



Araştırma Makalesi • Research Article

Artificial Intelligence in Accounting Education: Identifying Learning Styles and Assessing Individual Differences¹

Muhasebe Eğitiminde Yapay Zekâ: Öğrenme Stillерinin Tanımlanması ve Bireysel Farklılıkların Değerlendirilmesi

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ABSTRACT

Evaluations on the role of artificial intelligence (AI) in education emphasize its potential contributions to student-centered learning and personalized education. However, while studies have begun to explore the expected contributions of these relatively new AI applications, comparative differences—specifically performance assessments—between AI usage and direct human effort are not yet sufficiently developed. Although there are limited studies aimed at determining learning styles through the use of AI, their consistency with actual results is not thoroughly examined. This study aims to assess the individual differences of accounting students at a vocational and technical high education school using the Kolb Learning Style Inventory (KLSI) and to evaluate the performance (consistency) of AI applications (ChatGPT, Gemini, and Copilot) against actual implementations. To this end, responses from 11 vocational and technical high school accounting students, whose learning styles were previously determined using KLSI, were utilized. Three different AI tools were instructed to determine the learning styles of these students using the same commands. In this way, the effectiveness of AI tools in identifying and assessing individual differences among students was examined both independently and comparatively. According to the findings, ChatGPT showed the highest performance, with only one incorrect assessment, while the other AIs made three incorrect assessments. Notably, the observation that ChatGPT incorrectly identified did not overlap with the incorrect observations of the others. In contrast, two of the three incorrect assessments by Gemini and Copilot pertained to the same two observations. Based on all the findings, this study, which provides an initial evaluation of the performance of AI in meeting the expected contributions and, specifically, in using KLSI, suggests that while AI can facilitate the identification and evaluation of individual differences in teaching, the possibility of errors should not be overlooked. Essentially, the study, with its empirical evidence, highlights that AIs still need to continue learning themselves and that relying solely on AI in zero-tolerance-required tasks, such as identifying students' individual characteristics, could be risky.

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ÖZ

Yapay zekânın eğitimdeki rolüne dair değerlendirmelerde öğrenci merkezli öğrenme ve özelleştirilmiş eğitim konularında sağlayacağı katkılara vurgu yapılmaktadır. Fakat henüz çok yeni olan yapay zekâ uygulamalarının sağlaması beklenen katkılar konusunda çalışmalar yapılmaya başlanmıştır. Ancak, yapay zekâ kullanımı ile doğrudan insan gücü kullanımı arasındaki mukayeseli farklar (başarım değerlendirmeleri) aynı düzeyde değildir. Özelde yapay zekâ kullanımıyla öğrenme stillerinin belirlenmesi amacıyla yapılan sınırlı sayıda çalışma bulunsa da,

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Anahtar Kelimeler:

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bunların gerçek (fiili) sonuçlarla olan tutarlılığı ele alınmamaktadır. Çalışmanın amacı da Kolb Öğrenme Stilleri Envanterini (KÖSE) kullanarak bir mesleki ve teknik eğitim lisesindeki muhasebe öğrencilerinin bireysel farklılıklarını tespit etme ve değerlendirmede yapay zekâ (Chat GPT, Gemini ve Copilot) uygulamalarının fiili uygulama karşısındaki başarımını (tutarlılığını) değerlendirmektir. Bunun için daha önce KÖSE ile öğrenme stilleri fiili olarak belirlenen 11 mesleki ve teknik eğitim lisesi öğrencisinin verdiği cevaplardan yararlanılmış ve üç farklı yapay zekâ aracından, "aynı komutlandırılmayla" ilgili öğrencilerin öğrenme stillerini belirlemeleri istenmiştir. Bu suretle yapay zekâların öğrencilerin bireysel farklılıklarını tespit etme ve değerlendirme konusundaki işlevi ne derece doğru ve etkili (başarılı) bir şekilde yerine getirebildikleri hem münferit hem de karşılaştırmalı olarak ele alınmıştır. Elde edilen bulgulara göre en yüksek başarımlar ChatGPT'nin olmuştur. ChatGPT'nin hatalı tespit sayısı 1 iken diğer yapay zekâların hatalı tespit sayısı 3'tür. Ancak burada dikkat çeken husus; ChatGPT'nin hatalı olarak tespit ettiği gözlemin, diğerlerinin hatalı gözlemleriyle uyuşmamasıdır. Buna karşın Gemini'nin ve Copilot'un 3 hatalı tespitinin 2'si aynı iki gözleme aittir. Elde edilen tüm bulgular doğrultusunda, yapay zekâların kendilerinden beklenen katkının başarımı ve özeldede KÖSE yönüyle yapay zekâ kullanımının başarımına dair ilk değerlendirmeyi barındıran bu çalışmayla, öğretimde yapay zekâ kullanımının bireysel farklılıkları tespit etme ve değerlendirmede konusunda kolaylık sağladığı ifade edilebilirse de, hata ihtimalinin var olduğu da unutulmamalıdır. Esasen çalışma, ortaya koyduğu ampirik kanıtlarla, yapay zekâların kendisinin öğrenmeye devam etmesi gerektiğine; özellikle öğrencilerin bireysel özelliklerinin belirlenmesi gibi sıfır tolerans isteyen hususlarda doğrudan yapay zekâ ile hareket edilmesinin riskli olacağına işaret etmektedir.

