



Exploring the Pedagogical Integration of ChatGPT: Fostering Meaningful Learning Environments and Amplifying Student Engagement in Elementary Education

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Abstract. The invention of technology has led to some changes in education, and chatbots such as ChatGPT are one of the advancements of technology. The power of ChatGPT improves the teaching and learning process, with teachers having an opportunity to use ChatGPT to increase the effectiveness of their teaching. However, there are limited studies on the use of ChatGPT for teachers, especially at the primary school level. This study examines how primary school teachers perceive the role of ChatGPT in fostering a meaningful learning environment within the classroom and how the pedagogical integration of ChatGPT contributes to developing a dynamic and engaging learning atmosphere for elementary school students. The participants in this study were a school principal, nine teachers, a staff administrator, and two extracurricular teachers at a state elementary school in Sleman Regency in Yogyakarta, Indonesia. A descriptive case study design was adopted to portray the participants' views and experiences using ChatGPT for instructional design. The participants received training in creating instructional material, developing lesson plans, and conducting evaluations. They were also interviewed and required to submit the documents resulting from the training. The participants showed enthusiasm during the training, revealed positive beliefs toward the use of ChatGPT, and produced satisfying instructional teaching materials.

Keywords: Pedagogical integration, ChatGPT, Meaningful learning environment, Student engagement

1 Introduction

Technology has developed in recent years, and artificial intelligence (AI) is one of its inventions. AI history started with a system named ELIZA in 1964, which was a program that simulated text-based conversation with the user and was advanced in 1968 with the program named SHRDLU, which was designed to recognize natural language

among interactions along blocks in a virtual world [1]. Since that day, AI has been more advanced in Chatbots, which users can use for simple automatic tasks, integrated speech identification, a natural process of language, and fundamental AI [2]. These improvements in AI create novel possibilities for teachers and students in the classroom setting [3].

In EFL settings, Chatbots like ChatGPT technology are believed to assist teachers in making authentic and essential lesson plans that correspond to the current curriculum [3]. The ChatGPT language model has possible opportunities for improvement in language learning. For example, it could provide recent and effective tools in instructional language and assessment [4]. ChatGPT also could help teachers as a resource for designing lesson plans, activities, grading, and capturing student progress in learning [5].

Several studies have investigated the possibilities of ChatGPT in different levels of education, providing some of the benefits and challenges. ChatGPT can assist teachers in addition to reducing administrative workload and providing resources for creating learning material [3] [6]. It also found that ChatGPT improves classroom activity to be more effective and efficient [1] [7]. ChatGPT can accommodate the learning material based on the needs and inquisitiveness of students that relate to lesson objectives [2].

Despite that, research on ChatGPT for primary school teachers is still limited. Some of the research has intent on the implementation of ChatGPT for EFL/ESL teachers rather than teachers in general [8] [9] [4] [10] [3]. Moreover, most of the research focused on implementing ChatGPT for students rather than assisting the teacher with ChatGPT [11] [10] [12] [13]. Therefore, there is a notable disparity in the existing study relating to educational level and teacher perspective of using ChatGPT from this context.

Furthermore, it is essential to acknowledge that while recent studies have primarily concentrated on research conducted within the context of higher education, there is a growing interest in delving into the perception and implementation when incorporating ChatGPT into the educational framework of primary schools. It is imperative for teachers, particularly at the elementary school level, to support students in curriculum development, foster meaningful learning experiences, and enhance the educational setting within the institution. The implementation of ChatGPT has created significant changes in primary school education. Therefore, it is essential to examine the teachers' perceived roles and implementation of integrating ChatGPT for pedagogical purposes.

To achieve the objectives of the research, the study addresses the following research question:

1. How do elementary school teachers perceive the role of ChatGPT in fostering a meaningful learning environment within their classrooms?
2. How does the pedagogical integration of ChatGPT contribute to creating a dynamic and engaging learning atmosphere for elementary school students?

The first research question seeks to examine the elementary school teachers' perspectives and beliefs on the roles of ChatGPT in providing meaningful learning regarding the teaching and learning process within the school. It is essential to understand the teachers' beliefs regarding the usability of ChatGPT in assisting them in the educational process. The second research question seeks to explore how the

pedagogical incorporation of ChatGPT enhances the development of an engaging and interactive educational setting for elementary school students. This study is significant for understanding the pedagogical integration of ChatGPT within personalized learning contexts, fostering interactive learning, catering to diverse learning modalities, and promoting exploration and inquiry. By examining the teachers' attitudes and beliefs regarding ChatGPT also identifying the pedagogical approaches to maximize the potential use of ChatGPT in teaching and learning environments [9], the results will have connections to the usefulness of ChatGPT in enhancing more meaningful and interactive learning for students, ranging from elementary school level to high school level education.

