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ChatGPT-Supported Education in Primary Schools: The Potential of ChatGPT for Sustainable Practices

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Abstract: This study aims to evaluate the potential of using ChatGPT at the primary school level from the teachers' perspective within a sustainability framework. The research was conducted as a qualitative case study involving 40 primary school teachers in Turkey during the 2023–2024 academic year, all of whom had no prior experience with ChatGPT. Data collection tools included semi-structured interview forms and researcher diaries developed by the researchers. The data obtained were analysed using content analysis. The findings indicate that most primary school teachers believe ChatGPT is suitable for primary education and can contribute to Sustainable Development Goal (SDG) 4. Additionally, teachers noted that ChatGPT enriches the teaching process and is user-friendly. These findings suggest potential contributions to SDG 4.1 and SDG 4.2. However, concerns were raised regarding ChatGPT's potential to provide false information, which may negatively impact SDG 4.7. The study also identified that ChatGPT is particularly suitable for mathematics, Turkish, and English courses. This study's main contribution is that it shows how ChatGPT can help sustainable practices in primary education by getting teachers more involved and meeting specific curriculum needs. This gives us useful information for incorporating AI tools into education that is in line with SDG 4. It is recommended that training programs about ChatGPT and similar AI-supported tools be organised for teachers and parents.

Keywords: ChatGPT; artificial intelligence (AI); primary school teachers; primary school level; sustainable; SDG4

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1. Introduction

The role of technology in education is more critical today than ever before. Teachers strive to enrich students' learning experiences using effective and innovative classroom tools [1,2]. In particular, artificial intelligence (AI) and natural language processing developments can potentially transform education [3–5]. These developments accelerate and make learning processes more efficient and offer student-centred, personalised learning opportunities [6,7]. AI-supported tools, such as ChatGPT, are essential to increase learning outcomes by providing students with content according to their learning pace and needs [8]. These systems allow students to receive feedback at any time and continuously improve their learning processes [9]. However, despite these advantages, using AI-powered tools like ChatGPT in primary schools poses several challenges [10]. The accessibility of technology is a major issue. Not all schools, particularly those in rural or underfunded areas, have the infrastructure or resources necessary to effectively implement such tools in their classrooms [11]. Furthermore, the challenge lies in providing teachers with sufficient training to

effectively incorporate AI into their teaching methods [12]. Many primary school teachers may lack the technical skills or confidence to use AI-supported tools, limiting their ability to leverage the full potential of these technologies in their classrooms. Another concern is the ethical implications of using AI in education, such as data privacy, student dependency on technology, and the possibility of reducing human interaction in the learning process [13]. Such AI-based systems also offer significant opportunities for sustainable education practices. The United Nations' (UN) Sustainable Development Goals (SDGs) goal of "quality education" closely aligns with sustainability. While aiming to provide inclusive and equitable educational opportunities for all, this goal also emphasises the transformation of teachers and learning environments in this process [14]. AI models like ChatGPT can promote sustainability in education.

This study specifically contributes to the existing body of knowledge by examining how ChatGPT can facilitate sustainable educational practices in primary school settings. It fills the void in the literature by exploring teachers' viewpoints on AI tools, thereby offering a refined comprehension of the effective implementation of these technologies. Section 1 of this paper will review the existing literature on the role of AI in education, with a particular focus on ChatGPT's functionalities. Section 2 will present the methodology used in this study, including data collection and analysis methods. The subsequent section will discuss the findings from primary school teachers regarding ChatGPT's potential in sustainable education practices. Finally, the paper will conclude with recommendations for educators and future research directions.

In this context, sustainable education is about short-term achievements and preparing students for future challenges. The insights gathered from primary school teachers reveal the practical benefits and challenges of integrating ChatGPT into classroom practices, thus enriching the discourse around sustainable education. The personalised learning opportunities offered by ChatGPT can contribute to reducing inequalities in education and creating a more equitable learning environment. Nonetheless, we must address these challenges—ranging from technical infrastructure gaps and teacher preparedness to ethical concerns—to fully realize this potential [15]. Moreover, these tools can help achieve educational sustainability goals by promoting the efficient use of resources and reducing teacher workload [16,17]. In this framework, this study evaluates ChatGPT's sustainability potential from primary school teachers' perspectives. Understanding ChatGPT's potential in the classroom and exploring its practical applications can help determine how much this technology contributes to long-term sustainable education goals. In particular, teachers must transform their classroom environments using tools such as ChatGPT to promote quality, inclusive, and equitable educational practices. In the end, this study shows how ChatGPT has the potential to change education. It suggests that, if it is used correctly, it can not only improve learning experiences but also help achieve larger sustainability goals, which can lead to more creative and flexible ways of teaching.

1.1. What Is ChatGPT?

ChatGPT defines itself as an artificial intelligence platform launched in early 2022. When asked to define itself ("What is ChatGPT?"), it responds as follows:

> *ChatGPT is a language model developed by OpenAI. I am an artificial intelligence model based on the GPT-3.5 architecture. I am an AI assistant that can communicate with humans in natural language, answer questions on various topics, and perform text-based tasks. (ChatGPT 3.5, 25 September 2023).*

ChatGPT's ability to provide personalised and responsive AI support to students and teachers, such as providing instant feedback, answering questions, offering resources, evaluating assignments, and lesson planning, makes it an efficient application in human education [18]. Researchers who believe in the potential of ChatGPT in the field of education emphasise that this platform is successful in tasks such as answering questions and generating text, and has intelligent conversational capabilities in educational contexts [19–21]. On the other hand, those with opposing views on the use of ChatGPT in

education emphasise the negative impacts on learning and teaching at all levels, such as the spread of misinformation and biased views, the violation of academic integrity, job loss, and increased inequalities [22].

The advent of ChatGPT has generated significant public interest and worldwide apprehensions over the utilisation of AI in education [23,24]. This "ChatGPT tsunami" has created uncertainty for teachers and students, and the hope for a better education [25]. When the literature is examined, it is determined that there are generally conceptual studies, few empirical studies to eliminate uncertainties, and limited information about the roles and functions of artificial intelligence technologies such as ChatGPT in education. Several empirical research studies have investigated the utilisation of ChatGPT across various courses and educational levels. For instance, current research on ChatGPT, including Cooper's (2023) study on science education and Atlas' (2023) investigation into higher education, has explored the application of AI in student learning and educator instruction [18,26]. However, although previous research on AI integration in early childhood education has demonstrated the usefulness and potential benefits of ChatGPT in various aspects, studies on ChatGPT by classroom teachers are limited [24].