1. INTRODUCTION

The advancement of technology, changing social values, attitudes, and behaviors, differences in upbringing, thoughts, emotions, and future expectations have necessitated generational classifications (Adıgüzel, Batur, & Ekşili, 2014, p. 170). As individuals continue to develop cognitively and physically, their needs and expectations also change, and educational methods and materials serving them become inadequate to meet their needs (Turan, 2019, p. 82). It can be stated that educators also have certain expectations from students in response to the changing needs of the target audience during the educational process (Özdemir, Bengü & Karakaş, 2023, p.603). While students wish to learn according to their expectations and needs, educators adhere to the methods and techniques they know during the course process and expect academic and social success as an outcome. However, using the same methods and techniques for all students, who possess different learning characteristics, may not be sufficient to achieve the desired success. Scientific studies show that students' needs vary at different levels, that differences may arise in how these needs are met, and that not everyone desires to satisfy their needs to the same extent (Antalyalı & Bolat, 2017, p. 84). In the accounting learning process, considering students' individual differences while directing the learning process means placing the student at the center of the educational process. With the learner-centered educational approach, learning styles—one of the primary individual characteristics influencing learning—come to the forefront. To determine learners' learning styles, several models and inventories have been developed, considering hereditary traits, past experiences, environmental influences, and the acceptance and internalization of knowledge through different perspectives (Gencel, 2006, p. 27-28).

David Kolb defines learning as the transformation of experiences into knowledge and describes the Kolb Experiential Learning Style Inventory as being based on a comprehensive theory of learning and development, distinguishing it from other learning style and personality tests used in education.

While developing the Experiential Learning Theory, David Kolb drew upon the works of significant scholars such as John Dewey, Kurt Lewin, Jean Piaget, Lev Vygotsky, William James, Carl Jung, Paulo Freire, Carl Rogers, and Mary Parker Follett (Alice Y. & David A., 2013). The learning style inventory developed by Kolb is a tool used to determine individuals' learning styles and to develop educational strategies adapted to these styles. Considering individual learning differences, Kolb states that before delving into theories of learning, the most suitable learning style for the individual should be identified. In Kolb's learning model, individuals' learning styles are represented in a cycle, and the inventory identifies where individuals fall within this cycle. Within this cycle, there are four learning types that reflect the skills individuals use when learning: "Concrete Experience," "Reflective Observation," "Abstract Conceptualization," and "Active Experimentation" (Aşkar & Akkoyunlu, 1993, p. 37-38). Individuals with a concrete experience learning style prefer to learn by feeling, seeing-

touching, being involved in events, observing, and encountering objects directly. In contrast, individuals with an abstract conceptualization learning style focus on processing information through thinking, dealing with theories, concepts, principles, models, and scientific thinking techniques. Those with an active experimentation learning style prefer learning by doing, applying what they learn, and using it for problem-solving. Meanwhile, individuals with a reflective observation learning style observe events from different perspectives, try to grasp their essence, and ask "why" and "how" questions. Each person's learning style is a combination of these four fundamental types. The inventory consists of 12 questions, each with four options, and determines the most suitable learning style for individuals based on their scores. These learning styles are "Accommodator," "Assimilator," "Diverger," and "Converger."

To make the educational process effective and efficient, the use of technology in education has continued to develop while incorporating many innovations. From teaching methods to the procurement of course materials, many processes have recently emphasized the use of Web 2.0 technologies, deep learning, machine learning, image and language processing models, virtual reality, the metaverse, and artificial intelligence technologies in education (Kutlucan & Seferoğlu, 2024, p. 1060). While evolving technology and ongoing research have provided various definitions of artificial intelligence, the underlying goals of creating AI include thinking like humans, thinking intelligently, and acting humanly. In the early 1950s, following media portrayals centered around artificial humans, Alan Turing's "The Turing Test" demonstrated that a computer could successfully process information and was deemed "intelligent." Subsequently, in 1956, John McCarthy introduced the term "artificial intelligence" for the first time at the Dartmouth Conference (Pirim, 2006, p. 83-84). From its origins in the 1890s, artificial intelligence research has undergone both rapid advancements and challenges, spanning programming languages to books and films exploring the concept of robots. Following this, a period of rapid growth, known as the "artificial intelligence explosion," emerged. During this period, concepts such as deep learning techniques, expert systems, artificial neural networks, big data, search engines, and virtual assistants helped shape AI into its current form (Kopar, 2023).

One popular example of generative artificial intelligence is chatbots. Chatbots are software-based electronic systems that use defined keywords and phrases to provide human-like conversational responses (Salvagno, Gerli, & Taccone, 2023). Widely used examples include ChatGPT, Gemini, Copilot, Claude, Llama, Grok, Botpress, Dialogflow, Amazon Lex, and UChat. Choosing the right AI chatbot is essential, as features should align with the intended sector, usage goals, and personal or business needs. Initially used for entertainment, casual conversations, and personal tasks, chatbots have evolved to answer questions, solve problems, and provide various suggestions using textual or auditory visuals.

While the first AI systems were simply designed to play games and perform logical operations, AI now has applications in finance, medicine, defense, law, justice, and education. AI applications in education are broadly categorized into three areas: AI applications aimed at learners, educators, and systems. AI applications aimed at learners involve AI-based tools that enhance learning, providing personalized content and suggestions tailored to students' learning speeds, strengths, and weaknesses. Additionally, AI-supported educational platforms facilitate easy access to resources and materials. Students can take advantage of self-directed learning opportunities, receive instant feedback, and thus correct mistakes quickly, making the learning process more efficient. AI applications aimed at educators can empower teachers and improve educational and assessment processes. AI tools assist in creating teaching materials and content, enabling educators to develop course materials more efficiently and effectively. AI tools can also monitor and analyze students' progress, giving educators opportunities to intervene where necessary. Moreover, routine tasks such as grading exams and tracking student performance can be automated, allowing educators to use their time more effectively. AI applications aimed at systems involve smart systems designed to support the management of educational institutions. AI simplifies data analytics regarding student performance, educational programs, and overall school management, facilitating strategic decision-making. Additionally, AI-supported systems allow educational programs to reach larger student groups.

2. LITERATURE REVIEW

The use of artificial intelligence applications in education has become one of the most significant topics on today's educational agenda. The use of AI by educators in preparing teaching materials, personalizing education, providing feedback, and assessment has gained momentum. Correspondingly, the number of studies in the literature that guide educators on this topic has increased.