ChatGPT [Generative Pre-trained Transformer], a highly developed artificial intelligence than other Chatbots, was designed in November 2022 by OpenAI from a Microsoft-backed company [9]. It is provided for generating closely resembling human language into text-based inputs, achieved by utilization of advanced deep learning methods, specifically using empowered machine learning [2]. Ivanovska added that ChatGPT can be used for other purposes, much more than for study and conversation [2].

A study by Javaid [15] examining the opportunities through ChatGPT tools for improving education discovered several features of ChatGPT such as backup records, virtual assistance, follow-up action, tasks remembering, supportive prediction, interactive teaching and learning, on-time training assistance, handling large data facts, and case studied based education. The features are primarily oriented towards the field of education; nevertheless, there is potential for their application in various other domains.

For education, ChatGPT has various significance. In an EFL setting, ChatGPT can provide students with personalized learning through feedback and support from it. It can also engage and motivate students in results to develop language skills [16]. In a general education setting, students could utilize authentic language use through dialogues with ChatGPT using 'chat prompt' to get better information and explanation [17]. Other than that, ChatGPT can be used to instruct personal language. For instance, with accurate prompts, ChatGPT is able to provide information based on the learner's needs [18].

A study conducted by Koraishi [1] discovered that ChatGPT empowers teachers to optimize teaching materials and assessments so that it can address various students' needs. However, teachers need to consider several things when using ChatGPT; training and computer skills are required to maximize the usability of ChatGPT in the teaching and learning process. The study explains that teachers need support, especially in designing prompts and understanding AI-generated material, to unleash great potential and minimize any challenges related to the usage of ChatGPT.

In a similar vein, Subiyantoro [6] examined the potential of AI chatbots in providing teaching materials, supporting personalized learning, and helping teachers with administrative tasks. Nonetheless, there will be less human interaction, and further regulations about privacy and ethics must be considered while using ChatGPT. All in all, ChatGPT assists teachers in creating teaching material, yet some potential drawbacks may appear and need to be considered while using ChatGPT.

Several scholars are examining ChatGPT in a teaching context. In conclusion, ChatGPT has the immense potential to assist teachers in various teaching and learning conditions. To achieve the successful implementation of ChatGPT for educational purposes in classroom settings, it is essential to know teachers' attitudes and practices towards it. This research aims to assist the existing literature and provide recommendations for improving classroom interaction to make learning more enjoyable, meaningful, and dynamic for students.

2 Methodology

The following section provides a detailed research methodology adopted by the researchers to gather data. This section addresses the discussion relating to research design, setting, participants, data collection procedure, and data analysis.

2.1. Research Design

This study employed a qualitative inquiry to investigate the perceptions of elementary school teachers regarding the role of ChatGPT in enhancing the learning environment and promoting engagement among students. Qualitative methods were deemed suitable for exploring the research questions posed in this study and for offering detailed contextual insights. As highlighted by Creswell [19], a qualitative approach allows for a narrative depiction of social or human experiences in their natural context. Consequently, qualitative researchers delve into issues within specific settings over extended periods [20].

The study utilized a case study design, which involves an in-depth exploration of a specific system through detailed data collection methods [21]. The system, or individual case, can be delineated by temporal and spatial boundaries [19] or by temporal and activity-related constraints [22]. Case studies are valuable for uncovering insights into particular phenomena [21]. The case of this study, the integration of ChatGPT, was examined within the boundaries of an elementary school level in the context of fostering a meaningful learning environment and creating a dynamic and engaging learning atmosphere. Employing a descriptive approach [23], the study aimed to comprehensively examine and understand how elementary school teachers utilized ChatGPT for the pedagogical purposes outlined.

2.2. Setting

A state elementary school in Sleman Regency in Yogyakarta, Indonesia, was chosen as the site of this study. This is a state school in which students come from a middle socioeconomic background. This school has a Wi-Fi area, allowing teachers and students to get an internet connection in the school area. However, this school does not have an adequate computer lab to facilitate the integration of ICT.

2.3. Participant

The participants in this study were a school principal, nine teachers, a staff administrator, and two extracurricular teachers. The participants varied in age, educational background, teaching duration or years of teaching, and Educational Technology [EdTech] skills. All of the participants were given training on the integration of ChatGPT for instructional purposes.

2.4. Data Collection Method

In a study, the researchers involved two data collection procedures, including interview and document analysis. The researchers conducted semi-structured interviews to gather responses from the participants, including the headmaster and also teachers, to gain insights into the role of ChatGPT in their educational setting, especially in fostering a meaningful learning environment within their classroom and creating a dynamic and engaging learning atmosphere for elementary school students. Additionally, in exploring the integration of ChatGPT, data collection involved document analysis to understand the real implications and best practices of such AI tool integration, especially in their lesson planning and assessment.

