to ensure meaningful engagement for students (Vazhayil et al., 2019). A systematic approach is needed to provide learners with a meaningful and accessible learning experience (Woolf et al., 2013; El Shazly, 2021; Yang, 2022).

Third, it is essential to provide an optimized learning environment when conducting speaking lessons using AI chatbots. The technical infrastructure for utilizing AI chatbots should be prioritized and established (Vazhayil et al., 2019; Li, 2022). Issues such as external noise interfering with the recognition of learners' voices should be minimized (Kim et al., 2022), and support should be provided to create an environment that is conducive to optimal performance (Bii et al., 2018). Additionally, it is important to encourage learners and reassure them when they encounter difficulties during interactions with AI chatbots to prevent them from feeling overwhelmed.

Fourth, detailed guidance on the usage and task activities of AI chatbots is necessary. Since learners are encountering AI chatbots for the first time, instructors should provide thorough instructions on how to use them (Mendoza et al., 2022). Introduction to educational objectives (Kılıçkaya, 2020) and specific language learning tasks (Yin and Satar, 2020) should also be included to enhance the efficiency of the learning process.

Fifth, it is necessary to provide learners with pre-learning opportunities. If learners pre-learn relevant vocabulary, sentence patterns, and other aspects before using the chatbot (Vazhayil et al., 2019), it can minimize the burden of using the target language.

Sixth, it is important to generate and maintain students' interest. While the introduction of artificial intelligence technology through the use of chatbots can initially capture students' interest and attention, strategies are needed to sustain their interest throughout the class (Coniam, 2014; Yin and Satar, 2020; Pérez et al., 2020). Therefore, it is crucial to develop various teaching and learning methods that appeal to students, such as incorporating quizzes, graphics, and animations that facilitate easy understanding by learners (Gayathri and Rajendran, 2021).

Seventh, teachers need to provide appropriate scaffolding to learners. When learners encounter difficulties in interacting with the chatbot, offering necessary visual or additional materials can facilitate continuous conversations among students (Mendoza et al., 2022). It should be noted that while scaffolding is effective for novice learners, it can hinder support from the teacher for advanced learners, as suggested by research findings (Kalyuga, 2007; Williamson and Eynon, 2020; Chiu et al., 2023). Hence, teachers should provide scaffolding tailored to the learners' levels and characteristics, enabling them to engage in smooth interaction.

Eighth, strategies for promoting meaningful negotiation of meaning are needed to elicit additional utterances from learners. Utilizing strategies that encourage meaningful negotiation of meaning, teachers can specifically prompt learners' speech (Bygate, 1987; Lin and Mubarak, 2021). Additionally, for words or expressions that the chatbot does not immediately understand, strategies such as "requesting repetition," "eliciting clarification," and "eliciting inference" have been proposed (Chu and Min, 2019).

Ninth, it is necessary to provide immediate and personalized feedback to learners' utterances (Haristiani, 2019; Kılıçkaya, 2020;

**Table 1 The representative types and characteristics of design and development research.**

Design and development research	
Products and Tools research	Model research
<p>Exploratory topics</p> <ul style="list-style-type: none"> <li>• Comprehensive design and development projects</li> <li>- Instructional outputs and programs</li> <li>- Non-instructional outputs and programs</li> <li>• Specific project phases</li> <li>- Analysis</li> <li>- Development</li> <li>- Design</li> <li>- Evaluation</li> <li>• Tool design and development</li> <li>- Tool development</li> <li>- Tool utilization</li> </ul>	<ul style="list-style-type: none"> <li>• Model development</li> <li>- Comprehensive model development</li> <li>- Development of model components and processes</li> <li>• Model validation</li> <li>- Internal validation of model components</li> <li>- External validation of the model's impact</li> <li>• Model use</li> <li>- Research on factors influencing model utilization</li> <li>- Designer decision-making research</li> <li>- Designer expertise and characteristics research</li> </ul>
<p>Emphasis</p> <ul style="list-style-type: none"> <li>• A Study on a Specific Output and Tool Design and Development Project</li> </ul>	<ul style="list-style-type: none"> <li>• Model development, validation, and usage research</li> </ul>
<p>Results</p> <ul style="list-style-type: none"> <li>• Insights gained by analyzing the development of specific outputs and the conditions that promote their usage</li> </ul>	<ul style="list-style-type: none"> <li>• New design and development procedures or models, and the conditions that facilitate their usage</li> </ul>
<p>Context-Specific Conclusions</p>	<p>⇒⇒⇒ Generalized Conclusions</p>

Source: Reconstructed from Richey and Klein (2014), pages 33 and 41.

Dokukina and Gumanova, 2020; Xia et al., 2023). There are two ways to provide feedback: one is through an AI chatbot that recognizes learners’ utterances and provides immediate feedback, and the other is for teachers to provide feedback to learners who have difficulties in conversing with the chatbot.

Last, it is important to have learning management that allows students to appropriately review and evaluate their learning process (Mendoza et al., 2022). Providing reflection journals can facilitate students’ reflection on their tasks and presentations (Kong, 2020), and enabling learners to manage their learning materials and progress is also suggested (El Shazly, 2021; Xia et al., 2023). Learners should have the means to plan, review, and evaluate their learning process effectively.

**Methodology**

This study applied the Design and Development research methodology to develop principles for designing elementary English speaking classes using AI chatbots. Design and Development research is a systematic approach that aims to establish empirical foundations for creating new models, instructional or non-instructional products, and tools, as well as the development, evaluation, and validation processes associated with them (Richey and Klein, 2014, p. 6). It serves the purpose of generating new knowledge and validating existing practices.

According to Richey and Klein (2014), there are two types of research in the field of design and development: “Products and tools research” and “Model research”(Table 1). “Products and tools research” describes and analyzes the design and development processes used in specific projects, making it context-dependent. On the other hand, “Model research” aims to provide a general analysis of new design and development processes and can be somewhat more generalized compared to “Products and tools research.” Model research is utilized in developing design models, and further, design principles, strategies, and guidelines (Richey and Klein, 2014).

In this study, we utilized “Model research” among these two types. Model research allows us to analyze the effectiveness and

validity of existing or newly created models in the context of model development and the development process. Exploring model research involves three main topics: model development research, model validation research, and model use research.

First, “model development research” aims to develop comprehensive models and the processes associated with their components. Second, during the “model validation” phase, the validation of the model’s components is carried out. Lastly, in the “model use” phase, the conditions that affect the model’s use are studied, including research on the characteristics and expertise of designers and their decision-making processes.

In this particular study, which focuses on developing and validating a new instructional design model for elementary English speaking courses using AI chatbots, I performed model development research and model validation research. The specific procedures are outlined as follows.