Studies on the contributions of AI in education particularly examine its potential contributions to student-centered learning and personalized education. Among the academic studies focusing on these issues, Chen et al. (2005) designed an e-learning system that considers students' individual learning and needs. The system proposes that by identifying abilities based on student feedback and modeling teaching materials, personalized learning can be provided, helping students learn more effectively and efficiently. Another study, Woolf (2008), suggests developing personalized learning strategies that address individual student differences and using AI technologies based on these strategies. It highlights the role of AI in the design of personalized education programs, asserting that the more an AI-supported teaching material can reason about the individual's learning process, what it teaches, and the methods it uses for teaching, the greater its impact on education. The study consistently demonstrates the benefits of designing a personalized education model suitable for the student's level. Incemen and Öztürk (2024) examined AI applications used in various educational fields under the classification of Intelligent Tutoring Systems (personalized learning environments tailored to individual characteristics in structured fields such as mathematics, physics, or medicine), Expert Systems (AI-supported systems providing expert knowledge on a subject), and Chatbots (AI-supported chat robots that converse with students and answer their questions).

The literature also includes studies that examine the capacity of AI to analyze students' learning styles and provide personalized educational experiences based on this information. Graf (2007), based on the Felder-Silverman learning style model, worked on a system that automatically identifies students' learning styles and provides personalized content tailored to these styles, supporting the student learning process. The study concluded that providing adaptable lessons in learning management systems (LMS) based on students' learning styles could effectively support learning. Similarly, Hwang et al. (2012) designed a model using AI techniques to automatically determine students' learning styles based on the Felder-Silverman learning style model and create personalized game scenarios suitable for students' learning styles. The study found that personalized educational computer games not only increased learning motivation but also improved students' learning achievements. Cha (2006) designed a customized intelligent tutoring system (ITS) based on the Felder-Silverman learning style model, in which students' preferences were identified and user interfaces were adapted to these preferences. Beck (2008), in his study on the success of AI-supported systems in providing practical recommendations based on students' learning styles, concluded that AI-supported systems were partially successful in offering personalized learning experiences. Mousavinasab (2018), on the other hand, found that AI-supported intelligent tutoring systems had a certain impact on providing personalized experiences, but their full success depended on the student's motivation and learning environment.

The use of AI in accounting education is gaining increasing attention, focusing on improving educational processes, enhancing efficiency, and integrating AI-related courses and/or AI-supported courses into the curriculum to provide students with better learning experiences. Various studies and applications related to this topic exist in the literature. Baldwin (1995), in a study conducted in the 1990s, mentioned the concept of AI and argued that accounting students were not exposed to AI in accounting faculties. He suggested that AI topics should be integrated into the curriculum so that students could begin learning about AI before entering the workforce. Şen and Terzi (2022), evaluating the impact of AI and digitalization on accounting education by examining articles published on AI and accounting between 2015-2021, suggested that for university accounting education to be more suitable for today's needs, textbooks used in classes should be organized to introduce technology-focused content, more time and resources should be allocated to teaching information technologies in applied courses, and educators should receive training to ensure consistency between theory and practice. Similarly, Cunha et al. (2022) emphasized that accounting education provided by universities is inadequate in preparing

students for professional life, noting that what is "preached" in the literature does not align with what is practiced, and that graduates lack the skills required by the profession. As a solution, they stated that accounting course curricula need to be improved to develop skills that meet expectations. Tandiono (2023) argued that the teaching methods used by accounting educators and the accounting curriculum should be supported by AI. Supporting this view, Zhang and Zhao (2022) used an AI-supported educational tool in the teaching of financial accounting in China, as traditional teaching methods were inadequate for students. The application showed that AI had a positive impact on teaching financial accounting courses.

In another group of studies, Seyrek et al. (2024) expressed those teachers who frequently use AI in their courses preferred AI more for tasks such as preparing questions, creating content, designing activities, analyzing data, and tracking achievement. However, they also mentioned concerns that AI could make students lazy, stifle their creativity, lead to data breaches, and exacerbate inequalities in access to technology. In a bibliometric analysis conducted by Kutlucan (2024), it was stated that AI-supported tools such as ChatGPT were effectively used by both educators and students in business-accounting education, while plagiarism and ethical issues were identified as aspects requiring attention. Geçici (2024) argued that AI-supported systems in accounting education could improve the quality and efficiency of accounting education if ethical issues such as privacy, security, and intellectual property are resolved. A good accounting education contributes to the production of quality accounting information and the development of the accounting profession (Karakaş & Varıcı, 2024, p.138).

3. METHOD

3.1. Purpose and Significance of the Research

The purpose of the study is to evaluate the performance (consistency) of AI chatbots in identifying and assessing individual differences among accounting students at a vocational and technical high school using the Kolb Learning Style Inventory (KLSI) against actual implementation. At the same time, it aims to present, in a balanced manner, the contributions that AI has made or could make to student-centered learning and personalized education through evaluations of its role in education.

The existing academic literature focuses on the capacity of AI to provide student-centered learning and personalized educational materials. Although studies have begun on the use of AI to analyze individuals' learning styles, no research has yet been found that directly addresses Kolb's learning style inventory in the context of AI and personalized education. The study is significant in terms of linking the use of AI specifically with Kolb's learning style theory, evaluating its consistency with actual results, and highlighting AI's potential to enable personalized education in the future.

3.2. Scope of the Research

Within the scope of the research, responses from 11 vocational and technical high school students, whose learning styles had previously been determined using the Kolb Learning Style Inventory (KLSI), were utilized. Three different AI tools were instructed to identify the learning styles of the relevant students using the "same commands." In this way, the extent to which AI tools are accurate and effective (successful) in identifying and assessing students' individual differences was examined both individually and comparatively.

3.3. Research Question

To achieve the aim of the study, the following research question was addressed:

A1. Can artificial intelligence produce results similar to those obtained through the actual implementation of the Kolb Learning Style Inventory (KLSI)?

For this purpose, previously identified learning information for each student was provided to the AI chatbots in textual form. A single question was then posed to each chatbot to determine the accuracy and consistency of their responses with the research question.

B1. Based on the given learning information, can you identify the student's learning style within the framework of Kolb's learning style theory?