3 Result and Discussion

The Perception of Elementary School Teacher on the Role of ChatGPT in Fostering a Meaningful Learning Environment within Their Classroom

3.1. Personalized Content and Relevance

3.1.1. Enhancing Accessibility and Inclusivity

The usage of ChatGPT could enhance teaching accessibility and inclusivity. Orchid believed that “ChatGPT will assist the teachers in designing lesson plans for addressing weaknesses in students. For example, if there are students with less reading capability, ChatGPT has a solution to help the teacher solve those problems.” This statement is in line with one of the advantages of chatGPT by Baidoo-Anu [18]. ChatGPT can be used to create learning systems that are in accordance with students' abilities and performance in the class.

3.1.2. Supporting Differentiated Instruction

To support differentiated instructions in the learning situation, ChatGPT provides various information according to students' needs and knowledge. Orchid states that “ChatGPT could provide different information for teachers. For instance, teachers can utilise ChatGPT to search for text samples that align with students' proficiency levels”. In the case of students with reading deficiencies, ChatGPT can generate reading examples that are more accessible, and conversely, it can provide more challenging examples for advanced students. This is in line with Kurniawan's [24] study, revealing that ChatGPT's capabilities assist teachers in creating differentiated learning experiences and assessments that match their students' specific subjects and grade levels.

3.1.3. Promoting Creativity and Exploration

ChatGPT supports teachers in creating a lesson plan that involves students' creativity and exploration. Orchid also states, "With the assistance of ChatGPT, teachers can develop various lesson plans that will effectively stimulate students' creativity. ChatGPT offers interactive exercises involving the use of sticks to teach addition and subtraction in mathematics, enhancing students' comprehension during the learning process. ChatGPT also provides teachers with a set of group activities that can be implemented in the classroom". ChatGPT can shift the role of teachers into facilitators and highlight the importance of student-centered learning. This means that with assistance from ChatGPT, the activities engage students in exploring and developing their comprehension [4].

3.1.4. Encouraging Autonomy and Self-Directed Learning

Teachers can use ChatGPT to enhance the students' autonomous learning and give them tasks to search for some information related to the material in ChatGPT. Orchid agrees that "ChatGPT could be beneficial for the teachers and the students as well. Teachers can assign tasks to students, encouraging them to utilise ChatGPT as a valuable resource for information during the learning process. However, additional regulation is necessary for managing the use of cellphones during educational activities." In line with Orchid, Rose expressed her agreement toward the use of ChatGPT for language instruction, "ChatGPT could be used for brainstorming, providing information to students, and searching for class activities, thus, to address the limitations established on students regarding the use of cellphones in school, the teacher should be able to curate activities on Chatgpt that align with the students' individual interests." ChatGPT allows the students to search individually based on their curiosity. It could engage them to ask ChatGPT and then present the results in the class. Those statements are in line with Firat [12] that ChatGPT could be used as personalized recommendations for reading material and other resources, as well as interactive tasks and activities that meet students' specific needs and learning goals

3.2. Facilitating In-Depth Discussions

3.2.1. Providing Detailed Responses

The usage of ChatGPT could enhance teaching accessibility and inclusivity. Orchid believed that "ChatGPT will assist the teachers in designing lesson plans for addressing weaknesses in students. For example, if there are students with less reading capability, ChatGPT has a solution to help the teacher solve those problems.

3.2.2. Encouraging Critical Thinking

Elementary school teachers used ChatGPT as a learning tool to search for information, including sources, material, teaching ideas, and other information

needed for their teaching needs. Indeed, it requires them to be more creative, which leads to developing critical thinking for teachers and students. Rose considers that “ChatGPT gives information based on teachers' preferences. If the information is not in line as expected, it has to be more specific, the question needs to be as clear as possible, assuming that ChatGPT will give an answer according to how detailed the question that has been asked.” This is in line with Octavio [25], ChatGPT could be used as a stimulant for developing critical thinking. As similar to study by Guo, ChatGPT fosters students critical thinking skill to ask meaningful questions regarding to class activities [27].

3.2.3. Encouraging Critical Thinking

ChatGPT supports the exploration of complex topics in the teaching and learning process. Rose highlighted that “ChatGPT facilitates teachers in accessing additional information relevant to the learning process. Similarly, students can utilize ChatGPT to explore further on specific learning topics, such as supplementary materials provided in the classroom”. This statement is in line with Bozic [5], which states that ChatGPT could be used as a tool to enhance students' search for complex topics. It assists students in getting resource recommendations for the topics that have been discussed in the classroom.