1.2. TPACK, ChatGPT, and Sustainability

Technological Pedagogical Content Knowledge (TPACK) is a framework that defines the knowledge domains required for teachers to make educational processes more efficient and sustainable by effectively integrating content, pedagogy, and technology [27,28]. TPACK emphasises that teachers must balance the interaction among these three knowledge domains so instructors can convey content accurately and integrate technology into educational processes sustainably [29].

Among the Sustainable Development Goals (SDGs), the "Quality Education" goal (SDG 4) aims to promote lifelong learning opportunities while ensuring that education is inclusive, equitable, and of high quality for all. In line with this goal, the TPACK framework enables teachers to create sustainable and innovative educational environments by combining technology with pedagogical approaches [28]. In particular, the effective integration of technology into teaching processes is one of the keys to achieving sustainable development in education systems.

ChatGPT, an artificial intelligence (AI)-supported language model, represents the technological knowledge component of the TPACK framework and has excellent potential to achieve the pedagogical goals of teachers at the primary school level [30]. In sustainable quality education, incorporating AI tools such as ChatGPT into teaching processes can help teachers improve their digital literacy and make their learning processes more inclusive and effective. For example, teachers can use ChatGPT to provide customised learning experiences that match the individual learning pace of primary school students. Providing learning materials tailored to each student's needs is crucial in ensuring quality education, as it promotes equality of educational opportunities [31].

The role of ChatGPT in the TPACK framework also enables teachers to create sustainable learning environments by combining content, technology, and pedagogy. The pedagogical knowledge component is critical for teachers to know how and when to use technology. For example, when designing meaningful and engaging learning experiences for elementary school students, teachers must optimise ChatGPT's capabilities using their pedagogical knowledge [32]. This allows students to use technology meaningfully and creates a sustainable educational experience.

On the other hand, the content knowledge component is a decisive element in the effective use of ChatGPT. In sustainable educational processes, teachers' in-depth understanding of content knowledge is essential when integrating this technology into their teaching strategies. Effective use of ChatGPT in classroom activities is possible only if teachers thoroughly understand content knowledge and the limitations of AI technology [33]. This contributes to teachers guiding students to achieve their learning goals and serves the fundamental goals of quality education [6].

As a result, the integration of TPACK and ChatGPT encourages teachers to contribute to quality and sustainable educational processes. A balanced combination of technology, pedagogical methods, and content knowledge helps teachers achieve sustainable development goals. In this context, integrating ChatGPT into classroom teaching activities significantly contributes to sustainability efforts in education. It provides more inclusive and innovative learning opportunities for students at the primary school level.

1.3. ChatGPT's Role in Sustainable Education Frameworks for Primary Education

Primary school is a critical stage where children acquire essential skills which form the foundation of their later educational life [34]. In this process, teachers play a vital role in helping children develop these skills [35–37]. Integrating technology into educational processes provides students with basic literacy skills and helps them overcome challenges they will face in future educational levels by developing their technological literacy [38,39]. The proficiency of primary school teachers in information and communication technologies (ICTs) allows for the efficient use of technology-enhanced instructional instruments into their instruction [39]. In this context, integrating AI-supported tools, especially ChatGPT, into education offers an innovative solution that enables teachers to create more effective, sustainable, and efficient learning environments.

SDG 4 (Sustainable Development Goal 4), highlighted at UNESCO's "Beijing Consensus on Artificial Intelligence and Education" conference in Beijing in 2019, emphasises the importance of promoting artificial intelligence in education. Key strategies such as planning education policies, empowering teachers, and increasing opportunities for lifelong learning demonstrate the transformative impact of AI [14]. AI-based systems, such as ChatGPT, can effectively compensate for students' learning losses and improve their mathematical and language skills by supporting learning processes at the primary school level with personalised feedback [40,41]. Particularly within the sustainability framework, primary school education lays the foundation for building social and environmental awareness [42]. As a result, raising sustainability awareness in students at an early age enables education systems to contribute to long-term environmental and social sustainability [43,44]. ChatGPT can help achieve the Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), by introducing students to these concepts and contributing to the broader reach and continuity of education [30,45].

AI-powered tools can provide equality in education by offering personalised learning experiences, which can form the basis of sustainable development [40,41]. Tools such as ChatGPT can provide equal opportunities in education and create sustainable learning environments by responding to students' individual needs [30,45]. The advantages offered by artificial intelligence in expanding educational opportunities and eliminating learning losses, especially for students living in disadvantaged regions, are remarkable [32,46].

One of the most significant advantages offered by ChatGPT is its ability to provide personalised and immediate feedback to students [47]. This can significantly enhance the efficiency of education, especially in underserved areas, while increasing sustainability in learning processes [9]. The use of such innovative technologies in education provides broader opportunities for teachers and students to achieve the United Nations' SDG 4 targets in the context of sustainable development [48,49]. Additionally, teachers' ability to integrate tools such as ChatGPT into their educational processes supports sustainable education models by improving their digital pedagogical skills [50].

The increase in online education during the pandemic has heightened the need for digital technologies among teachers and students [47]. This process, which began in 2020, revealed the importance of technology integration in education for sustainability [51]. Especially in disasters, technologies such as ChatGPT emerge as essential solutions to ensure continuity in education [52]. These technologies can prevent learning losses by increasing access to education and ensuring the continuity of sustainable learning environments [53].

A sustainable education approach should encompass environmental sustainability and the pedagogically effective use of technology [54]. While ChatGPT enables teachers to

create innovative technology-based learning experiences, it also contributes to realising the Sustainable Development Goals [55]. In this context, teachers' ability to use ChatGPT pedagogically meaningfully is critical for ensuring sustainability in education [32].

Consequently, the integration of ChatGPT at the primary school level offers the potential to transform education by improving teachers' digital pedagogical skills while providing students with more equitable and sustainable learning opportunities. This study aims to reveal how teachers can effectively use ChatGPT and how this technology can contribute to sustainable education goals.