The responses generated by the AI chatbots were analyzed and compared with the actual results obtained through the KLSI, enabling an evaluation of the extent to which the AI tools could accurately determine the students' learning styles. This approach not only sought to test the performance of the chatbots but also to explore their practical alignment with established educational methods.

3.4. Limitations of the Research

This study has several limitations that should be acknowledged. Firstly, the determination of students' learning styles was based on the evaluations of specific artificial intelligence (AI) applications—namely ChatGPT, Gemini, and Copilot—in both Turkish and English. It was observed that while GPT models produce more consistent and accurate responses to prompts in English, inconsistencies and errors arose in Turkish prompts, particularly due to challenges in translating technical terms and concepts.

Secondly, the study is limited by the scope of AI tools examined, the focus on a specific learning style, a defined time frame, and the reliance on a browser-based interface. These constraints may limit the generalizability of the findings. Furthermore, given the rapid evolution of AI infrastructures and their underlying data sources, which are continuously updated alongside technological advancements, the results of this study may lose validity over time. As new AI tools and improved models emerge, future studies may yield different processes and outcomes.

In light of these limitations, it is recommended that future research incorporate a broader range of AI applications, test diverse learning styles, and include multilingual evaluations to enhance the robustness and generalizability of the findings.

3.5. Data Collection Process of the Research

In the study, the responses of 11 Accounting and Finance department students from vocational and technical high schools, whose learning styles had previously been determined using the Kolb Learning Style Inventory (KLSI) in a different study, were utilized, and three different AI tools were employed. Based on the idea that accessing all AI chatbots might be challenging, widely used applications such as ChatGPT, Gemini, and Copilot were selected. The responses provided by the AI tools to questions aimed at determining the students' learning styles were recorded and then examined for consistency with actual results.

ChatGPT is an AI-based chatbot developed by OpenAI, with its first version launched in 2018. It is a chatbot capable of communicating naturally with users, providing appropriate responses to written and spoken questions, offering suggestions, and continuously learning and improving itself (chat.openai.com). Gemini is an AI language model developed by Google. It is a chatbot that assists users in natural language processing (NLP), research, content generation, and everyday communications (gemini.google.com). Copilot is an AI code completion tool created by Microsoft. It assists in providing information, answering questions, and supporting creative projects, among other tasks (copilot.microsoft.com).

The three AI tools were used simultaneously and in coordination within the same browser. With the consideration of accessibility for everyone, the free versions of the AI chatbots were used instead of the advanced or plus versions. The same prompts were written in Turkish to the AI tools, and the responses for each student were recorded separately. The responses were then analyzed using comparative tables.

4. RESEARCH FINDINGS

In this section, the responses provided by the AI chatbots to the questions asked are presented as text for each student individually. Following this, a comparative table of the learning styles identified by the AI chatbots is included. The analysis derived from the examination of the tables is also provided in this section. The exchanges with the AI were conducted between August 26 and August 29.

Table 1. Responses of AI Chatbots to the Provided Prompts

Prompts	ChatGPT	Gemini	Copilot
I want to determine the learning styles of some information. Can you help me with this?	You can use various methods and tools to identify students' learning styles. I can guide you through this process. First, can you elaborate a bit more on what kind of learning knowledge you are talking about and how you want to identify their learning styles? For example, do you want to apply a specific test or do you plan to identify learning styles by analyzing existing data?	Determining students' learning styles is essential to providing them with a more effective and personalized educational experience. This way, you can uncover students' strengths, improve their weaknesses, and increase their motivation to learn. Methods for Determining Learning Styles Observation Surveys and Questions: Analysis of Work Products Standardized Tests	Hello! You can use various methods and tests to determine students' learning styles. Here are some suggestions: Using these methods, you can determine students' learning styles and offer them the most appropriate learning methods. Can I help you with anything else?
I need your personal opinion when determining learning styles. I want you to determine the student's learning model and learning style in line with the information I will give you about the student.	In order to determine the student's learning style, we can use the information you provide about the student to determine the most appropriate learning model. If you share information such as the student's preferred learning methods, strengths and weaknesses, interests, and previous learning experiences, I can help you determine the learning style. What information would you like to share about the student?	Of course, I would be happy to help you with this. Based on the information you will share about the student I can do some analysis to determine their learning style. However, remember that this will only be an estimate. A more comprehensive assessment may be necessary for a definitive result. Information you need to give me: The student's age: Age is an important factor that can affect learning styles. Achievements in classes: In which classes are they successful and in which are they struggling? Behavior in class: Participation in class, frequency of asking questions, interest in group work, etc. How they do their homework: What methods do they prefer	Of course, I can help you with that. There are several different approaches to determining a student's learning style. For example, visual, auditory, kinesthetic, or reading/writing-oriented learning styles. In order to determine a student's learning style, I will need some information about the student's learning habits, strengths, and preferences. Can you tell me about the following characteristics of the student: What types of activities do they enjoy? What methods do they use when learning (reading, listening, writing, moving)? How do they learn in social environments?

		<p>when preparing their homework? Hobbies and interests: What do they like to do in their free time? Preferences for learning: What types of materials do they like more (books, videos, experiments)? Weaknesses and strengths: What are their best and worst points in the learning process? Criteria I Will Use to Determine Learning Styles:</p> <p>Visual Learning: A preference for representing information visually (graphs, diagrams). Auditory Learning: A preference for learning by listening. Kinesthetic Learning: A preference for learning by moving and trying.</p> <p>Verbal Learning: A preference for learning by reading and writing.</p> <p>Logical-Mathematical Learning: A preference for learning with numbers, logic and relationships.</p>	<p>How do they spend their free time?</p> <p>If you share this information, we can make a better guess about the student's learning model.</p>
<p>So, let's go with students one by one, shall we? The student ranks his preferences while learning in descending order from 1 to 4, with the best being 4. For example, if he learns best by reading, he can learn 4 by listening 3, by watching 2 and by doing at least 1.</p>	<p>Yes, I understand. By indicating how the student ranks different learning methods, I can analyze his learning style based on this information. According to the ranking system, the method in which the student learns best receives 4 points, while the least effective method receives 1 point. Based on this information, I can evaluate which learning style is dominant and what learning approach can be recommended.</p>	<p>As students share their forms one by one, I will conduct an individual assessment for each student and provide you with feedback as follows:</p> <ul style="list-style-type: none"> • Student's dominant learning style: The learning style that is most evident. • Other learning styles: The student's tendency toward other learning styles. • Methods that can be used in the learning process: Suggestions that will support the student's learning style. 	<p>Yes, I understand. You can share the form where the student ranks his/her learning preferences from 4 to 1. I will try to determine the student's learning style based on this information. We can start with the first student. You can share information about the student.</p>