First, the initial design principles were derived through a review of domestic and international literature related to using AI chatbots in classroom settings. The literature review encompassed academic papers, conference proceedings, institutional research reports, articles, and books. The main topics were AI chatbots and English-speaking classes, while subtopics were categorized into principles for designing classes using AI chatbots and models for designing classes using AI chatbots.

Second, to validate the viability of the initial design principles, an expert validation review was conducted. The expert panel consisted of individuals who held master’s or doctoral degrees in the relevant field and had published papers or presented on topics related to the research (Table 2). The validity assessment questionnaire for the design principles was adapted from Kim S (2016a, 2016b) to suit the present study. The questionnaire utilized a 4-point scale (4: strongly agree, 3: agree, 2: disagree, 1: strongly disagree) for closed-ended items and included open-ended items to allow experts to provide additional comments and opinion.

Third, a usability evaluation was conducted to determine if the developed instructional design principles utilizing the AI-based chatbot for elementary English-speaking classes were helpful for



**Table 2 Expert panel profile and validity evaluation participation process.**

Expert profile					Validation participation	
Classification	Job	Years of experience	Degree	Specialty field	Primary	Secondary
A	Professor	13 years	Ed.D.	Curriculum design, E-learning	○	○
B	Professor	16 years	Ph.D.	AI-based English education	○	○
C	Elementary school teacher	22 years	Ph.D.	Elementary English education	○	○
D	Elementary school teacher	17 years	Ph.D.	Instructional model	○	○
E	High school teacher	25 years	Ph.D.	Instructional model	○	○

**Table 3 Usability evaluation participant profiles.**

Elementary school teacher	Affiliation	Years of experience	Gender	Degree
A	Gyeongnam ○○ Elementary school	7 years	Female	Ph.D. program
B	Seoul ○○ Elementary school	20 years	Female	Ph.D.
C	Gyeongnam ○○ Elementary school	13 years	Male	Master’s degree

elementary school teachers in the field. Three elementary school teachers participated in the evaluation, selected based on their interest in AI chatbots or prior experience using them during class. The participants had a range of teaching experience, from 7 to 20 years, to ensure that the application of the developed design principles was feasible across different levels of teaching experience (Table 3).

During the usability evaluation, the participating teachers had one-on-one discussions with the researchers to receive explanations about the instructional design principles and discuss any areas of misunderstanding. Next, the teachers designed lessons based on the provided instructional design principles and, upon completing the lesson designs, responded to a usability evaluation questionnaire. The usability evaluation items were designed on a 4-point scale to assess the teachers’ understanding of the instructional design principles for AI-based elementary English-speaking classes and the practical assistance provided by the design principles in their actual lesson planning. The final section of the questionnaire allowed the teachers to freely provide their opinions on strengths, weaknesses, and suggestions for improvement.

The responses from the expert validation and usability evaluation were analyzed for validity and reliability using the Content Validity Index (CVI) and Inter-Rater Agreement (IRA) among the evaluators. Based on the input from experts and users, the final instructional design principles were developed.

The specific procedure of the study is as depicted in Fig. 1.

**Results**

**Derivation of the initial design principles and components of the model.** Through a review of existing literature, elements applicable to designing elementary English speaking classes using AI chatbots and general design principles were identified. Based on commonalities among the findings, the components were derived through an iterative process. As a result, five initial components of the model for designing elementary English speaking classes using AI chatbots were identified: AI chatbot learning tool, AI chatbot utilization curriculum, AI chatbot learning support, AI chatbot utilization activities, and AI chatbot learning outcomes and evaluation, as presented in the Table 4.

**Expert Validation results regarding the initial Components.**

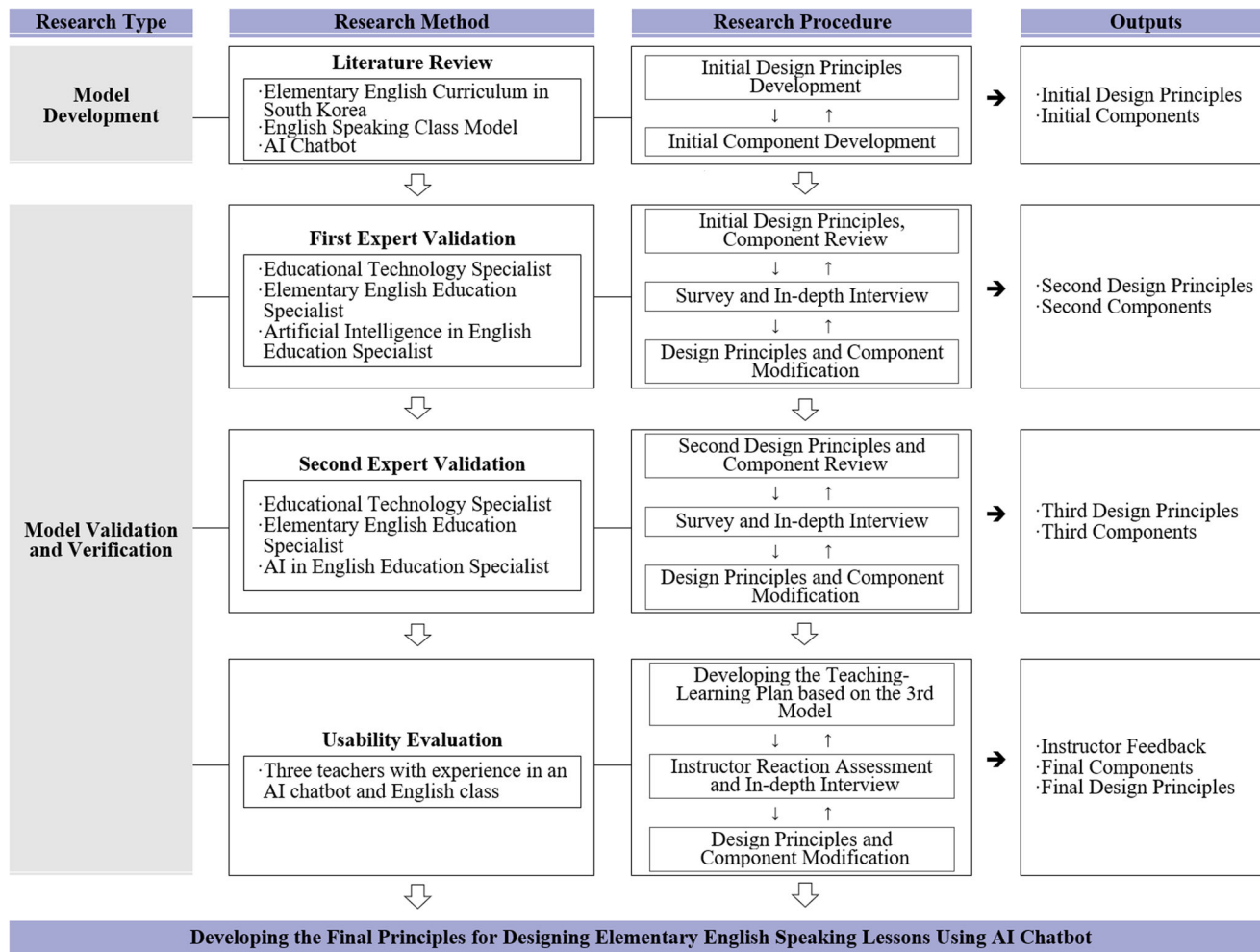
The expert validation of the components of the principles for designing elementary English language classes using AI chatbots was conducted in two phases (Table 5). In the first phase of expert validation, the average score for the “level of components” was the highest at 3.60, while the other items ranged between 3.00 and