3.2.4. Stimulating Curiosity

ChatGPT facilitates in-depth discussions, which could be used to stimulate students' curiosity. Rose believed that “Teachers can trigger questions to motivate students to ask ChatGPT for the answers. It could increase students' curiosity and ask ChatGPT for better understanding. The more specific the prompts, the more detailed ChatGPT will generate the answer.” One of the most significant features of ChatGPT is its rich information resource, which provides students with information from another perspective that may not be thought of by students [28]. This feature assists students in increasing their motivation and curiosity to gain a greater comprehension of the learning material.

3.2.5. Promoting Collaboration

ChatGPT assists teachers in designing collaborative learning in the classroom. Anemone states, “with help from ChatGPT, teachers can create an activity to encourage students to collaborate in groups. It also makes the learning in the classroom livelier than students learn individually”. From that, students who usually do not contribute to the class could be more active and engaged with the learning materials when they individually make prompts to consult with ChatGPT on the assigned material and later discuss their answers generated by ChatGPT to the other members to come up with a result of their discussion. This learning situation further exemplifies the statement from Octavio [25] that ChatGPT can serve as a valuable teaching aid. One of the advantages of ChatGPT is that it fosters collaboration in the learning environment.

3.3. Cultivating Real-World connections

3.3.1. Providing relevant examples

ChatGPT provides some cases that relate to students' interests. Anemone highlighted that "ChatGPT aids teachers in designing lesson plans that align with students' everyday activities. The lesson being taught becomes more beneficial to students when it is relevant to their own experiences." This is in line with Halaweh stating that ChatGPT is one of the artificial intelligences that could provide information related to and relevant to students' interests and daily life context [29].

3.3.2. Addressing Current Event

ChatGPT fosters concrete interactions regarding learning and real-time occurrences. Students can learn about any possible event that happened recently and create a learning environment to be more valuable. Anemone stated that "ChatGPT enables teachers to enhance the authenticity of the learning experience and facilitate its practical application in daily life. For instance, ChatGPT can offer insights into the consequences of littering, and based on the findings generated from ChatGPT, teachers can present this information for classroom discussions". Students can be given prompts from what is happening in the world related to any issues to generate discussion among them using English as the target language and relevant to the learning objectives. This is in accordance with Ray [30] that ChatGPT is able to show recency bias by giving greater importance to recent or present events, trends, or beliefs in the information it generates.

3.3.3 Supporting Project-Based Learning

ChatGPT provides support to teachers in making project-based learning activities. Anemone believes that "ChatGPT gives numerous references to support project-based learning. There are several activities that can assist teachers in designing activity plans generated by ChatGPT. Thus, it could enhance students' critical thinking, and inter-activeness from project-based learning that has been provided from ChatGPT." From this statement, Purnama [31] stated that ChatGPT has great potential for improving the teaching and learning process, and it could be used as a new alternative learning media facilitating project-based learning.

3.3.4 Facilitating Virtual Field Trips

ChatGPT could facilitate teachers for making virtual field trips and activities related to teachers' subjects and learning objectives. Anemone highlighted that "ChatGPT has various information that could be used as teaching materials. For instance, students can access ChatGPT to get information about places, such as mountains, tourism villages, and popular landmarks, and later use it as a topic for discussion in the class". Students do not need to travel far to get ideas and images of the places or conditions. ChatGPT provides clear descriptions that make it seem as if they have real experiences. Kostikova argued that the results

that ChatGPT has generated encourage students to be more creative, enabling them to examine and interpret the material provided [32].

3.4 Empowering Student Inquiry

3.4.1 Providing Instant Access to Information

ChatGPT enables quick access to information. Anemone stated that “ChatGPT is beyond expectation; it provides very detailed information compared to other search engines, and its search results are concise and directly relevant to the user's query.” This improves students' motivation to learn more because the information is clear and straight to the point. Therefore, Rane [33], said that ChatGPT encourages a student-centred approach that accommodates various learning styles. Students will find themselves safe to gather information and explore a lesson or topic in ChatGPT.

3.4.2 Supporting Independent Research

ChatGPT could support students in learning individually. Anemone believed, “Using ChatGPT, teachers can give instruction to get any information related to the subject. Supporting the curriculum, the instruction can be delivered with High Order Thinking Skills [HOTS] to increase students' critical thinking, in addition to solving the problems provided by the teachers.” In line with Firat [12], ChatGPT can give recommendations and suggestions for learning specific subjects that cater to the distinct criteria and learning goals of students. With ChatGPT, students can receive learning support that will improve their academic performances [34].