In Table 1, the responses provided by the AI chatbots are presented as they were. In response to our request for assistance in determining the learning styles of students with existing learning information, all three chatbots mentioned methods that could be used to identify learning styles. Following these answers, when we specified that we needed their personal insights rather than employing any method, the three different AI chatbots asked us to elaborate on the information we would provide about the students in different ways. In this response, a common approach was observed among the chatbots.

After asking a follow-up question to ensure that they fully understood us, all three AI chatbots demonstrated their understanding by providing examples. Again, all three AI chatbots showed similar progress in their responses.

Table 2. Following Responses of AI Chatbots to the Provided Prompts

Prompts	ChatGPT	Gemini	Copilot
STUD1 scale information was shared.	<p>Student 1:</p> <p>Preferred Methods of Learning:</p> <p>Considering my feelings = 4 Thinking about ideas = 3 Doing things = 2 Watching = 1</p> <p>Analysis:</p> <p>Highest Preference: Emotional Interaction Other Preferences: Thinking, Applying, Watching</p> <p>Learning Style:</p> <p>This student prefers to establish emotional connections and include his/her feelings in the learning process. He/she may have an emotional learning style. He/she also finds thinking important, which may indicate a tendency towards conceptual learning. While practical activities can also be moderately effective, they may be less beneficial than visual materials (watching).</p> <p>Recommendations:</p> <p>2. Student 2:</p> <p>In line with these analyses, you can shape</p>	<p>Thank you for such a detailed learning style assessment. With the information you provided, we can better understand your learning style.</p> <p>General Assessment:</p> <p>The answers you gave show that you have an emotional and experiential learning style. You bring your feelings, experiences and intuition to the forefront while learning. You prefer to learn with concrete examples and experience rather than abstract concepts.</p> <p>Detailed Analysis:</p> <p>Conclusion:</p> <p>This analysis provides you with a general perspective. You can consult an expert for a more detailed assessment. Knowing your learning style will help you make your learning process more efficient.</p> <p>Remember: Everyone's learning style is different and you don't have to use a single learning style.</p>	<p>According to the student's answers, various factors stand out among learning styles. Here are a few observations about the student's learning style by evaluating this information:</p> <p>.....</p> <p>General Assessment</p> <p>The student seems to be quite prone to the kinesthetic learning style. In addition, reading/writing-oriented and emotional/intuitive learning styles also stand out. Therefore, it may be beneficial for the student to have more interactive and practical learning materials, as well as content that they can establish emotional connections with and that will encourage them to think.</p>

	<p>your teaching methods by considering each student's individual learning preferences and make their learning processes more efficient. Supporting students' strengths and preferred learning styles will increase their motivation and make positive contributions to their learning processes.</p>	<p>You can find the most suitable one for yourself by trying different learning methods.</p>	
<p>Can you evaluate the learning style analysis within the Kolb Learning Style Framework? (Detailed information about the Kolb learning style scale inventory is also provided)</p>	<p>Yes, your answers can be evaluated within the framework of Kolb's Learning Styles. Kolb's Learning Style Model addresses learning in four main dimensions:</p> <p>Concrete Experience (CE): Learning based on emotional and personal experiences. Reflective Observation (RO): Learning by observing and thinking. Abstract Conceptualization (AC): Learning based on logical analysis and theories. Active Experimentation (AE): Learning by practicing and trying. These four dimensions are combined to form four main learning styles:</p> <p>Diverger: Concrete Experience (CE) + Reflective Observation (RO) Assimilator: Abstract Conceptualization (AC) + Reflective Observation (RO) Converger: Abstract Conceptualization (AC) + Active Experience (AE) Accommodator: Concrete Experience (CE) + Active Experience (AE) Result:</p>	<p>Of course, we can evaluate your answers based on the Kolb Learning Styles model. According to Kolb, people go through four basic stages while learning:</p> <p>Concrete Experience: Living new experiences and being open to them. Reflective Observation: Observing lived experiences and evaluating them from different perspectives. Abstract Conceptualization: Creating general concepts by analyzing the information obtained from observations. Active Experience: Putting new concepts into practice in real life. According to your answers, the stages that are more dominant in your learning style are:</p> <p>Concrete Experience: Being open to new experiences and using your emotions in the learning process show that this stage is important for you. Active Experience: Preferring to learn by doing and caring about seeing the results shows that you are more successful in the active experience stage.</p>	<p>Thank you, this detailed information will be very helpful. Now, I will evaluate the student's answers within the framework of Kolb's Learning Style Model. Kolb's Learning Styles According to Kolb's model, there are four basic learning styles:</p> <ol style="list-style-type: none"> 1. Concrete Experience: Learning by experiencing and doing. 2. Reflective Observation: Learning by observing and thinking. 3. Abstract Conceptualization: Learning by thinking theoretically and conceptually. 4. Active Experimentation: Learning by trying and doing. <p>Student's Preferences By analyzing the student's answers, we can determine which learning style he is more prone to:</p> <p>Evaluation Looking at the student's answers, we can say that he is more prone to Concrete Experience and Active Experimentation styles. This student seems to prefer to include his feelings and experiences in the learning process, to actively participate and to do practical work.</p>