3.40. The IRA among the experts was 0.11, indicating a need for modifications in the overall design principles. IRA stands for the Index of IRA, which is an index representing the reliability of evaluations among experts. In this paper, it is calculated by dividing the number of items on which experts unanimously agreed by the total number of items (Rubio et al., 2003). In the primary expert validation, among the total of 9 domains, an IRA of 1.00 was observed, as one item received a score of 1. This is due to the fact that one of the five experts assigned a score of 2 to one or more items. However, in the second phase of expert validation, the revised components based on the converging opinions from the first phase were evaluated by the experts. The CVI was 1.00, indicating that the experts considered all items to be valid. The IRA was also 1.00, indicating high agreement among the experts and ensuring the reliability of their evaluations.

The expert reviews on the components conducted in the second phase are summarized in the below Table 6. First, there were opinions from experts indicating that some components have incorrect hierarchy, and some sub-components are overlapping, suggesting the need to reorganize the components and sub-components and derive the upper-level components again. For example, the provision of individual feedback was considered more suitable for the sub-component of “AI Chatbot Utilization Activities”, according to one expert. Additionally, there were opinions suggesting that the components, “AI Chatbot Learning Tool”, “AI Chatbot Utilization Curriculum” and “AI Chatbot Learning Support” all seemed to be included in “AI Chatbot Utilization Activities”, making it difficult to distinguish each item effectively. Second, it was recommended that the descriptions of the components should be distinct and clearly presented, highlighting the differentiation between “AI Chatbot Utilization Activities” and “AI Chatbot Learning Support.” Third, since some sub-components are not well-differentiated within each component, there is a need to modify the names of the components to align with the corresponding sub-components.

Some of the initial components have a broader scope and lack clear explanations, thus requiring modification in response to the expert reviews. Fourth, there is a need to add certain sub-components to each component and provide clear explanations for them. For instance, one expert suggested adding the principle of sharing and reflecting on opinions with group members when utilizing the new technology of AI chatbots in certain activities. These expert reviews have been taken into account to make improvements.

**Expert validation results for the initial design principles.** The expert validation for the overall design principles was conducted,



**Fig. 1 The process of developing instructional design principles.** It indicates the research type, research methods, procedural steps, and the flow of outputs for developing the final model of instructional design.

considering the criteria of validity, explanatory power, usefulness, universality, and comprehensibility. Expert opinions were examined and provided for the items of validity, explanatory power, usefulness, universality, and comprehensibility for the overall design principles in two rounds of validation. The summarized results of the expert validation for the overall design principles, conducted in the 1st and 2nd rounds, are presented in the Table 7.

The results of the first expert validation review on the overall design principles showed generally high scores, with an average of 3.60 or above in all categories. The CVI was above 0.80 for all items, indicating that the participating experts found the design principles to be valid. The IRA was 0.80, indicating a reasonable level of consistency among the experts' evaluations and establishing their reliability. However, one expert suggested that adding explanations and examples would facilitate teachers' ability to design lessons according to the derived principles. In the second expert validation, explanations and examples were added, and a design principle and detailed guidelines related to communication and collaboration in group activities were included. The revised components were restructured and organized according to the design principles. In the second validation, all categories of the design principles, including validity, clarity, usefulness, universality, and comprehensibility, received the highest score of 4.00. The CVI was 1.00 for all items, indicating that all participating

experts found the design principles to be valid. The IRA was also 1.00, suggesting a high level of consistency and reliability among the evaluators' ratings.

The initial principles and detailed guidelines were restructured, revised, deleted, integrated, and refined based on the input from primary experts. As a result, a set of second-stage design principles and detailed guidelines was derived, consisting of a total of 10 principles and 24 detailed guidelines. The expert validation opinions and modifications incorporated during this process are summarized in Table 8.

Firstly, the components were restructured as a result of the overall restructuring based on the expert feedback, addressing the unclear inclusion relationship between principles and detailed guidelines and eliminating any duplication or overlap with previously mentioned principles and detailed guidelines. Secondly, areas with low validity scores and suggestions for modifications based on the expert validation feedback were either removed or integrated, while essential principles and detailed guidelines representing the core aspects of the study were added. Any content that resembled or duplicated existing information was removed during this process. Thirdly, due to changes in some components and the addition and removal of principles, the overall positioning and restructuring of the framework were readjusted. Fourthly, the content was elaborated by providing more specific and actionable statements, modifying abstract and