2. Materials and Methods

In this study, the case study method was chosen as a qualitative research approach to explore in-depth the thoughts and experiences of primary school teachers regarding integrating ChatGPT into primary school education within sustainable education. Qualitative research methods allow for a detailed understanding of participants' experiences and perceptions by examining phenomena in their natural settings [56,57]. A case study is a research methodology employed to meticulously analyse and delineate one or more specific circumstances, events, phenomena, or communities [58,59]. In this context, examining the use of ChatGPT in primary school education provides a unique opportunity to understand its application and potential impacts in real-world educational settings. Furthermore, this study aims to evaluate the role of ChatGPT in supporting sustainable educational practices. Through the case study method, we obtained comprehensive insights into primary school teachers' perspectives on the potential of ChatGPT. We shed light on its practical application and adaptation to sustainability in education.

2.1. Participants

The study participants comprised 40 primary school teachers working in public schools in Turkey during the 2023–2024 academic year. The participants were selected using the purposive sampling method. The primary purpose of purposive sampling is to focus on specific population characteristics that best allow researchers to answer their research questions [60]. Purposive sampling is a prevalent method in qualitative research for identifying and selecting information-rich situations to optimize the utilisation of limited resources [60]. This sampling method involves identifying and selecting individuals or groups who are knowledgeable and experienced regarding the topic of interest [61]. The primary school teachers selected in this context voluntarily engaged in the study, and a consent form was secured from each participant. The research employed identifiers (T1, T2, T3, . . . T40) in lieu of the subjects' actual names. Among the participating educators, 28 were female and 12 were male. Of these teachers, 18 had 1–5 years of service, 12 had 6–10 years of service, 6 had 11–15 years, and 4 had 16–20 years of service. Thirty-two teachers worked in rural areas, while the remaining eight worked in schools in the central region. This distribution highlights the challenges faced by teachers in rural settings, including limited resources and variability in class sizes, which can directly impact the teaching process. We employed the purposive sampling method to select participants who are knowledgeable and experienced in the integration of technology in education, despite the sample not being representative of all primary school teachers in Turkey. This approach guarantees that the insights acquired are especially pertinent for comprehending the application of ChatGPT in diverse educational settings. The student count in the courses of the 18 teachers involved in the study varied from 1 to 20. Fourteen teachers had class sizes between 21 and 39, and the remaining eight had 40 or more students. Twelve teachers held master's degrees, while the remaining 28 had bachelor's degrees. In Turkey, primary school teachers often work under regulations set by the Ministry of National Education, following a centrally determined curriculum. This context may influence teachers' experiences with sustainable education practices and technology integration. The diversity among participants in terms of gender, years of service, and geographical distribution offers a nuanced perspective on the challenges and opportunities faced by teachers in both urban and rural settings. This

variety allows for an exploration of how different levels of experience impact the integration of ChatGPT in the classroom. For instance, teachers with varying years of service may have different comfort levels and familiarity with technology, which can influence their ability to implement innovative tools. Such insights can inform future research aimed at generalising findings across different regions and educational settings. The backgrounds of the participating teachers varied, as evidenced by the range of years of service among the participants. Specifically, the distribution includes 18 different groups of teachers with 1–5 years of experience, 12 with 6–10 years of experience, 6 with 11–15 years of experience, and 4 with 16–20 years of experience. Moreover, the challenges highlighted by the participants, particularly those working in rural areas with limited resources, underscore the importance of context in shaping educational practices. By addressing these specific challenges, the study contributes to a deeper understanding of how technology can support teachers in diverse environments. As such, the findings can serve as a foundation for future studies that seek to explore the broader implications of ChatGPT integration in primary education across different populations and educational frameworks. This diversity can provide important insights into how teachers of different experience levels integrate innovative tools such as ChatGPT into their classrooms. In summary, although the specific sample and context limit generalisation, the study offers crucial insights that can guide future research and practice. Understanding how ChatGPT can effectively integrate into diverse primary school settings in Turkey and beyond can be based on the variability in teacher backgrounds and the challenges they face.

2.2. Implementation Process

This study developed a training program for primary school teachers to integrate ChatGPT successfully at the primary school level. During the development of this training program, both national and international literature was examined. The draft program was finalised by incorporating the opinions of two experts in the field of artificial intelligence in education. The AI experts in our study have a deep knowledge of AI applications in education. The first expert is an academic working on educational technologies who has discussed AI applications at numerous international conferences. The second expert has experience in artificial intelligence and has integrated AI tools into various educational projects. Both experts contribute to the current research on the use of artificial intelligence in education. In this context, their expert opinions contributed greatly to the development of the draft program. The teachers participated in the training, which introduced the program content, for 10 h each week. This training was completed over a total of 4 weeks. The content of the prepared training program is presented in Table 1.

Table 1. ChatGPT training program.

1st Week
• What is ChatGPT? - An overview of artificial intelligence and the processing of natural language. - How does ChatGPT work? - The potential and importance of ChatGPT in education.
2nd Week
• Use and examples of use at the primary school level (e.g., answering student questions and creating learning material) • Integrating ChatGPT with sample applications at the primary school level. - Creating and editing learning materials. - Its role in developing students' language skills. - Designing activities for subjects such as literacy and mathematics. The training also discussed how ChatGPT can assist across various subjects by providing tailored explanations and generating relevant exercises, thus enriching the overall educational experience for students.

Table 1. *Cont.*

3rd Week
• Integration of ChatGPT into Primary School - How can it be integrated harmoniously into the primary school curriculum? - Providing customised learning experiences for student needs. • Using ChatGPT for Students - Teaching students how to use ChatGPT. - Developing skills to ask ChatGPT the right questions. - Security considerations when using ChatGPT. • Implementing Sample Practices for Students - Creating ChatGPT-supported lesson plans for students. - Using ChatGPT at events. This section included examples of how to use ChatGPT for various subjects, illustrating its application in creating lesson plans and interactive activities that foster student engagement and understanding in all academic areas.
4th Week
• Practice and Discussion - Sharing primary school teachers' thoughts on integrating ChatGPT at the primary school level. - Discussion of the difficulties and solutions that may be encountered during implementation. - An overview of the future and impact of ChatGPT in education. The discussion also focused on the potential limitations of ChatGPT in different subject areas, including mathematics, and strategies for overcoming these challenges through effective instructional practices.