3.4.3 Facilitating Inquiry-Based Learning Activities

In addition to project-based learning, ChatGPT enables the implementation of learning activities that promote inquiry-based learning. Jasmine stated, “ChatGPT could be used as a teaching aid in which to instruct students in formulating inquiries and acquiring knowledge from the available outcomes of ChatGPT. Additionally, ChatGPT can offer web suggestions pertaining to videos and images that can be utilized for educational purposes”. Teachers can provide some cases from the world's issues or any real-world contexts relevant to the topics for the students to solve. Students can consult ChatGPT to solve the case, and then later; students can be required to formulate relevant and feasible solutions to the case. Adeyele asserted that ChatGPT assists teachers in creating Inquiry-based learning to support students in personalized learning [35]. In addition, students will get a better understanding of the lesson that has been simplified by Chat GPT.

3.5 Immediate Feedback for Mastery

3.5.1 Assessment Assistance

ChatGPT assists teachers in creating appropriate assessments by giving instant feedback on specific subjects. Jasmine highlighted that “ChatGPT enables teachers to develop assessments and grading rubrics of particular learning objectives. Therefore, the questions prompt should be detailed to get the information needed by the teachers for the evaluation regarding the assessment type, the grading criteria, and the skills being assessed. Furthermore, ChatGPT gives essential components that should be considered while evaluating students’ performance or knowledge. This finding is relevant that ChatGPT could be used as a learning aid to assist teachers in creating appropriate assessments and scoring the students’ assessments [18], [36].

3.5.2 Interactive Quizzing

ChatGPT enables teachers to create an interactive quiz to increase students’ understanding and mastery of the lesson. Jasmine believes that “ChatGPT is a valuable tool for teachers to enhance students’ and teacher’s engagement by facilitating the creation of quizzes.” This can also create a positive competitive learning ambience among students. Jasmine added that not only is it able to generate quizzes or test items, but ChatGPT can also generate answer keys for these quizzes”. In accordance with Kohnke [14], one of the benefits of using ChatGPT in education is its capability to design quizzes and test items that can be applied in teaching situations.

3.5.3 Personalized Learning Paths

ChatGP provides rapid responses to increase students’ mastery of the lesson in terms of its ability to personalize learning. Jasmine said, “With ChatGPT, students are able to do personalized learning. It could be used as a guidance to answer students’ questions and teachers could facilitate their students to learn by itself.” In line with Subiyantoro [6], When students need assistance solving difficulties quickly, Chatgpt can offer real-time responses and information around-the-clock, promoting independent learning.

3.5.3 Progress Tracking

ChatGPT enables teachers to give immediate responses by assisting teachers in tracking the students’ progress. It could assist teachers in monitoring students in the teaching and learning process. As Jasmine stated, “Using chatGPT, teachers could keep an eye on their students’ learning process. By assigning various tasks, teachers can assess each students’ comprehension level, and subsequent instruction can be tailored to that knowledge”. With the ability of ChatGPT, teachers could utilize it to manage the classroom and integrate ChatGPT into the teaching process that is implemented in the classes [25].

3.6 Promoting Reflective and Connection

3.6.1 Facilitating Peer Discussions

Through ChatGPT, teachers are able to facilitate group discussions among students or students as a whole class. Several activities could be generated in ChatGPT to assist teachers in designing various learning activities. Jasmine believes that “ChatGPT could increase the effectiveness of teaching and learning process, by generating the example of classroom activities.” Octavio [25] stated that ChatGPT could be a teacher’s assistant in designing learning materials. Those activities that ChatGPT generates allow the teachers to create a practical group discussion in the class.

3.6.2 Supporting Metacognitive Skills

With ChatGPT, teachers could generate reflective activities based on the students' feelings toward learning. Jasmine states, “ChatGPT assists students in their learning by offering reflection tasks that measure their comprehension and engagement levels in relation to classroom activities.” As outlined by Dahri [37], ChatGPT has the power to provide significant insights and explanations that enhance students' comprehension level of complicated topics. He mentioned that ChatGPT supported the lesson plan creation and could achieve the highest competency.

3.7 Supporting Diverse Learning Path

3.7.1 Adjusting Support Level

Adjusting support level refers to ChatGPT's ability to design lesson plans based on students' level of proficiency. Jasmine highlighted, “Teachers can utilize ChatGPT as a reliable and easily implementable learning tool. Besides, ChatGPT could assist the teachers for answering various difficult questions in accordance to teachers’ need”. Similar to Amin, the benefit of using ChatGPT as a support learning tool is that teachers can focus on directing the students and addressing their needs [4].

3.7.2 Flexible Learning Resources

Another advantage of ChatGPT is its capacity to offer teachers various and comprehensive learning resources. These resources are accessible and can be introduced and implemented within the classroom. Jasmine believed that “ChatGPT offers a wide variety of instructional resources and are seamlessly integrated into the classroom without the need of additional apps or software.” This is in line with Amin's [4] view that ChatGPT is able to provide various learning activities and further resources to the class. ChatGPT is a dynamic learning platform, that provided boundless advantages to giving educational resources, referring to individuals from different background [38].