**Table 4 The initial design principles and components.**

Components	General design principles
AI Chatbot Training Tool	<ol style="list-style-type: none"> <li>1. Media Selection Principles Media is selected by considering various factors such as learners' proficiency level, media characteristics, and educational effectiveness in English speaking learning.                             <ol style="list-style-type: none"> <li>1.1. Select media that is easy for learners to operate and provides diverse and immersive learning experiences to facilitate effective English language learning (Yu, 2022; Chapelle, 2001).</li> <li>1.2. Choose media that enables individual interactions to maximize learners' participation in English language learning (Huang et al., 2019).</li> </ol> </li> </ol>
AI Chatbot Utilization Curriculum	<ol style="list-style-type: none"> <li>2. Content Restructuring Principles Content is restructured in English speaking using AI chatbot based on English proficiency standards, adjusting the appropriate learning volume and difficulty.                             <ol style="list-style-type: none"> <li>2.1. Consider various factors such as student proficiency, coherence within units, and social norms to restructure the order or substitute content within units (Vazhayil et al., 2019; Woolf et al., 2013).</li> <li>2.2. When learners have limited prior knowledge related to the learning topic, break down the lesson content into smaller units for better understanding (Kong, 2020).</li> </ol> </li> <li>3. Authenticity Principles Provide authentic language and meaningful tasks that are used in real-life situations.                             <ol style="list-style-type: none"> <li>3.1. Tailor specific tasks according to the proficiency level of learners to ensure that the AI chatbot utilizes more authentic materials (Yin and Satar, 2020; Yoo, 2021).</li> <li>3.2. Present unstructured tasks that resemble real-life situations, offering various solutions (Kim and Lee, 2020; Kim, 2016a).</li> </ol> </li> </ol>
AI Chatbot Learning Support	<ol style="list-style-type: none"> <li>4. Creating a Learning Environment Principles Evaluate technical resources and support systems to reflect environmental conditions and prepare contingency plans for addressing issues in the learning environment.                             <ol style="list-style-type: none"> <li>4.1. Provide technical support to create an optimized environment for running the AI chatbot (Vazhayil et al., 2019; Li, 2022).</li> <li>4.2. Prior to the start of the lesson, provide detailed instructions to learners on how to use the technology involved in the lesson to optimize the learning environment (Bii et al., 2018).</li> <li>4.3. Establish an environment that minimizes external noise interference to ensure the learner's voice is recognized (Kim et al., 2022; Kong, 2020).</li> <li>4.4. Preemptively notify learners about potential issues such as voice recognition failures and unexpected responses caused by the sensitivity of the chatbot to prevent confusion (Yoo, 2021).</li> </ol> </li> <li>5. Principle of Providing Guidance Provide learners with guidance on the lesson (learning objectives, content, methods, tools, evaluation, etc.).                             <ol style="list-style-type: none"> <li>5.1. Ensure learners have a clear understanding of the learning objectives (Kılıçkaya, 2020; Hwang, 2020).</li> <li>5.2. Pre-instruct learners on the learning content and instructional methods to be used in the lesson (Yin and Satar, 2020; Vazhayil et al., 2019).</li> </ol> </li> </ol>
AI Chatbot Utilization Activities	<ol style="list-style-type: none"> <li>6. Principle of Stimulating and Sustaining Interest and Motivation Stimulate and maintain learners' motivation based on their interests and engagement.                             <ol style="list-style-type: none"> <li>6.1. Select topics that consider learners' interests and provide learning activities that can generate learner motivation (Penny, 1996; Gayathri AN and Rajendran VV, 2021).</li> <li>6.2. Develop strategies to stimulate and sustain learners' interest and motivation (Coniam, 2014; Yin and Satar, 2020; Pérez et al., 2020).</li> </ol> </li> <li>7. Principle of Scaffolding Plan the step-by-step provision of tasks to facilitate learner participation.                             <ol style="list-style-type: none"> <li>7.1. Demonstrate interactions with the AI chatbot and have learners model their behavior accordingly (Mendoza et al., 2022).</li> <li>7.2. Provide cues (confirmation of understanding, request for clarification, repetition) to assist learners in completing their utterances when they encounter difficulties in interacting with the chatbot (Bygate, 1987; Lee, 2002; Mendoza et al., 2022; Lee and Park, 2019). e.g., "What do you mean?" (request for clarification), "One more time" (repetition request).</li> <li>7.3. Provide appropriate scaffolding according to the learners' proficiency level, as scaffolding is effective for novice learners but may be disruptive for advanced learners (Kalyuga, 2007; Williamson and Eynon, 2020; Chiu et al., 2023).</li> </ol> </li> <li>8. Principle of Creating a Supportive Learning Environment for Growth and Development Foster a friendly learning environment based on the belief in learners' growth and development.                             <ol style="list-style-type: none"> <li>8.1. Provide diverse forms of emotional support (linguistic and non-linguistic) to help learners form positive emotions when facing learning failures (El Shazly, 2021; Kılıçkaya, 2020).</li> <li>8.2. Use positive reinforcement (support, encouragement, praise) for successful learner interactions to sustain engagement (Dokukina and Gumanova, 2020; Hong et al., 2021).</li> </ol> </li> </ol>
AI Chatbot Learning Outcomes and Evaluation	<ol style="list-style-type: none"> <li>9. Principle of Individualization Assess learners' progress during and after the learning process and provide individualized feedback.                             <ol style="list-style-type: none"> <li>9.1. Provide immediate and appropriate feedback on learners' utterances (Haristiani, 2019; Kılıçkaya, 2020; Xia et al., 2023).</li> <li>9.2. Offer supplementary or advanced tasks based on learners' learning outcomes (Chang et al., 2021).</li> </ol> </li> <li>10. Principle of Learning Management Provide learners with information about their learning progress, allowing them to self-assess, set learning goals, and manage their learning.                             <ol style="list-style-type: none"> <li>10.1. Encourage students to plan, monitor, and evaluate their own learning process (Mendoza et al., 2022; Yang, 2022; Chang et al., 2021; Kong, 2020).</li> <li>10.2. Include learning management system (LMS) features to support and facilitate learners' management of their learning (El Shazly, 2021; Xia et al., 2023).</li> </ol> </li> </ol>

ambiguous descriptions into concrete statements that represent specific actions or behaviors. Lastly, examples and explanations were added to the detailed guidelines to facilitate understanding and provide references for designing English speaking courses using AI chatbots. These additions aimed to assist in comprehending the detailed guidelines and their practical application.

The third-round design principles were improved based on these experts' feedback and recommendations.

**Usability evaluation results.** The usability evaluation was conducted to assess the suitability of the developed 2nd iteration instructional design principles for actual classroom use by

**Table 5 Results of expert validation for the components.**

Domain	1st Expert Validity Verification(n = 5)			Domain	2nd Expert Validity Verification(n = 5)		
	Mean	CVI	IRA		Mean	CVI	IRA
The appropriateness of components	3.40	0.80	0.11	The appropriateness of components	4.00	1.00	1.00
The level of components	3.60	1.00		The level of components	4.00	1.00	
Composition of sub-components	3.20	0.80		Composition of sub-components	4.00	1.00	
Explanatory nature of components	3.20	0.80		Explanatory nature of components	4.00	1.00	
AI Chatbot Training Tool	3.20	0.80		Creating AI Chatbot Learning Environment	3.80	1.00	
AI Chatbot Utilization Curriculum	3.40	0.80		AI Chatbot Utilization Curriculum	4.00	1.00	
AI Chatbot Learning Support	3.40	0.80		AI Chatbot Teaching and Learning Activities	4.00	1.00	
AI Chatbot Utilization Activities	3.00	0.60		Evaluation of AI chatbot learning	4.00	1.00	
AI Chatbot Learning Outcomes and Evaluation	3.40	0.80					

**Table 6 The expert opinions and improvements regarding the components from the primary and secondary expert reviews.**

The expert opinions		Detailed improvement suggestions for the components
1st	<p>Reorganizing the components and sub-components</p> <p>Ensuring clear differentiation and providing distinct descriptions for each component</p> <p>Modifying some components' names</p> <p>Adding some sub-components</p>	<ul style="list-style-type: none"> <li>Restructured the subcomponents of 'AI Chatbot Utilization Activities'</li> <li>Restructured the subcomponents of 'AI Chatbot Utilization Activities' to include 'Individual Feedback Provision' and 'Guidance Provision Principles'</li> <li>Provided differentiation in the descriptions of 'AI Chatbot Utilization Activities' and 'AI Chatbot Learning Support'.</li> <li>Modified 'AI Chatbot Learning Tool' and 'AI Chatbot Learning Support' to 'Creating AI Chatbot Learning Environment'</li> <li>Revised 'AI Chatbot Learning Outcomes and Evaluation' to 'Evaluation AI Chatbot Learning'.</li> <li>Added a subcomponent of 'Communication and Collaboration' involving sharing opinions and reflecting with group members.</li> </ul>
2nd	Modification of the names of the higher-level components	<ul style="list-style-type: none"> <li>Modified 'AI Chatbot Learning Tool' and 'AI Chatbot Learning Support' to 'Creating AI Chatbot Learning Environment'</li> </ul>