	<p>Concrete Experience (CE): 32 points Active Experience (AE): 31 points Abstract Conceptualization (AC): 23 points Reflective Observation (RO): 21 points</p> <p>According to this assessment, the student received high scores in Concrete Experience (CE) and Active Experience (AE) dimensions. In this case, the student has the Accommodator learning style. People with a divergent learning style prefer to learn by experiencing and actively participating. These people are open to new experiences and like to learn by doing. They are more interested in application than theory and are usually skilled at problem solving.</p>	<p>These results suggest that you have an Accommodating learning style. Experiencers enjoy being thrown into new experiences and practical applications. They learn using their emotions and intuition and are generally successful in group work.</p> <p>Compared to other Kolb learning styles:</p> <p>Assimilating: They focus more on abstract concepts and theories. They do not prefer learning based on experiences like you.</p> <p>Converging: They have high problem-solving and decision-making skills. They focus on practical applications, but their emotional aspects are less pronounced.</p> <p>Diverging: They are good at evaluating different perspectives and generating creative ideas. Although they are open to experiences like you, they exhibit a more observant approach.</p> <p>In summary:</p> <p>Your learning style likes to live new experiences, use your emotions, and learn through practical applications. These characteristics make you an experimental student. By using this information, you can make your learning process more efficient. For example, participating in group projects, focusing on practical lessons, and taking on new hobbies may be beneficial for you.</p>	
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The students' learning characteristics were sent individually as text to the AI chatbots for each student. When the learning characteristics of the first student were shared and the identification of their learning style was requested, the ChatGPT chatbot interpreted each question answered about the students' learning characteristics as referring to a different student and analyzed them within different learning styles (emotional, conceptual, kinesthetic, introverted, etc.). It stated that the student had an experiential and emotional learning style. Gemini interpreted the learning styles in terms of different learning models and concluded that the student had an emotional and experiential learning style. Copilot similarly analyzed the learning styles from the perspective of different models and stated that the emotional and intuitive aspects were dominant.

In summary, since we initially did not request the AI chatbots to identify the learning style specifically within the framework of Kolb's theory, they provided evaluations and suggestions based on various learning styles, and all three identified the same learning style for the same student.

When the AI chatbots were explicitly asked to analyze the learning style within the context of Kolb's learning style theory, all three first explained Kolb's four distinct learning styles and learning modes. Subsequently, ChatGPT listed which answers corresponded to each learning style, stated that it calculated the scores by summing them, and concluded that STUD1 had an Accommodator learning style. Gemini identified STUD1's learning style as Accommodating without demonstrating how it performed the calculation. Copilot, on the other hand, calculated the scores for each of the student's answers individually and indicated that the student was more inclined toward the Concrete Experience (learning by feeling) and Active Experimentation (learning by doing) styles.

In summary, inconsistencies were observed between the Turkish and English terminologies used by ChatGPT and Gemini in identifying the students' learning styles. Copilot, instead of explicitly stating the learning style, provided the names of the axes (learning modes) on which the learning style is located. For verification purposes, when Copilot was asked again which of the four learning styles the student had, it provided the same answer.

Table 3. Subsequent Responses of AI Chatbots to the Provided

Prompts	ChatGPT	Gemini	Copilot
STUD2 scale information was shared.	Based on the information you have provided, I can analyze the student's learning style within the framework of the Kolb Learning Style Model. By adding up the scores given to each learning dimension, I will determine which learning style he/she is more prone to. Scores: Result: Reflective Observation (RO): 42 points Active Experience (AE): 31 points Abstract Conceptualization (AC): 22 points Concrete Experience (CE): 13 points	Accordingly, the style that the student is closest to in the Kolb learning style model seems to be the Experiencing style. Why Experiencing? The importance he/she gives to emotions and experiences: The student brings his/her emotions and experiences to the forefront while learning. He/she is open to new experiences and prefers to be actively involved in the learning process. Orientation to practical application: The student wants to put the information into practice immediately and see the results. He/she prefers to learn by doing.	By analyzing the student's answers, we can determine which learning style he is more prone to: Evaluation Looking at the student's answers, we can say that he is more prone to Reflective Observation and Active Experimentation styles. This student seems to prefer observing and thinking carefully, as well as actively participating and doing practical work. In this case, the student may be prone to Assimilator learning styles. Assimilators learn through abstract conceptualization and reflective observation,

	<p>According to this assessment, the student has a high score in the Reflective Observation (RO) dimension. In this case, the student has an Assimilator learning style. People with an Assimilator learning style collect, analyze, and create theories about information. It is easier for them to learn by observing and thinking logically. They pay attention to details and usually adopt an analytical approach. Such people are usually successful in creating conceptual models and organizing information.</p>	<p>Social interaction: The student exhibits a positive attitude towards personal relationships and group work. This is also compatible with the social aspect of the experiencing style. Relationship with Other Styles</p> <p>Diverging: The student also seems competent in evaluating different perspectives. However, he/she does not display all the characteristics of the converging style due to his/her greater emphasis on experiencing and applying.</p> <p>Converging: Although the student has logical thinking and problem-solving skills, he/she prefers to use these skills more in practical applications.</p> <p>Assimilating: Although the student is interested in abstract concepts and theories, this interest is more effective when combined with experiencing and applying.</p> <p>As a result, the student is an active learner who is open to new experiences. He/she likes to use his/her emotions and experiences in the learning process. Therefore, in the educational processes aimed at the student;</p> <p>Practical applications: Activities such as laboratory work, projects, gamification</p> <p>Group studies: Collaborative learning environments</p>	<p>and have strong theoretical and analytical thinking skills. Accommodators learn through concrete experiences and active experience, and place importance on practical and experiential learning.</p>
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		Real life scenarios: Applications such as simulations, case studies Subjects that can be emotionally connected: Using methods such as examples and stories related to the student's interests will be more effective.	
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As seen in Table 3, the incorrect translations of ChatGPT's learning style identifications into Turkish continue with the subsequent prompts. After Gemini incorrectly identified the learning style of STUD2, a correction prompt was given, but it provided the same response again. Copilot stated that STUD2 was more inclined toward the reflective observation and active experimentation experience styles but incorrectly analyzed the student's learning style axis. As a result, it concluded that the student was inclined toward the Assimilator and Accommodator learning styles, which are located on different learning axes.