3.8 Cultivating a Positive Learning Environment

3.8.1 Fostering Confidence

The first thematic of ChatGPT for cultivating a positive learning environment is the ability to promote students' confidence towards learning experiences. Lily mentioned that "ChatGPT can assist teachers in locating educational resources and organizing instructional materials, so promoting greater collaboration and interactivity among students during classroom instruction". As similar to Subiyantoro [6] that ChatGPT has a capability to support learning process and assisting them to overcome learning objectives.

3.8.2 Cultivating a Growth Mindset

The findings from the interview with the participating teachers show that ChatGPT fostered students' positive learning environment. Using ChatGPT, teachers can facilitate and improve students' mindset towards learning. Lily believed that "ChatGPT facilitated students in gaining a comprehensive understanding of the ongoing classroom instruction. Hence, it enhanced their fundamental skills to foster creativity". This is related to Ivanovska's [2] study; one of the advantages of using ChatGPT in education is the ability to support students who are having difficulties learning the materials since it covers students' unique and different learning styles.

3.8.3 Creating a Supportive Learning Environment

In addition, the study revealed that ChatGPT enabled teachers to support students by creating a learning environment that is suitable for their needs. Lily highlighted that "With ChatGPT, it could alleviate the academic load on teachers by enabling them to enhance their creativity through the prompts that yield relevant answers aligned with the learning objectives." Cheong [17] has a similar statement that ChatGPT could generate different problem-solving regarding students' needs, leading to students' support of learning material.

The Pedagogical Integration of Chat-GPT Contributing to the Creation of a Dynamic and Engaging Learning Atmosphere for Elementary School Students

3.9 Personalized Learning Experiences

3.9.1 Adaptive Tutoring

Another finding from the elementary school teachers participating in this study was that ChatGPT facilitated teachers to generate adaptive tutoring for students referring to learning material within the classroom. Lily stated that "ChatGPT enables students to obtain a more comprehensive explanation of their learning materials when they encounter difficulties in comprehending the material presented during class." The participant acknowledged ChatGPT's ability to generate adaptive tutors regarding students' needs by offering an answer related to students' difficulties with the learning material. These findings correlate with the previous study [6, 39], which found that another advantage of using ChatGPT in education is the ability to generate adaptive learning experiences based on students' interests.

3.9.2 Interactive Q&A Session

According to elementary school teachers' experiences while using ChatGPT as pedagogical integration, what contributes to the creation of a dynamic and engaging learning atmosphere is its ability to design an interactive question and answer during a classroom activity. As mentioned by Lily, "using ChatGPT, I could facilitate enhanced collaboration between students and teachers in resolving textbook queries better. Additionally, it served as a platform for discussion, enabling students and teachers to clarify responses provided by ChatGPT". This finding is in line with a previous study from Rane [33] that the results generated by ChatGPT can be a discussion material to engage students in discussion and interaction with other members of the class. With ChatGPT, teachers can get answers to their queries related to the teaching materials. Thus, it will assist teachers and students in solving a problem from a textbook or common question within the classroom.

3.9.3 Peer Collaboration

ChatGPT demonstrates the capacity to facilitate collaborative activities among peers in educational settings, thereby enhancing classroom engagement. This is one of the findings of ChatGPT in pedagogical integration for creating dynamic and engaging learning within the class environment. Lily outlined the benefit of using ChatGPT, "ChatGPT enables educators to design highly interactive learning experiences, fostering increased collaboration among students within the classroom setting. Furthermore, ChatGPT has the capability of providing comprehensive information concerning the learning projects based on the teacher's objectives". This is supported by the work of Nguyen [40], who found that ChatGPT has the potential to promote students' collaborative experiences through activities provided by ChatGPT.

3.9.4 Individualized Assessments

In accordance with elementary school teachers, using ChatGPT for pedagogical integration contributes to creating a dynamic and engaging learning environment that can assist teachers in creating various assessments to evaluate students' comprehension. Lily expressed the ability of ChatGPT to create an individualized task, stating that "Utilizing ChatGPT, teachers can generate practices and assessments tailored to the individual aptitudes of their students. Additionally, it has the capacity to facilitate individualized instruction, thus, enhancing students' understanding of educational concepts". Similar observations were made by Kurniawan [24], who reported that teachers got benefits from the availability of ChatGPT, which they can utilize to enhance the diversity of learning experiences and tailor them to accommodate the capacities of their students.