**Table 7 Expert Validation Results for the Overall Design Principles.**

Domain	1st Expert Validity Verification (n = 5)			2nd Expert Validity Verification (n = 5)		
	Mean	CVI	IRA	Mean	CVI	IRA
Validity	3.80	1.00	0.80	4.00	1.00	1.00
Explanatory power	3.60	1.00		4.00	1.00	
Usefulness	3.80	1.00		4.00	1.00	
Universality	3.60	0.80		4.00	1.00	
Understanding	3.60	1.00		4.00	1.00	

teachers. Three elementary school teachers working in schools in Seoul and Gyeongsangnam-do, South Korea participated in the usability evaluation. They were given an explanation of the developed instructional design principles by the researcher and were asked to imagine themselves designing an elementary English-speaking class using an AI chatbot. Based on this, they were requested to create a teaching and learning guide. Subsequently, a usability evaluation questionnaire was provided to assess the extent to which the instructional design principles were helpful in lesson planning.

The usability evaluation results for the two questions indicate an average score of 4.00, with both CVI and IRA showing a score of 1.00 (Table 9). All three teachers who participated in the usability evaluation provided positive responses, stating that design principles and detailed guidelines are helpful in designing English speaking lessons using AI chatbots. Their opinions on the

strengths, weaknesses, and areas for improvement of each principle and model, as presented in open-ended questions, are summarized in Table 10 as follows.

The feedback gathered from Elementary school teachers through the usability evaluation questionnaire yielded the following results. The design principles were found to be helpful in the instructional design process, as they were accompanied by detailed explanations and examples. However, some examples were deemed insufficiently specific, and it was suggested that they should be presented more concretely using terminology familiar to classroom teachers.

The opinions of Elementary school teachers, obtained through usability evaluation, were incorporated into the final model development alongside the results of the secondary expert validation. The final model underwent improvements mainly at the level of terminology and relationships between terms, with no significant structural changes.

**Final instructional design principles and guidelines.** The final instructional design principles and guidelines derived from expert validation and usability evaluation are presented in the following Table 11. The components include "Creating AI Chatbot Learning Environment," "AI Chatbot Utilization Curriculum," "AI Chatbot Teaching and Learning Activities," and "Evaluation of AI Chatbot Learning". A total of 10 instructional design principles and 24 detailed guidelines can be applied.

**Discussion**

In this study, we aimed to develop instructional design principles and guidelines to support the design of elementary English



**Table 8 The opinions and suggestions from the primary and secondary expert validations regarding the design principles.**

The expert opinions		Detailed improvement suggestions for the design principles	
1st	Reorganization	Modification of components	<ul style="list-style-type: none"> <li>• Modifying Some Components: Creating AI Chatbot Learning Environment, AI Chatbot Utilization Curriculum, AI Chatbot Teaching and Learning Activities, Evaluation AI Chatbot learning</li> <li>• Principle and Detailed Guidelines for Communication and Collaboration</li> <li>• Removing the Detailed Guidelines '3.2. Presenting unstructured tasks to provide various real-life-like solutions' and '4.2. Providing detailed instructions to learners on how to use technology for the lesson and optimize the learning environment'</li> <li>• Changing the name of the principle "Individualization" to "Principle of Providing Individualized Feedback."</li> <li>• Adjusting the position of the principle "Creating Learning Environment" from 4 to 2</li> <li>• Adjusting the position of the 1st principle "6. Engaging and Sustaining Interest and Motivation" to the 2nd principle 4, and the 1st principle "7. Scaffolding Principle" to the 2nd principle 6.</li> <li>• Adjusting the position of the 1st principle "9. Principle of Individualization" to the 2nd principle 7.</li> <li>• Integrating the 1st principles "2. Principle of Content Restructuring" and "3. Principle of Authenticity" into the 2nd principle "3. Principle of Content Restructuring."</li> <li>• Elaborating "The principle of media selection"</li> <li>• Elaborating "The principle of learning management"</li> <li>• Elaborating "The principle of providing individualized feedback"</li> <li>• Adding examples for detailed guidelines</li> </ul>
		Addition and Removal of Principles and Detailed Guidelines	
		Repositioning of Principles and Detailed Guidelines	
		Integration of Principles and Detailed Guidelines	
	Modification of statement format	Elaboration of Content Statement	<ul style="list-style-type: none"> <li>• Including a range of media that are efficient and effective for teaching and learning</li> <li>• Elaborating "Guidance on how to use chatbots"</li> </ul>
		Inclusion of Examples and Explanations	
2nd	Elaboration of Content		

**Table 9 Usability Evaluation Results for Design Principles.**

Question	Elementary School Teacher			Mean	CVI	IRA
	A	B	C			
Design principles and detailed guidelines are helpful for designing elementary English speaking lessons using AI chatbots.	4	4	4	4.00	1.00	1.00
An explanation of design principles and detailed guidelines helps in understanding what elementary English speaking instructional design using AI chatbots entails.	4	4	4	4.00	1.00	

**Table 10 Suggested strengths, weaknesses, and areas for improvement identified in the usability evaluation.**

	Strengths	Weaknesses	Areas for improvement
Design Principles	<ul style="list-style-type: none"> <li>• The explanation and examples provided for design principles and detailed guidelines make them easily applicable.</li> </ul>	<ul style="list-style-type: none"> <li>• I would appreciate more specific examples for some cases.</li> <li>• It seems that one of the design principles lacks clear differentiation within its detailed guidelines.</li> </ul>	<ul style="list-style-type: none"> <li>• It is necessary to provide examples that are more familiar to classroom teachers.</li> <li>• It is necessary to present the detailed guidelines, explanations, and examples in a more readable format in a table.</li> </ul>

speaking classes utilizing AI chatbots. Based on the results of the research, we can discuss the theoretical and practical aspects as follows:

First, through the development of instructional design principles and guidelines, we have enabled teachers to systematically design English speaking classes using AI chatbots. Unlike previous studies that only focus on measuring the cognitive and definitional effects of using AI chatbots in instruction (Kim, 2016a, 2016b; Han, 2020; Kılıçkaya, 2020) or provide instructional guidelines and models (Lin and Mubarak, 2021; Mendoza et al., 2022), our study includes design principles and guidelines that teachers need to consider during the instructional design

process. In particular, there has been a growing interest in utilizing various Edu-tech in public elementary schools in South Korea since the outbreak of the COVID-19 pandemic in 2020. Teachers who are incorporating various edu-tech tools into their lessons might find it confusing, given the vast amount of new edu-tech resources being introduced. At this time, referencing the instructional design principles and guidelines for elementary English speaking classes using AI chatbots can be a valuable resource. Designing their own lessons with the guidance of these principles, especially those incorporating artificial intelligence chatbots, can undoubtedly reduce trial and error and provide useful materials for systematic implementation.