In the prepared training, artificial intelligence and ChatGPT were introduced, and information on successfully integrating them into primary school education was conveyed. Then, during the training process, sessions were conducted to prepare lesson plans and activities incorporating ChatGPT. Sample applications were made to teach students how to use ChatGPT, ask the right questions, and utilise it effectively. However, it is crucial to emphasise that the quality of the questions posed significantly influences ChatGPT's effectiveness. We encouraged teachers to hone their skills in crafting well-structured questions to ensure ChatGPT provides more accurate and useful responses. Furthermore, the training sessions integrated discussions on generating ideal questions to elicit optimal answers. The safe use of ChatGPT and the issues to be considered were discussed, and the discussion section was initiated. In this section, teachers expressed their thoughts and concerns about using ChatGPT in the educational process. Lengthy discussions were held on these topics. Overall, the training aimed to equip teachers with the skills to leverage ChatGPT in a variety of subjects while addressing any limitations it may present in specific contexts.

2.3. The Process of Collecting Data

Data were gathered utilising a semi-structured interview format and researcher diaries to examine in-depth primary school teachers' views on integrating ChatGPT in the context of sustainable education at the primary level. We chose the semi-structured interview method due to its flexibility, which allows participants to express their thoughts in detail. This method includes both guided and open-ended questions and provides a deeper understanding of teachers' experiences and perspectives on the potential of ChatGPT in education. To ensure the validity and reliability of the study, the research triangulates data collection instruments to gain a broader and deeper understanding [62]. Triangulation employs two or more datasets [63]. Data were gathered at distinct intervals as part of the triangulation [64]. Interviews were performed post-training to ascertain the perspectives of primary school teachers. Prior to commencing the interview, the researcher apprised the participants of the ethical considerations, assuring them that the material gathered

would remain confidential and not be utilised beyond the scope of the research. All of the teachers signed a written informed consent form. The interviews lasted an average of 30–35 min and were conducted by the researcher. During the interview process, follow-up questions such as "...can you give an example about...?" and "...please explain what you mean in more detail about..." were used to clarify and expand the teachers' comments and encourage discussion. The interviews were recorded on voice recorders to prevent data loss. At the conclusion of each interview, participants were permitted to continue listening to the recording, and their consent was secured. After completing the interviews, the data were converted into verbatim transcripts. Before starting the research, the necessary permissions of the ethics committee were obtained from the relevant institutions [65]. The data collection process is shown in Figure 1.

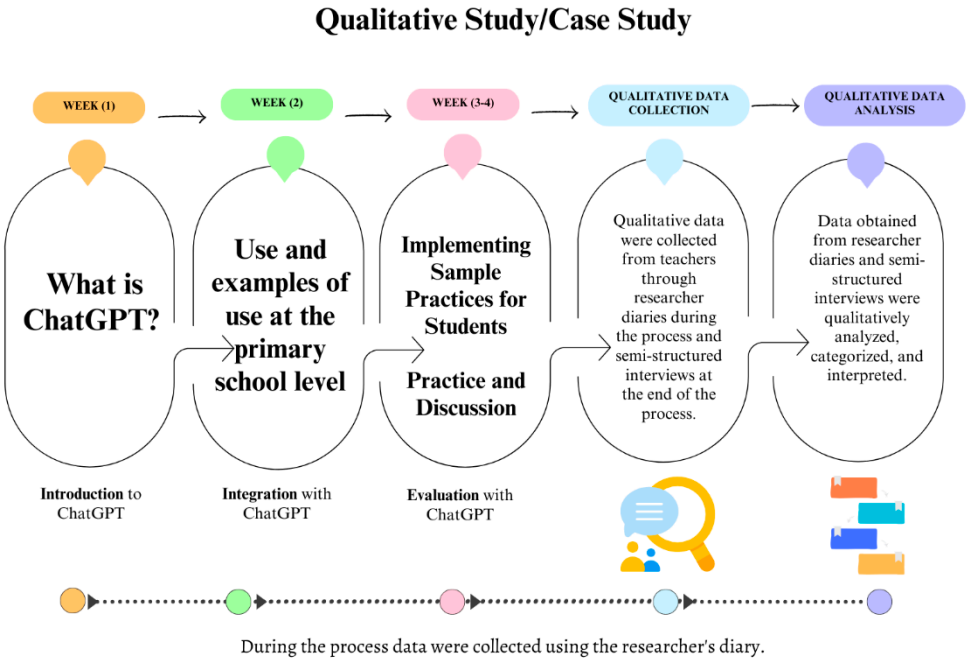

Figure 1. The process of collecting data.

2.4. Data Collection Tools

The researchers prepared a semi-structured interview protocol to determine primary school teachers' views on using ChatGPT at the primary school level. The draft form was created after conducting the necessary literature reviews and gathering expert opinions. Two specialists in primary education and artificial intelligence applications in education examined this form. The interview protocol was finalised in line with the feedback received from the experts. The semi-structured interview format is found in Appendix A. Alongside the semi-structured interview format, a researcher's diary served as a data collection instrument to monitor the activities of teachers throughout the training program.

2.5. Data Analysis

In this study, to evaluate the potential of using ChatGPT at the primary school level within the sustainability framework from the teachers' perspective, their responses to semi-structured interview questions and research diaries were analysed through content analysis. The data obtained were described using inductive content analysis [59,66]. This analysis involves a classification process that includes coding and identifying themes or categories that facilitate the subjective interpretation of interview data [67,68]. The researchers identified themes through analysis and discussion and did not rely on pre-existing themes in the literature. The content analysis of the data began by reading the data line-by-line and making initial codes. These were evaluated based on the patterns that emerged, and were then classified. The categories were organised into overarching themes

that emerged directly from the data through iterative analysis and reflected the core ideas and experiences of the participants. In-person interviews with educators lasted roughly 30 to 35 min. Educators were instructed to confirm their documented responses by reviewing them at the conclusion of each interview. The Findings section comprises snippets from the teachers' feedback. A detailed coding system with frequency values was developed following data processing in the MAXQDA 2020 application. Two researchers coded the data independently, and 40% of the data obtained from the interviews were analysed. Due to the compatibility of 85% of the investigators' independent coding, a single researcher analysed the residual data. Following the evaluations, the codes with discrepancies were deliberated, and the consensus codes and themes were employed in the study.