3.9.5 Real-Time Support

Another key thematic finding from elementary school teachers regarding the use of ChatGPT in learning situations is real-time support. Teachers and

students can access ChatGPT without a time limit and in any condition. As Lily mentioned, “ChatGPT reduced the learning strain by providing on-demand access to teachers and students. Additionally, the utilization of ChatGPT can enhance students' ability to learn autonomously”. Our data echoes the result of Opara's [41] study, which found that ChatGPT can offer to independent students and individuals seeking immediate responses to develop new skills. He outlined that ChatGPT can decrease teachers' workload in addition to teaching and learning situations.

3.10 Interactive Learning

3.10.1 Class Discussions

ChatGPT possesses the capability to augment classroom conversations. This conversation aims to enhance collaboration among students and teachers, as well as foster cooperation among students themselves. One of the discoveries made during an interview with an elementary school teacher is that ChatGPT can enhance interaction in the learning process. Daisy mentioned that “ChatGPT enables teachers to design educational activities that foster student engagement in discussing learning materials, thereby enhancing students critical thinking skills and facilitating deeper information exploration.” These findings are in line with the conclusions of Ivanovska [2], indicating that one of the advantages of ChatGPT is its ability to engage in meaningful discussions with students. Octavio [25] also mentioned that besides the ability to promote collaboration, ChatGPT could increase students' critical thinking toward the learning material.

3.10.2 Interactive Quizzes and Polls

ChatGPT enhanced the learning experience by creating interactive quizzes and polls, encouraging students to participate actively in the learning process. This discovery was derived from the experience of elementary school teachers in enhancing educational outcomes by establishing a dynamic and engaging learning atmosphere for students. Daisy stated that “ChatGPT can assist teachers in their learning activities, particularly in the creation of quizzes or polls that enhance student engagement.” This is in agreement with Kohnke's [14] findings, where it was shown that by using ChatGPT, teachers will be able to develop quizzes to promote student engagement regarding learning materials.

3.10.3 Collaborative Storytelling

Another key finding from the ability of ChatGPT in creating interactive learning is it can provide students to be more active by doing collaborative storytelling as learning activity during the classroom. Daisy outlined that “Teachers can utilise ChatGPT as a platform to facilitate collaborative learning activities, such as storytelling, which will effectively include students and enhance their participation in the learning process. These results are consistent with a study conducted by Baskara [10], which suggests that the implementation

of ChatGPT can increase the collaboration between students to maximize the use of ChatGPT.

3.10.4 Simulated Role-Playing

Teachers can adapt teaching materials provided by ChatGPT; one example of this is simulated role-play. This activity engaged students and created an interactive learning environment inside the classroom. Daisy believed that “ChatGPT enables teachers to design engaging educational exercises, including the utilisation of role-playing activities. Students will enhance their communication skills and foster a dynamic learning environment, resulting in a more diverse classroom experience”. The findings confirmed a previous study by Baido-Anu [18] that one of the benefits of using ChatGPT in education is its ability to enhance interactive learning that generates innovative activities during classroom learning, including role-play.

3.10.5 Interactive Simulations and Games

ChatGPT enhances interactive learning by effectively generating diverse learning activities, such as simulations or games. This is one of the key thematic findings of ChatGPT in pedagogical integration for designing a learning environment that becomes engaging and interactive for the students. Daisy highlighted that “Teachers can enhance the interactivity of learning by modifying the educational content and utilizing ChatGPT as a teaching aid platform. This can be achieved through engaging activities such as brainstorming sessions or educational games, which promote greater student participation and engagement”. These findings resonate with the theoretical framework proposed by Hatmanto [9], which posits that ChatGPT offers the capability to generate interactive learning activities that can effectively stimulate students' motivation, hence immediately enhancing their learning experience.

3.10.6 Immediate Feedback

In this instance, it was discovered that elementary school teachers, while utilizing ChatGPT, were capable of evaluating the learning activities conducted in the classroom. Teachers can effectively employ this to verify their work and enhance their comprehension of the educational content. Daisy explained that “ChatGPT provided the capability to offer prompt feedback, thereby assisting teachers and students in comprehending the learning material more thoroughly. Additionally, it can alleviate the teachers' burden in performing administrative duties”. Similar to the study conducted by Rane [33], it indicates that using ChatGPT, teachers can utilize it in various learning objectives, in addition to providing instant feedback that allows teachers to monitor students' progress and encourage collaborative learning experiences.

3.11 Support for Different Learning Modalities

3.11.1 Visual Learning

ChatGPT can generate diverse educational content according to students' individual learning preferences. The efficacy of ChatGPT in enhancing learning interactivity and dynamism has been observed through the experiences of elementary school teachers. Daisy emphasized this by mentioning ChatGPT's ability to support students with a visual learning style. Daisy stated that "ChatGPT can offer recommendations for educational activities that specifically involve visual elements inside the classroom setting. Teachers can utilize many forms of interactive media, such as images and videos, to enhance learning, particularly for students who have a preference for visual learning. Even though the information was just on what kind of images or pictures or videos that could possibly be used in the learning activities, it already assisted teachers in designing classroom activities". These findings are also related to a study conducted by Rane [33], who found that teachers could customize classroom activities relating to the students' learning styles, especially for visual learning students.