**Table 11 Final Instructional Design Principles and Guidelines for Elementary English Speaking Classes Utilizing AI Chatbot.**

Components	Design Principles and Detailed Guidelines
<p>Creating AI Chatbot Learning Environment</p>	<p>1. Principle of media selection Media is selected based on a comprehensive consideration of the learner’s level, the characteristics of the media, and the educational utility of English speaking learning. Guideline 1.1. By selecting an easily operable and efficient media (Dialogflow) for both learners and instructors, effective English learning can be facilitated.” Explanation Dialogflow is a chatbot builder provided by Google for free. It utilizes deep learning-based natural language processing technology and allows instructors to create chatbots without coding. Additionally, learners can easily access it by giving voice commands through the Google Assistant app or by following a link provided by the instructor. It is designed to be user-friendly once the usage methods are learned.</p> <p>Guideline 1.2. Select media that enables individual interactions to ensure maximum participation opportunities for learners in their English learning. Explanation Learners can participate in individual English speaking practice by using their personal mobile phones or tablet PCs to easily access the Google Assistant app. Having their own devices allows them to engage in English speaking learning individually.</p> <p>2. Principle of Creating a Learning Environment: The principle involves assessing technical resources and support systems to reflect environmental conditions and preparing contingency plans to address issues that may arise in the learning environment. Guideline 2.1. Provide technical support to create an optimized environment for running an AI chatbot. Explanation To conduct a classroom-wide lesson using an AI chatbot, it is essential to have sufficient wireless routers installed. Each wireless router can accommodate approximately 10 students, allowing them to connect and participate smoothly. Therefore, it is recommended to install routers based on the number of students in the class. Additionally, provide each student with a tablet PC and headset. Pre-install the Google Assistant app on all tablet PCs and ensure the language setting is set to English. Students can either log in with the teacher’s account or access the chatbot through a provided Web Demo link posted on the class website.</p> <p>Guideline 2.2. External noise can hinder the recognition of learners’ voices, so it is important to create an environment that is free from disturbances for clear speech recognition. Explanation In order to prevent issues such as the chatbot mistakenly picking up other students’ voices, it is important to create an environment where students can focus on their own speech by wearing individual headsets and maintaining a reasonable distance between each other while conversing with the chatbot.</p> <p>Guideline 2.3. To prevent confusion, provide advance notice about potential issues such as voice recognition failures and unexpected responses due to the sensitivity of the chatbot. Explanation Google Assistant was initially developed as an “AI secretary” and is primarily designed to recognize and respond to native English speakers when the language is set to English. This increases the likelihood of voice recognition failures for language learners. Additionally, the current voice recognition accuracy may not be perfect, leading to misinterpretation of pronunciation or unexpected responses. It is important to explain these potential challenges to learners before starting the class.</p>
<p>AI Chatbot Utilization Curriculum</p>	<p>3. Principle of Content Restructuring: Based on the English curriculum standards, the appropriate amount of learning and level of difficulty for speaking practice using an AI chatbot are restructured. Guideline 3.1. Consider the students’ proficiency levels, the interconnectivity of units, social norms, and other contextual factors to rearrange the sequence or replace the content within the units for restructuring. Explanation Based on the English curriculum standards for each grade level (e.g., [6ENG02-04] Can describe surrounding locations or places using simple and basic sentences), the appropriate topics for speaking practice using an AI chatbot are selected. Then, considering the learners’ proficiency levels and the interconnectivity of units, the sequence of units and key expressions within the curriculum are rearranged or restructured.</p> <p>Guideline 3.2. When learners have insufficient prior knowledge related to the learning topic, break down the lesson content into smaller units. Explanation In the case of the 6th-grade unit on giving directions, where the key expressions involve prepositions (between, next to, in front of, behind) to indicate the location of buildings, it is important to consider the learners’ prior knowledge. If learners have limited or insufficient prior knowledge of these prepositions, it is recommended to provide explicit instruction and guidance on the prepositions along with visual aids to help them understand and practice using the prepositions effectively.</p> <p>Guideline 3.3. Provide learners with specific tasks based on their proficiency levels to enable the AI chatbot to be utilized with more authentic materials. Explanation The AI chatbot can engage learners by asking questions related to the tasks, such as requesting directions to specific locations or prompting learners to describe people they encounter. Learners can then respond using the appropriate language and engage in a dialogue with the AI chatbot. By providing learners with these specific tasks, instructors promote authentic language use and enable learners to practice real-life communication skills. Through these interactions, learners can enhance their speaking abilities, improve their comprehension of spoken language, and develop their vocabulary and descriptive skills.</p>
<p>AI Chatbot Teaching and Learning Activities</p>	<p>4. Principle of Stimulating and Sustaining Interest and Motivation This principle emphasizes the importance of leveraging learners’ interests and curiosity to enhance and maintain their motivation for learning. Guideline 4.1. Consider learners’ interests when selecting topics and provide learning activities that can inspire learners’ motivation.</p>