3. Results

The tables below display the findings of the content analysis derived from the interviews and researcher diaries, which elucidated the perspectives of primary school teachers included in the study regarding the utilisation of ChatGPT.

3.1. Theme 1: Use of ChatGPT at the Primary School Level

Table 2 presents the themes, categories, and codes related to using ChatGPT at the primary school level.

Table 2. Primary school teachers' opinions on the use of ChatGPT at the primary school level.

Theme	Category	Code	*f*
Use of ChatGPT at the primary school level	Suitable	Create personalised activities	30
		Proposing material	27
		Proposing a lesson plan	25
		Creating creative activities	25
	Not suitable	Learning false information	32
		Creating addiction	28
		Causing a decrease in communication	25
		Young age groups	15

The teachers participating in the study indicated the appropriate and inappropriate situations for using ChatGPT at the primary school level. Teachers emphasised that ChatGPT can be suitable for creating personalised activities, providing material suggestions, preparing lesson plans, and developing creative activities. However, it was also noted that it may not be appropriate due to issues such as obtaining misinformation, the risk of addiction, decreased communication, and the developmental characteristics of young age groups. For example, T5 said, "*... ChatGPT should be used under the supervision of parents and teachers. I think the ability to design lesson plans and activities according to individual characteristics will be beneficial to me...*", emphasising the potential of ChatGPT to provide personalised learning experiences. Similarly, T25 stated, "*...with ChatGPT, it will be more possible to design inclusive activities and develop creative ideas...*". T6, who could not hide his surprise and happiness when he learned about the opportunities provided by ChatGPT during the education process, stated that "*... the most difficult issues for me were preparing inclusive activities and conducting the lesson in line with different, creative ideas. Meeting with ChatGPT to solve these difficulties made me very excited...*". T7 remarked, "*... I think that the difficulties I had in lesson preparation, especially in preparing different materials, will be overcome with ChatGPT. I believe it has the potential to guide me in preparing lesson plans and materials according to the available resources and the needs of my students...*". Teachers who were new to the profession were very interested in the training process. One of them, T11, stated that

"*. . . this is my first year in the teaching profession. I was having serious problems creating lesson plans according to the subjects. I see ChatGPT's potential to guide me in preparing lesson plans as a great advantage for me. . .*". Along with these teacher opinions, T28, who was observed to be very sensitive about this issue, stated that "*. . .I think that not all of the information obtained from ChatGPT and other artificial intelligence tools will be correct. This is a big problem for both teachers and students. Especially students can take this information directly without questioning. . .*".

In conclusion, teachers' views on using ChatGPT at the primary school level vary. Potential advantages were emphasised, mainly supporting teachers' lesson planning and materials preparation. Teachers must be carefully guided in this context, and parents or teachers should supervise students' use.

3.2. Theme 2: Advantages and Disadvantages of Using ChatGPT

Table 3 presents the themes, categories, and codes related to the advantages and disadvantages of using ChatGPT at the primary school level.

Table 3. Advantages and disadvantages of using ChatGPT at the primary school level.

Theme	Category	Code	*f*
Advantages and disadvantages of using ChatGPT	Advantage	Improving teaching	32
		Easy to use	30
		Information source	30
		Accessibility	28
		Guidance	28
	Disadvantage	Learning false information	35
		Creating addiction	34

The teachers who participated in the study stated the advantages and disadvantages of using ChatGPT at the primary school level. They noted that its use can provide advantages in improving teaching, simplicity, information sources, accessibility, and guidance. However, the teachers also stated that it may create disadvantages in terms of learning incorrect information and developing addiction. For example, T2 said, ". . .The teacher can use ChatGPT as a supportive element in the classroom, especially by making the evaluation process fun. Having interactive boards in the classrooms and easy use of ChatGPT will provide a great advantage. . .". T7 stated, ". . . I think that the quality of the lessons will increase with the guidance of ChatGPT. I believe that teaching can be done better with the idea that materials and activity planning can be designed more effectively. . .". T10 remarked, ". . . Although ChatGPT can potentially provide incorrect information, it can also be used as an information source. I consider easy access from anywhere a great advantage. . ." T19 said, "ChatGPT can provide great advantages to teachers and students with the guidance it can offer in every part of the teaching process. For example, the evaluation process can be more efficient and fun under the guidance of ChatGPT. Again, I think it will be more possible to plan according to individual characteristics with the guidance it will provide. . ." Teachers mentioned both the advantages and disadvantages of ChatGPT. For instance, T38 stated, ". . . I think that ChatGPT should be considered only as a guide because this tool has many different information sources. There is a possibility that these sources may be wrong or biased. I think it would be useful to anticipate these issues and be cautious. . .", and mentioned that ChatGPT could potentially create harmful effects in the lesson process.

3.3. Theme 3: Courses Where ChatGPT Can Be Used

Table 4 presents the themes, categories, and codes related to the lessons where ChatGPT can be used at the primary school level.

Table 4. Lessons where ChatGPT can be used at the primary school level.

Theme	Category	Code	*f*
Lessons where ChatGPT can be used	Math–Science education	Mathematics lesson	35
		Science lesson	30
	Language Education	Turkish lesson	35
		English lesson	35

The primary school teachers who participated in the study stated that ChatGPT can be used effectively in mathematics, science, and Turkish and English lessons within the scope of language education at the primary school level. For example, T8, who participated in the study, said, "*. . . In science lessons, there may be topics that are not understood in some subjects. Students can realise what they are learning by getting support from ChatGPT outside the classroom. I also think that ChatGPT will benefit language development. The answers it provides to the questions will help them learn new words. . .*". Similarly, T7 stated, "*. . . In mathematics lessons, generating answers to solved questions is advantageous. Producing solutions from different perspectives can help students understand the subject more clearly. In addition, it provides the opportunity to create different questions and solutions about a topic. For this reason, ChatGPT will be beneficial in and out of the classroom in mathematics lessons. . .*". While explaining the process related to science in the educational process, the majority of the teachers stated that they listened very carefully and asked many questions while discussing the benefits of ChatGPT in the science course and that it would help them solve the problems they experienced by asking many questions. For example, T10 stated, "*. . . the examples it provided to concretise the abstract subjects in science will be beneficial for me. I also think that it will provide important benefits in establishing connections with daily life. . .*". Teachers also shared the idea that ChatGPT can be helpful in language education. T19 stated, "*. . . We can create texts such as poems, stories, and fairy tales using ChatGPT in English and Turkish lessons. It can also be useful in creative writing activities. . .*".