Following these analytical inconsistencies, detailed prompts about the origin of the Kolb Learning Style Inventory were provided, and the student's learning characteristics continued to be shared.

Table 4. Consecutive Responses of AI Chatbots to the Provided Prompts

Prompts	ChatGPT	Gemini	Copilot
STUD3 scale information was shared.	"We can say that he has a Converging learning style. This style is typical for individuals who prefer to produce solutions to problems and make decisions. They are successful in performing technical tasks and like to transform theories into practical applications. "It seems that he is closer to the Converging learning style." "The student may be prone to the Converging learning style. Convergents learn through abstract conceptualization and active experience, and their problem-solving and decision-making skills are strong."	"It appears to be closer to the Converging learning style."	"The student may be prone to the Converger learning style. Convergents learn through abstract conceptualization and active experimentation and have strong problem-solving and decision-making abilities."
STUD4 scale information was shared.	"These results indicate that the student has an "Accommodator" learning style. The Accommodator style is characterized by high Concrete Experience (CE) and Active	"You could say that your learning style tends to be 'accommodating.' This means that you like to try new experiences, apply them, and come up with practical solutions."	"The student may be prone to the Accommodator learning style. Accommodators learn through concrete experiences and active experimentation and place importance on

	Experience (AE), and students generally prefer to learn through concrete experiences and active applications. Adopting pragmatic and experiential learning methods, such students are comfortable with problem solving and acquiring new experiences."		practical and experiential learning."
STUD5 scale information was shared.	"The learning style can be determined as Diverging. Individuals with the Diverging style prefer to learn by observing and gathering information. They have the ability to see situations from different perspectives and usually develop creative and imaginative solutions."	"It appears to be closer to the Diverging learning style."	"The student may be prone to a Diverger learning style. Divergers learn through concrete experiences and reflective observation, have a broad perspective, and have strong creative thinking abilities."
STUD6 scale information was shared.	"It is designated as Accommodator. This style refers to an approach to learning based on concrete experiences and active experimentation."	"He appears to have an accommodating learning style."	"The student seems to be more oriented towards Concrete Experience (CE) and Active Experience (AE). This indicates a learning style that prefers learning by experiencing and actively participating."
STUD7 scale information was shared.	"Your learning style could be interpreted as 'Assimilator'."	"When we examined your answers, we concluded that the student's learning style is predominantly Converging and Accommodating. However, Assimilating characteristics cannot be ignored either."	"The student may be prone to the Converger learning style. Convergences learn through abstract conceptualization and active experimentation and have strong problem-solving and decision-making abilities."
STUD8 scale information was shared.	"With these results, your learning style can be described as 'Accommodator'. This style is more inclined to learn from experience, explore through practice, and interact with the real world. These individuals tend to learn based on concrete experiences and direct application."	"It appears to be closer to the Diverging learning style."	The student may be prone to the Diverger learning style. Divergers learn through concrete experiences and reflective observation, have a broad perspective, and have strong creative thinking abilities.
STUD9 scale information was shared.	"With these results, your learning style can be described as	When your answers are examined, it is seen that the student's learning	"The student may be predisposed to the Assimilator learning

	"Assimilator". This style is prone to understanding theoretical models, making logical analysis and organizing information. They usually learn based on abstract concepts and reflective observation."	style is predominantly "Diverging".	style. Assimilators learn through abstract conceptualization and reflective observation, focusing on theoretical models and logical analysis."
STUD10 scale information was shared.	"We can say that he has a Diverging learning style. This style is typical for individuals who prefer to observe and learn from experience."	"The student's learning style appears to be predominantly "Diverging"."	"It seems to be oriented towards Concrete Experience (CE) and Reflective Observation (RO). This indicates a learning style that prefers learning by experiencing and observing. It is closer to the Diverger learning style. This style emphasizes the student's creative thinking and problem-solving abilities."
STUD11 scale information was shared.	"We can say that he has an assimilating learning style. This style is typical for individuals who prefer to understand theories and models, analyze and organize information."	"The student's learning style appears to be predominantly "Experiencing (Accommodating)."	The student may be predisposed to the Assimilator learning style. Assimilators learn through abstract conceptualization and reflective observation, focusing on theoretical models and logical analysis."

During the learning style identification process, ChatGPT explicitly showed the inventory it conducted to reach a conclusion, but we noticed that it missed some answers to certain questions. For this reason, it could reach incorrect results. In such cases, we requested it to recalculate, after which it reached the correct result. When ChatGPT made incorrect identifications and we asked it to review its response, it tended to arrive at the correct answer. However, the other two AI chatbots repeatedly proposed the same result with different explanations.

After providing detailed prompts about the Kolb Learning Style Inventory (origin point, combined score calculation, interpreting positive and negative results), a reduction in incorrect responses was observed. Nevertheless, despite the detailed prompts, we observed that the AI chatbots still made incorrect predictions about students' learning styles.

As shown in Table 4, in addition to identifying the student's learning style, Gemini provided general information about the strengths and weaknesses of the learning style. Additionally, it examined study suggestions based on the learning style and its relationship with other learning styles. ChatGPT, on the other hand, only explained the identified learning style. Copilot provided information about the axes on which the student's learning style was located. A common point among the three AI applications is that while the English names of the identified learning styles were frequently correct, their Turkish translations were incorrect.

In line with the purpose of the study, a comparative table was created to determine the consistency between the responses provided by the AI chatbots and the learning styles of students identified using the Kolb Learning Style Inventory.