**Table 11 (continued)**

Components	Design Principles and Detailed Guidelines
Explanation	<p>One effective approach is to engage learners in an interview-style conversation with the chatbot, where they can ask the chatbot for information such as its name, age, favorite food, or favorite subject. This activity creates a sense of curiosity and excitement as learners interact with the chatbot, prompting their interest and motivation. To further enhance learners' engagement, instructors can introduce a quiz-like activity where learners receive rewards or incentives for correctly answering questions or gathering information from the chatbot. This gamified approach makes the learning experience more enjoyable and encourages active participation.</p>
Guideline 4.2. Adequate measures should be in place to trigger and sustain learners' interests and motivation. Explanation	<p>Instructors can take steps to create a sense of familiarity and establish a friendly relationship between the chatbot and the students. Choosing a chatbot name that is associated with the school's name or identity can contribute to this familiarity. Addressing the chatbot by its chosen name further enhances the students' sense of connection and can help foster a perception of the chatbot as a study companion and friend in their English learning journey. Moreover, instructors can employ external and internal rewards to increase students' satisfaction and motivation, even in cases where students may experience difficulties in speech recognition. External rewards, such as points, badges, or virtual incentives, can provide extrinsic motivation, while internal rewards, such as a sense of accomplishment or personal growth, can generate intrinsic motivation. These rewards can enhance students' willingness to persist in their language-learning efforts and drive them to overcome challenges.</p>
5. Principle of Providing Guidance This principle emphasizes the importance of providing learners with guidance and information about the lesson, including learning objectives, content, methods, instructional tools, and assessment.	
Guideline 5.1. Highlights the importance of increasing learners' awareness of the learning objectives.	
Explanation	<p>The learning objectives that need to be achieved during the lesson should be clearly explained in writing and emphasized during the introduction of the lesson. Additionally, the learning objectives should be mentioned throughout the lesson activities to enhance learners' awareness of their own learning goals.</p>
Guideline 5.2. Pre-inform learners about the learning content and instructional procedures to be conducted during the lesson.	
Explanation	<p>Provide learners with a learning guide or worksheet that includes commands for interacting with the AI chatbot, aligned with the flow of activities conducted during the lesson. Additionally, write instructions related to this on the board to ensure learners are aware of them in advance.</p>
Guideline 5.3. Pre-instruct learners on how to use the AI chatbot.	
Explanation	<p>Before commencing the actual lesson, allocate time to introduce the AI chatbot to students and provide them with pre-instructions on how to use it. Once learners have familiarized themselves with the usage, you can proceed with speaking activities using the AI chatbot from the next session onwards. It is advisable to pre-inform students that they can seek assistance from the teacher or their group mates if they encounter any difficulties in using the chatbot during the course of the lesson.</p>
6. Principle of Scaffolded Learning Support Plan the gradual provision of tasks to facilitate learner engagement.	
Guideline 6.1. The instructor demonstrates interaction with the AI chatbot and encourages learners to model the behavior.	
Explanation	<p>The instructor can demonstrate and model the process of interacting with the AI chatbot by speaking the command to activate the chatbot (e.g., "Talk to activity 1") and engaging in a conversation with it. This encourages learners to observe and learn from the instructor's demonstration, allowing them to understand the steps involved in communicating with the chatbot and providing them with a model to follow.</p>
Guideline 6.2. Provide cues (comprehension checks, clarification requests, repetition requests) to help learners complete their utterances during interactions with the chatbot when they encounter difficulties.	
Explanation	<p>When creating the chatbot, the instructor can provide cues in the prompts (inputted in the prompt tab in Dialogflow) to assist learners in completing their conversations with the chatbot, especially in areas where they may struggle to respond. For example, using cues such as "He's wearing red what?" (clarification request), "What do you mean?" (clarification request), or "One more time" (repetition request), the instructor guides learners and helps them successfully conclude their conversations with the chatbot. These cues prompt learners to seek further explanations, ask for clarification, or repeat their responses as needed.</p>
Guideline 6.3. Provide appropriate scaffolding according to the learners' proficiency level, as scaffolding is effective for novice learners but may be disruptive for advanced learners.	
Explanation	<p>For students who struggle with expressing key phrases in English, provide a "Repetitive Chatbot" option in the learning materials. This allows students to practice and repeat conversations with the chatbot until they feel more comfortable with using the key expressions. For students who are more confident and proficient in engaging with the chatbot, provide a "Question and Answer Chatbot" option. This enables students to have interactive conversations with the chatbot, allowing them to engage in a back-and-forth exchange to further develop their language skills. In the learning materials, guide students to choose the appropriate learning mode based on their proficiency level and preference. This empowers students to take control of their learning and select the chatbot type that best suits their needs. Furthermore, gradually encourage students to elaborate on their responses, guiding them to provide more detailed and nuanced answers. Ultimately, guide students to use the "Task-Oriented Chatbot" to engage in conversations with the chatbot, addressing specific tasks and challenges.</p>

**Table 11 (continued)**

Components	Design Principles and Detailed Guidelines
	<p>7. Principle of Individualized Feedback Provision The instructor assesses the learner’s reactions, engagement, and progress in relation to the learning process and outcomes. They also monitor the learner’s achievement of learning objectives. In addition, the instructor provides individualized feedback in a timely manner.</p>
Explanation	<p>Guideline 7.1. Provide immediate and appropriate feedback on learner’s utterances. The instructor can input intents in the chatbot to enable it to provide immediate feedback such as “You did a good job,” “Great!,” or “Well done” when the learner successfully completes their utterance. In case of unsuccessful attempts, the chatbot can respond with prompts like “Repeat after me” and provide examples of appropriate responses.</p>
Explanation	<p>Guideline 7.2. Based on the learner’s learning activity outcomes, the instructor provides supplementary or advanced tasks to the student. The instructor provides supplementary or advanced tasks based on the learner’s process and outcomes of interacting with the chatbot and completing the tasks, enabling personalized activities for the learner.</p>
	<p>8. Principle of fostering a learning environment that supports growth and development Creating a friendly and inclusive learning environment based on belief in learners’ growth and development.</p>
Explanation	<p>Guideline 8.1. Provide diverse emotional support in linguistic and non-linguistic forms to help learners develop positive emotions in response to learning failures. Instructors help learners develop a positive learning mindset by using their eye contact, facial expressions, tone of voice, and encouraging language to convey the message that learners can overcome learning failures caused by various factors such as speech recognition errors, misunderstandings due to external noise, and try again.</p>
Explanation	<p>Guideline 8.2. Provide positive reinforcement (support, encouragement, praise) to sustain learners’ successful interactions, promoting continuous engagement in verbal exchanges. The instructor provides praise to the learners each time they successfully complete a stage of the &lt;repetitive&gt;, &lt;conversational&gt;, &lt;question-and-answer&gt;, or &lt;task-based&gt; chatbot activities during the learning process. This encourages the learners to believe in their growth and motivates them to take on the next stage of speech with confidence.</p>
	<p>9. Principle of Communication and Collaboration Provide opportunities for team members to engage in communication and collaboration during the process of completing tasks using the AI chatbot.</p>
Explanation	<p>Guideline 9.1. Reflect with team members on the process and outcomes of performing English speaking tasks through the AI chatbot. Reflect on the process and outcomes of performing tasks through the AI chatbot, as well as any thoughts that come to mind during the learning process. Write them down on the learning materials, reflecting on one’s own learning attitude and providing free opinions on the use of chatbots in the classroom with team members. The instructor can use this as a reference for designing future activities.</p>
Explanation	<p>Guideline 9.2. Present reflective tasks for learners to reflect on their interaction process with the AI chatbot, and encourage them to share their opinions with team members. This allows for collective reflection and discussion on the interaction experience with the chatbot. The AI chatbot is designed for individual participation with each learner having their own tablet PC. However, in the final stage of the task, called the “task-oriented chatbot,” learners initially work on the task individually, and then they engage in interactive exchanges within their team to solve the task collectively. Learners who have successfully completed the task through a single conversation with the chatbot can assist their team members who are facing challenges in task completion, thus collaborating to solve the task together.</p>
Evaluation of AI chatbot learning	<p>10. Principle of Learning Management: Provides learners with information about their learning progress and enables them to actively manage their learning.</p>
Explanation	<p>Guideline 10.1. Encourage learners to plan, monitor, and evaluate their own learning process effectively. The teacher provides learners with a checklist to enable them to self-assess their English speaking skills periodically. Learners can evaluate their own learning process and outcomes, and check their progress in speaking skills.</p>
Explanation	<p>Guideline 10.2. The learning management system (LMS) should include features that help manage and support learners’ learning. Dialogflow’s History feature retains a record of all conversations that the learner has had with the AI chatbot. Learners are required to mention their attendance number before engaging in the conversation. Therefore, the LMS feature provides information about the time, content, and details of the conversations between the learner and the chatbot based on their attendance number.</p>