3.11.2 Kinesthetic Learning

ChatGPT also provides classroom activities for students that have kinesthetic learning styles. By giving suitable prompts, teachers could use ChatGPT to construct learning that can dynamically adjust to the requirements of students, particularly those with kinesthetic learning preferences. Daisy believed that "teachers can leverage the environment to design learning activities that motivate students to demonstrate their understanding through artistic expression, such as drawing, which aligns with the learning objectives." As asserted by Halaweh [29], teachers can use ChatGPT to create dynamic learning materials and offer students new ways of learning the materials.

3.11.3 Multimodal Presentations

ChatGPT is capable of incorporating adaptive learning techniques tailored to individual students' learning capabilities. Teachers can integrate students' various learning styles, such as visual, kinesthetic, and auditory, into an activity to enhance learning efficacy utilizing ChatGPT. Daisy stated that "ChatGPT can enhance classroom learning by offering teachers tailored ideas for learning exercises that take into account students' individual learning skills, including visual, kinesthetic, and auditory modalities. This integration aims to enhance student comprehension and understanding". These findings are in line with a previous study by Javaid [15], who found that ChatGPT has the capabilities to transform the classroom environment and foster deeper learning, creating an interactive learning experience for both teachers and students.

3.12 Encouragement of Exploration and Inquiry

3.12.1 Open-Ended Questions

According to the elementary school teachers' experience in using ChatGPT as a teaching aid for creating dynamic and interactive learning environments,

ChatGPT proved to be a valuable tool for assisting students and teachers in addressing any questions that emerge during the learning process. This enhanced students' readiness to ask questions and enhance their capacity for critical thinking. As Daisy mentioned, "ChatGPT enables teachers to enhance students' collaboration by facilitating active inquiry and questioning regarding the learning materials, thereby fostering students' critical thinking skills." These findings supported a previous study by Firat [12], which found that ChatGPT has the ability to encourage students' learning comprehension by giving recommendations and suggestions in addition to helping the students relate to their needs.

3.12.2 Problem-Solving Challenges

ChatGPT enhanced the capability of teachers to develop a lesson plan that centers around the students' aptitude for problem-solving, which can be utilized by teachers for classroom implementation. That tailored lesson plan is beneficial to improve students' capacity to engage in critical thinking and provide accurate responses as they progress in their studies. Daisy asserted, "ChatGPT can assist teachers in creating instructional exercises that prioritize problem-solving approaches, aiming to stimulate students to think critically and devise answers to various challenges." As stated by Hatmanto [9], who has similar insight, ChatGPT could create task-based learning activities that can engage students in problem-solving through task-based activities.

3.12.3 Debate

The last key theme related to the experience of teachers in using ChatGPT to make learning dynamic and interactive was its ability to create learning activities that involve students in expressing their opinions to enhance the soft skills of the students. Daisy highlighted that "ChatPGT can produce various learning activities to promote students' engagement during the learning process. One such activity involves fostering arguments or opinions related to ongoing learning topics. Enhancing students' communication skills and fostering their critical thinking abilities will enable them to articulate their opinions in alignment with the learning objectives effectively". As a related study by Bozic [5] indicates, ChatGPT enhanced classroom discussion, encouraged students to think critically, and involved them in meaningful discussions.

4 Conclusions

ChatGPT is an AI tool that has the potential to transform classroom dynamics significantly, especially in elementary schools. The findings of the study showed that it can enhance lesson planning, support differentiated instruction, and create a dynamic learning environment. It accommodated a variety of learning styles and needs by providing customized learning paths, deep discussions, and autonomous learning. In addition, the teachers asserted that ChatGPT is a powerful AI tool to assist them create authentic lesson plans, reduce administrative workload, and personalize student

learning experiences. It was also identified that ChatGPT enabled teachers to provide a dynamic and engaging classroom environment by promoting differentiated learning, self-directed learning, and critical thinking. ChatGPT also offers real-time support, personalized feedback, and interactive learning activities, making it an invaluable tool for establishing relevant and engaging learning environments.

To maximize the potential of ChatGPT, teachers need to be provided with and involved in training on technological skills and pedagogical strategies. Therefore, there is a requirement for sufficient teacher training regarding AI tools, especially ChatGPT. In addition, implementing strong privacy and ethical regulations is critical to ensure that AI is used safely and responsibly. By addressing these issues, policymakers and teachers can use ChatGPT to build more enriched, engaged, and equitable learning environments for elementary school students.

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