Table 5. Comparison of Kolb Learning Styles of Actual Students with Three Different AI Chatbots

Students	Actual Styles	ChatGPT	Gemini	Copilot
STUD1	Accommodator	Accommodator	Accommodator	Accommodator
STUD2	Assimilator	Assimilator	Accommodator	Accommodator
STUD3	Converger	Converger	Converger	Converger
STUD4	Accommodator	Accommodator	Accommodator	Accommodator
STUD5	Diverger	Diverger	Diverger	Diverger
STUD6	Accommodator	Accommodator	Accommodator	Converger
STUD7	Assimilator	Assimilator	Converger	Converger
STUD8	Diverger	Accommodator	Diverger	Diverger
STUD9	Assimilator	Assimilator	Diverger	Assimilator
STUD10	Diverger	Diverger	Diverger	Diverger
STUD11	Assimilator	Assimilator	Assimilator	Assimilator

When the actual Kolb learning styles were compared with the responses provided by the three different AI tools, it was observed that they provided both similar and different answers. Despite providing detailed prompts to the AI chatbots, they could still produce incorrect answers. The consistency of the AI chatbots with the actual results is presented in Table 6.

Table 6. Consistency of Three Different AI Chatbots with Actual Results

Students	Actual Styles	ChatGPT	Gemini	Copilot
STUD1	Accommodator	✓	✓	✓
STUD2	Assimilator	✓	✗	✗
STUD3	Converger	✓	✓	✓
STUD4	Accommodator	✓	✓	✓
STUD5	Diverger	✓	✓	✓
STUD6	Accommodator	✓	✓	✗
STUD7	Assimilator	✓	✗	✗
STUD8	Diverger	✗	✓	✓
STUD9	Assimilator	✓	✗	✓
STUD10	Diverger	✓	✓	✓
STUD11	Assimilator	✓	✓	✓

When Table 6 is examined, it is observed that ChatGPT has 1 incorrect identification, while the other AI chatbots each have 3 incorrect identifications. However, the notable point here is that the observation incorrectly identified by ChatGPT does not overlap with the incorrect observations of the others. In contrast, 2 of the 3 incorrect identifications made by Gemini and Copilot correspond to the same two observations.

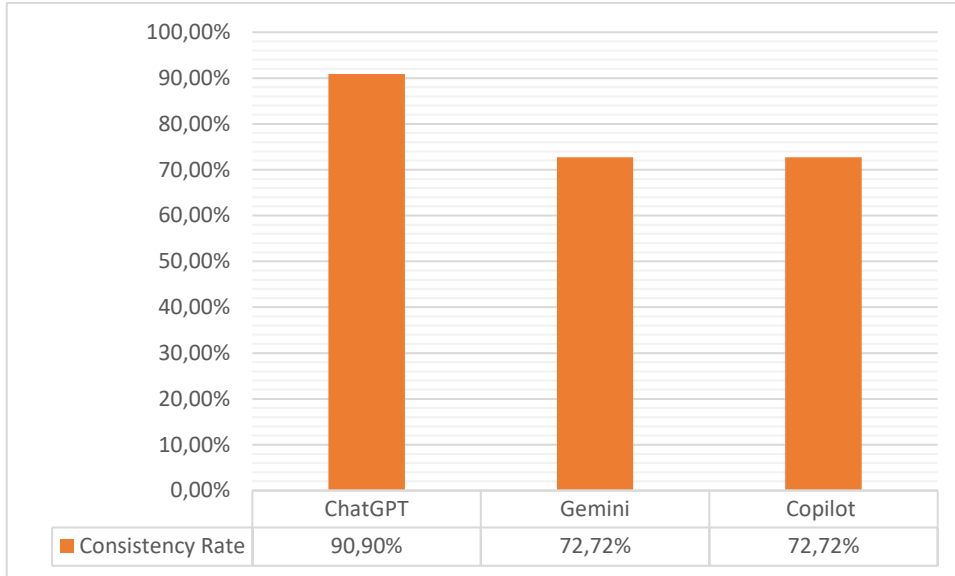


Figure 1. Consistency of Kolb Learning Style with Actual Results Across Three Different AI Tools

According to the findings, the highest success was achieved by ChatGPT. While ChatGPT demonstrated 90% consistency with the actual results, Gemini and Copilot showed 72% consistency.

5. CONCLUSION AND RECOMMENDATIONS

This study highlights the significance of identifying students' learning styles to facilitate personalized and effective learning, particularly within accounting education. By leveraging artificial intelligence (AI) tools—ChatGPT, Gemini, and Copilot—the research investigated their capabilities in determining learning styles based on the Kolb Learning Style Inventory. The findings demonstrate that AI tools can play a supporting role in educational personalization, although notable limitations remain.

The study revealed that **ChatGPT** emerged as the most consistent tool, achieving a 90% accuracy rate, while **Gemini** and **Copilot** achieved 72.72% accuracy, sharing common errors. ChatGPT provided detailed explanations for learning styles but did not consider students' alternative preferences. In contrast, Gemini offered generalized suggestions, and Copilot emphasized broader learning axes rather than specific styles. A recurring limitation was the inability of these AI tools to retain prompts over extended sessions, which limited their practical application in real-world educational settings.

Several limitations of the study should be acknowledged. Accurate results required detailed and repetitive prompts, posing challenges for classroom use. Additionally, the dynamic nature of learning styles, as highlighted in Kolb's model, remains a barrier for AI tools, which struggle to adapt to evolving student preferences.

To address these limitations and build on the study's insights, future research should focus on:

- i. **Longitudinal Studies:** Investigating the long-term impact of AI-driven learning style identification on student engagement, participation, and performance.
- ii. **Empirical Integration in Education:** Testing AI tools in real-world accounting classes to assess their effectiveness in delivering personalized content.
- iii. **Algorithm Enhancement:** Developing AI systems with improved accuracy, error minimization, and better retention of user prompts.
- iv. **Curriculum Development:** Incorporating AI-supported learning approaches into higher education to enhance the practical application of accounting education.

In conclusion, while AI tools such as ChatGPT, Gemini, and Copilot show promise in supporting personalized learning, their current limitations require educators to exercise caution. Human oversight remains essential to complement AI-based assessments. As AI technologies continue to advance, their potential to deliver more accurate, adaptive, and impactful educational solutions will likely increase, fostering enhanced learning outcomes in diverse educational contexts.

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