3.4. Theme 4: Processes in Which ChatGPT Can Be Incorporated into Lessons

Table 5 presents the themes, categories, and codes created for the processes in which ChatGPT can be included in lessons at the primary school level.

Table 5. Processes where ChatGPT can be incorporated into courses.

Theme	Category	Code	*f*
Processes where ChatCPT can be incorporated into courses	Mathematics	Description	32
		Application	31
		Evaluation	30
	Life knowledge	Description	30
		Application	30
		Evaluation	30
	English	Understanding	28
		Application	25
		Evaluation	25

The primary school teachers who participated in the study stated that ChatGPT can be included in the teaching process in the explanation, application, and evaluation sections of mathematics and science lessons, as well as the understanding, application, and evaluation sections of English lessons. For example, T21 stated, "*. . .I think that ChatGPT will support teachers in the sections where subject information is conveyed. It will also support*

making associations with daily life, especially in courses such as mathematics. It will make it easier for students to learn vocabulary in English lessons, and it will provide the opportunity to do exercises and evaluations for the words they have learned…". T34 stated, "*…I see ChatGPT as an important auxiliary element in terms of its ability to provide me with supplementary information for the lessons I teach and to provide information about how and where to use this information in daily life. I also think it will provide important benefits, especially in the evaluation process of mathematics, science, and English courses. I believe that it will be advantageous to be able to pose and answer any questions and to be able to produce different questions…*". The findings emphasise the potential of using ChatGPT, especially in mathematics, science, and English. In these courses, ChatGPT can play an essential role in transferring the subject matter to students, making associations with daily life, providing practice exercises, and contributing to the evaluation processes.

3.5. Theme 5: ChatGPT's Potential to Replace the Teaching Profession

Table 6 presents the themes, categories, and codes created based on primary school teachers' opinions about ChatGPT's potential to replace the teaching profession.

Table 6. Views on ChatGPT's potential to replace the teaching profession.

Theme	Category	Code	*f*
ChatGPT can replace the teaching profession	Irreplaceable	Emotional connection	40
		Values education	38

The primary school teachers participating in the study emphasised that ChatGPT cannot replace the teaching profession. While supporting this view, they highlighted that ChatGPT could not effectively fulfil essential elements such as emotional bonding with students and values education. For example, T23 said, "*We should not think of the teacher as something that only teaches in the classroom environment like robots. The teacher establishes an emotional bond with the children in the classroom, especially during the primary school years, and becomes a role model for them to gain desirable behaviours. Therefore, ChatGPT or other technological products cannot replace teachers…*". T38 stated, "*…As teachers, we do not only teach students in classrooms. We also carry out educational activities. ChatGPT can support students in terms of teaching. Nevertheless, it will not be able to fulfil educational activities effectively…*". Emphasising critical points, T26 said, "*…Teachers know the situation of each student in the classrooms and apply special education and training activities for them. However, ChatGPT can only do this to a certain extent. For example, can it approach a student who does not have a mother or father with compassion, hug them, and help solve their questions? Or can it assist a sibling–jealous child in adapting to this new situation? Of course not, so no technological product can replace the teaching profession…*". In conclusion, primary school teachers emphasise that artificial intelligence tools such as ChatGPT cannot replace the teaching profession. This refers to the critical roles of teachers, such as role modelling, emotional bonding, and individualised teaching, which technological tools cannot fulfil.

The content analysis of primary school teachers' thoughts on the utilisation of ChatGPT at the primary school level was executed using the categories and codes developed in MAXQDA. These categories and codes are shown in Figure 2.

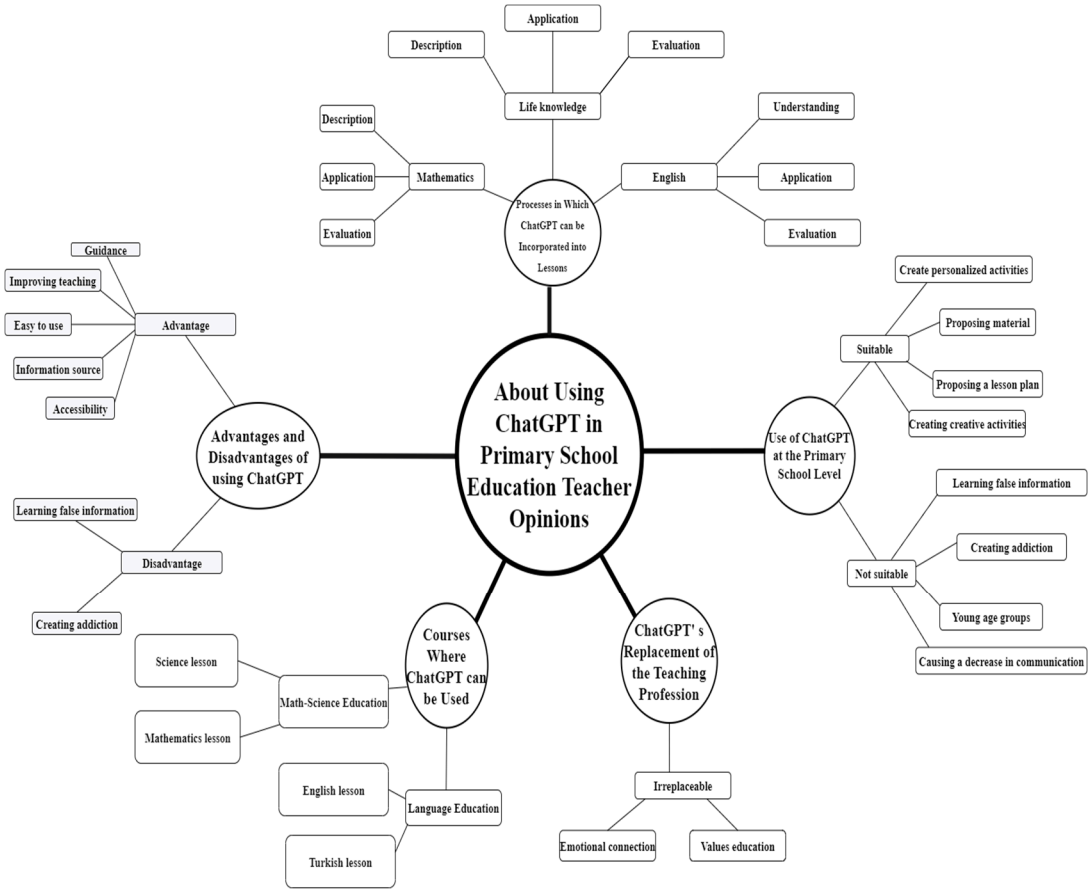

Figure 2. Teachers' views on the use of ChatGPT at the primary school level.