Second, we have applied a research methodology that integrates theoretical and practical aspects based on a review of relevant literature on AI chatbots in English language instruction. While previous studies have focused on developing instructional models based on students’ and teachers’ needs or addressing specific challenges in AI chatbot-assisted instruction (Mendoza et al., 2022), our study contributes to the field by providing a logical process for developing instructional designs. Through a comprehensive review of theories and literature related to AI chatbots, English speaking skills, and instructional design, we derived instructional design principles and guidelines, and further validated them through expert review. The research findings hold

significance in guiding instructors to have a systematic and comprehensive perspective when designing their classes. Third, our study offers ideas that extend beyond the application of AI chatbots in English language instruction alone. It provides insights into utilizing AI chatbots for various languages such as Korean, Chinese, and Japanese. When designing language-specific instruction, teachers can refer to the foundational design principles and guidelines that are essential for incorporating AI chatbots as a learning tool. Furthermore, although our study focuses on instructional design principles for elementary English-speaking classes, the principles and guidelines can be applied to middle school, high school, and university-level



English speaking classes with appropriate modifications. By considering the target learners' proficiency levels and corresponding curricula, our developed design principles and guidelines can be adapted for other levels of English-speaking instruction.

In conclusion, our research contributes to the field by developing instructional design principles and guidelines to support the design of elementary English speaking classes using AI chatbots. These guidelines provide teachers with a systematic and comprehensive approach to instructional design and can be applied not only in English language instruction but also in other languages. Additionally, the principles and guidelines can be extended to different educational levels, offering valuable insights for designing English speaking classes across various learner groups.

## Conclusion

Based on the research results, the following conclusions can be drawn:

First, the instructional design of elementary English speaking classes using AI chatbots follows a structure where the activities revolve around the "AI chatbot teaching and learning activities" and conclude with reflection and evaluation of the learning process. Teachers have the flexibility to adapt and customize the process based on their specific contexts. This instructional design process relies on the underlying support of the learning tool called Dialogflow and the technical infrastructure required to manage it. Teachers need to align their instructional design with the available software and hardware resources. For example, if there are AI speakers available in the classroom, tasks can be assigned to the whole class or to small groups. Similarly, if there is a limited number of tablet PCs, tasks can be assigned to small groups or rotated among students.

Second, the instructional design principles developed in this study for English speaking classes using AI chatbots can contribute to increasing the attainability of English language goals and standards within the curriculum. The design principles offer options for teachers to choose between repetitive or question-and-answer-based chatbots according to the students' proficiency levels, enabling personalized instruction. Traditional teacher-centered lecture-style instruction has limitations in achieving personalized instruction, but AI chatbot-assisted instruction can provide an alternative to overcome the physical constraints of dense classroom environments and limited English instruction time. Furthermore, considering the English education environment in South Korean elementary schools, we are exploring methods to replace native English teachers currently placed in elementary schools. Using AI chatbots for English speaking lessons could potentially serve as an alternative to substitute native English teachers. Therefore, in South Korea's English education environment, it is expected that using AI chatbots for English speaking lessons will have a more significant impact.

Third, AI chatbot-assisted English speaking classes have the potential to reduce the proficiency gap caused by socioeconomic disparities. English language education in Korea heavily relies on private tutoring, and improving speaking skills, one of the four language skills, requires significant investment of time and effort. Utilizing an AI chatbot for English speaking classes allows learners to practice their English speaking skills not only during regular class hours but also after school, enhancing their communication abilities. However, to achieve this, it is crucial to provide each student with a tablet PC or Chromebook and establish wireless internet environments in students' homes.

Some limitations and suggestions for future research based on the research process and results are as follows:

First, this study focused on elementary school students in South Korea, and the application of the developed instructional design was limited to elementary schools. Therefore, it is necessary to compare the differences and effectiveness of applying the instructional design model to middle school and high school students. To generalize the instructional design model to different educational levels, it is important to analyze which aspects of the design principles and guidelines need to be modified and improved when applying them to middle school and high school students.

Second, the process of planning and implementing AI chatbot-assisted English speaking classes requires more time and effort compared to traditional lecture-style instruction. It requires knowledge of tools like Dialogflow for AI chatbot development and practical experience in creating AI chatbots and learning materials. Additionally, to implement these classes during instructional time, securing tablet PCs, establishing wireless internet environments, and technical preparations like logging into the Google Assistant app on all devices using the teacher's Google account are necessary. Given these challenges, there is a possibility that teachers might feel burdened and hesitate to implement AI chatbot-assisted instruction. Therefore, educational institutions should establish the necessary technological infrastructure to support teachers in utilizing various AI learning tools, reducing the time and cost burden associated with instructional design.

Third, as AI chatbots are capable of various forms of input and output, including text and speech, it is essential to develop instructional design models not only for English speaking but also for listening, reading, and writing in the field of English education. This would provide guidelines for teachers to conduct interactive English language classes in all four language skills. Further research is needed to explore the ways in which AI chatbots can be utilized in English language instruction across these four areas.

In conclusion, the research has developed instructional design principles and guidelines to support the design of elementary English speaking classes using AI chatbots. These guidelines provide a systematic and comprehensive approach to instructional design, not only for English language instruction but also for other languages. They can be extended to different educational levels, offering valuable insights for designing English speaking classes for diverse learner groups. However, further research is required to address limitations and explore the application of the instructional design model to different educational levels and language skills.

## Data availability

All data generated or analyzed during this study are included in this published article.

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## Author contributions

JH contributed to the research design, data acquisition, data analysis, and writing of the original draft of this paper. DL contributed to the conceptualization, supervision, writing up, and editing of the original draft of this paper.

## Competing interests

The authors declare no competing interests.

## Ethical approval

This article does not contain any studies with human participants performed by any of the authors. Therefore, this article does not require ethical approval.

## Informed consent

There are no human participants in this article and informed consent is not applicable.

## Additional information

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