When Figure 2 is analysed, it reflects primary school teachers' views on using ChatGPT at the primary school level. Many teachers believe that ChatGPT would be helpful at this level. In particular, they emphasise that ChatGPT can assist teachers in providing guidance, utilising existing resources efficiently, and creating tailored activities for students. Furthermore, they articulated apprehensions regarding detrimental outcomes like addiction, harm to the teacher–student rapport, and the proliferation of disinformation. These concerns underscore a critical discourse over the equilibrium of technology's role in education. Consequently, the use of ChatGPT in elementary education requires meticulous consideration to comprehend and regulate the equilibrium between its prospective advantages and the associated hazards. This delineates the aspects that must be evaluated when ascertaining technology's function in education.

4. Conclusions and Discussion

This study investigates primary school teachers' views on integrating ChatGPT within a sustainable education framework. A training program was developed and implemented to introduce primary school teachers to the potential uses of ChatGPT in their classrooms. Following this training, the participating teachers' views on using ChatGPT at the primary school level were comprehensively examined, focusing on its potential to enhance sustainable education practices. The evaluations of primary school teachers reveal various views on using ChatGPT at the primary school level. In general, ChatGPT is considered suitable for use at this level. These teachers particularly emphasised the suitability of ChatGPT in areas such as preparing personalised activities, suggesting materials, lesson planning, and creating creative activities. These results reflect that technology can enrich teachers' teaching practices and meet students' diverse learning needs.

Moreover, from the perspective of SDG 4 (Quality Education), these results reflect the potential to improve the quality of education and make teaching processes more flexible and student-centred. In particular, they are directly linked to SDG 4.1 (ensuring free, equitable, and quality primary education for all children) and SDG 4.2 (increasing access to quality services for early childhood development, care, and preschool education). The personalised learning opportunities offered by ChatGPT in this context support the principle of equity in education by ensuring that students receive education tailored to their individual needs. However, there were also findings reflecting some teachers' views that this technology is unsuitable for the primary school level. These findings are based on issues such as ChatGPT's risk of providing false information, concerns about addiction, decreased communication, and its suitability for younger age groups. At this point, technological pedagogical knowledge and experience can help teachers integrate ChatGPT effectively and minimise potential risks. Studies in the literature also reflect these contradictory results [22,25,69]. For example, Jauhiainen and Guerra (2023) emphasise the potential of ChatGPT in education, where lessons can be planned [70] and materials can be prepared according to students' characteristics, while Abdaljaleel et al. (2024) point out the possible adverse effects of ChatGPT [71]. This suggests that the pedagogical and social implications of the technology need to be carefully considered. These results are relevant to SDG 4.a (making educational environments safe, inclusive, and effective for children), as the reliability and ethical use of ChatGPT in education are critical to guaranteeing safe and supportive learning experiences for students. Under SDG 4.c.1 (supporting educators' professional development), providing continuous professional development programs and mentoring services for teachers can increase their competencies in pedagogically integrating such technological tools.

Moreover, teachers must strike a careful balance when integrating technology into teaching and learning processes to ensure students' safety and the quality of their learning experiences. In conclusion, while the use of ChatGPT at the primary school level has excellent potential to improve the quality of education, the role of this technology in education should be carefully evaluated. This evaluation should focus on maximising the pedagogical benefits of the technology while minimising its potential risks toward achieving the sub-goals of SDG 4.

The findings of the study, in which primary school teachers evaluated the advantages and disadvantages of ChatGPT in education, show the potential of using ChatGPT at the primary school level. From the perspective of SDG 4 (Quality Education), teachers emphasised the advantages of ChatGPT, especially in improving teaching, the ease of use, information resources, accessibility, and guidance. These advantages, in line with SDG 4.1 and SDG 4.2, are significant regarding technology reducing teachers' workload and enriching students' learning experiences. Moreover, the potential of ChatGPT to provide customised learning experiences by analysing each child's individual needs and learning preferences is considered an essential advantage for ensuring equitable and quality primary education [24]. This approach can contribute to SDG 4.5 (ensuring equity in education) by enabling students to be supported more effectively, considering their different learning speeds and needs. ChatGPT's ability to recognise children's conversations and questions is also valuable in providing interactive support and increasing learning opportunities [72]. These findings support the relevance of ChatGPT at the primary school level and relate to SDG 4.a (promoting safe, inclusive, and effective learning environments).

However, primary school teachers who participated in the research also pointed out the disadvantages of ChatGPT. In particular, the disadvantages, such as students learning misinformation and the risk of addiction, are prominent. The literature indicates that ChatGPT may generate inaccurate and misleading information, hence casting doubt on its accuracy and dependability [73–75]. This poses an obstacle to SDG 4.7 (knowledge-based education that promotes sustainable development), as misinformation can negatively affect students' critical thinking skills and access to accurate information. These issues can present a serious problem for those who base their students' educational processes on ChatGPT,

especially in specialised subjects and responses to current events [74–76]. Consequently, it is underscored that educators and learners must possess adequate knowledge and literacy in utilising ChatGPT [77,78]. This is directly linked to SDG 4.c (enhancing educators' competencies), as teachers' effective use of technology depends on their continuous professional development. It is also noted that ChatGPT is trained on large datasets and may contain biased or inaccurate information, as its knowledge is limited and updates may not yet have been made [79]. This may raise concerns, particularly regarding reliability and accuracy, and may complicate achieving SDG 4.7. Teachers and students should develop information literacy skills using AI tools such as ChatGPT to overcome these issues. These findings highlight the need for teachers to maximise the potential of technology and develop appropriate strategies to improve students' learning experiences. In line with SDG 4.c, training and guidance on technology's ethical and pedagogical aspects enable teachers to use these tools effectively and minimise potential risks. In this way, ChatGPT and similar tools can be used sustainably to improve the quality of education. To address the ethical and inappropriate issues associated with the use of ChatGPT, it is essential to implement comprehensive digital citizenship education in primary and secondary schools. This education should include discussions on the ethical use of AI tools, how to critically evaluate the information generated by these tools, and the importance of corroborating data with reliable sources. Encouraging students to think critically about the information they receive will help them discern the credibility of the content and reduce the risk of misinformation. Moreover, besides seeking answers through ChatGPT, students can engage in project-based learning and collaborative activities that encourage them to explore topics in depth, work in teams, and discuss their findings with peers and teachers. These methodologies not only provide opportunities for active learning but also allow students to apply critical thinking skills and ethical reasoning in real-world contexts. In summary, promoting information literacy and critical evaluation skills, combined with the use of ChatGPT, can significantly mitigate ethical concerns. By fostering an educational environment that encourages inquiry, collaboration, and ethical considerations, we can enhance the effectiveness of AI tools while ensuring that students navigate the complexities of information responsibly and thoughtfully.

Primary school teachers stated that using ChatGPT in Turkish, English, and mathematics lessons would be appropriate. In addition, it was determined that ChatGPT would be suitable for the explanation, implementation, and evaluation processes in life science lessons. These opinions show that teachers can use ChatGPT for different purposes in various courses. The studies in the literature also support these views. The study by Kasneci et al. (2023) confirms that ChatGPT can provide students with relevant, high-quality reading materials [22]. Thanks to its natural language processing capability, ChatGPT can produce appropriate texts for students' levels [26,80,81]. This capability aligns with SDG 4.6 (Improving Literacy and Numeracy), as providing tools to improve language skills plays a critical role in enhancing the quality of education.

Moreover, creating differentiated questions and tests can provide teachers with practical convenience and time savings in the assessment process [26]. This allows teachers to improve the quality of teaching by making their assessment process more efficient, in line with SDG 4.7.1 (Building Teachers' Capacities for Quality Education). However, some studies also point out the limitations of ChatGPT. Al-Worafi et al. (2023) warned that the assessment questions proposed by ChatGPT may only cover a fraction of the targeted learning objectives [82]. Therefore, it is suggested that ChatGPT should be used to guide teachers in the assessment process [83]. There are also caveats that ChatGPT can encourage students to apply knowledge and reasoning skills but cannot replace critical thinking and original work [80]. In the context of SDG 4.7, these caveats provide essential guidance on how technology should be integrated. ChatGPT should encourage students not only to be recipients of information but also to develop critical thinking and original work skills. In this context, using technology for pedagogical purposes can improve the quality and effectiveness of education.

Consequently, teachers must understand how to use technologies such as ChatGPT for pedagogical purposes. ChatGPT can be a powerful tool to support teaching processes and enrich students' learning experiences, but it needs to be guided and used correctly. This approach offers sustainable solutions to improve the quality of education, which aligns with all the sub-goals of SDG 4 (Quality Education).

All of the primary school teachers emphasised that ChatGPT cannot replace teachers. ChatGPT should first be seen as a helpful assistant for teachers and students [84]. It should be noted that the teacher's role in primary education is vital and must be partially replaced by technology. Teachers possess the skills to effectively teach and guide students [80,81]. Moreover, teachers are essential as mentors and role models for students [85]. Technologies like ChatGPT can facilitate teachers' tasks and benefit students, but they must maintain the human dimension and personal interaction teachers provide. In particular, it should be remembered that ChatGPT cannot support students emotionally or communicate with them in the same way. Such interactions deepen and enrich students' learning experiences and can only be provided by teachers. In this context, technologies like ChatGPT should be considered tools supporting quality education. However, they should be carefully integrated to preserve the human dimension and personal interactions in education. A technology-enabled education model should focus on enhancing teachers' pedagogical skills and the social–emotional support they provide students. In this way, technology and the human factor can be used in a balanced way to achieve the goal of quality education and create a more inclusive and effective educational environment in line with sustainable development goals.

This research possesses certain limitations. The limited sample size of the study (N = 40) may restrict the generalisability of the findings. The restricted participant count may be ascribed to temporal and resource limitations. We highly advocate for future research to use more diverse participant cohorts. Secondly, our research is founded on educators' perspectives following the training they underwent prior to the implementation of ChatGPT in authentic classroom environments. This may not completely represent the impact of ChatGPT in real classroom settings. The constrained duration of the research process precluded the utilisation of ChatGPT in the classroom. Furthermore, it is imperative to incorporate ChatGPT direct into the classroom setting and assess the long-term implications of this integration. This implementation would enhance our understanding of the real-time experiences and emotions of teachers and students. We recommend that subsequent research concentrate on the application of ChatGPT in educational settings and its enduring impacts.

5. Recommendations

Based on the findings, the following recommendations are proposed:

1. Provide training for teachers to familiarise them with the pedagogical potential of AI-supported ChatGPT. This training will enable educators to harness the educational benefits of this tool.
2. Revise the content of teacher education programs to incorporate coursework on artificial intelligence, ensuring that future educators are well-prepared to integrate AI technologies into their teaching practices.
3. Specialised training sessions for current primary school teachers and pre-service teachers will enable them to understand and effectively use AI-based ChatGPT's pedagogical advantages.

These recommendations aim to promote the responsible and effective use of AI tools such as ChatGPT in educational settings, address ethical considerations, and encourage better teacher and parent engagement. Implementing these recommendations will increase the potential for using ChatGPT in primary school education and support the Sustainable Development Goals.

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Appendix A

The semi-structured interview form

1- Is ChatGPT suitable for the primary school level?
2- What are the advantages and disadvantages of ChatGPT in the education process?
3- For which courses is ChatGPT suitable?
4- Which process of the course can be included?
5- Can ChatGPT replace the teacher?

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