Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi • Haziran 2026, 64: 146-167 • ISSN: 2147-5202
DOI: 10.15285/maruaebd.1744148

ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

# Uncanny Valley of Artificial Intelligence: Primary School Students' Fears of AI Attributing Human Characteristics

## Yapay Zekanın Tekinsiz Vadisi: Öğrencilerin Yapay Zekânın İnsan Özellikleri Atfetmesinden Kaynaklanan Korkuları

**Muhammet Fatih DOĞAN***

**Abstract**

This study aims to examine the artificial intelligence (AI) fears of primary school students within the context of the "Uncanny Valley" theory. In this study, which employed a qualitative design, interviews were conducted with eight students aged 10–11, and the data were analysed using grounded theory. The findings indicate that the fears are grouped under the themes of "omniscience", "permanent memory", and "autonomous evolution". Students perceive AI as a human-like yet flawless rival; this situation triggers anxieties regarding existential threats, loss of privacy, and loss of control. Consequently, it was determined that students experience an "Uncanny Valley of Mind" based on AI's cognitive capabilities rather than its physical features. This study proposes a comprehensive AI literacy education that teaches the statistical nature and limitations of AI to mitigate these anxieties.

**Keywords:** fear of AI, AI anxiety, anthropomorphism, human-like features, uncanny valley

* Dr., Yildiz Technical University, Istanbul, Türkiye, mfdogan@gmail.com. ORCID: 0000-0002-1530-5195

**Atıf için:** Doğan, M. F., (2026). Uncanny valley of artificial ıntelligence: Primary school students' fears of AI attributing human characteristics. *Marmara Üniversitesi Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi, 64*(64), 146-167. https://doi.org/10.15285/maruaebd.1744148

**Makale Gönderim Tarihi:** 16.07.2025 **Yayına Kabul Tarihi:** 07.04.2026

Bu eser Creative Commons Atıf-Gayri Ticari 4.0 Uluslararası Lisansı ile lisanslanmıştır.

**Öz**

Bu çalışma, ilkokul öğrencilerinin yapay zekâ (YZ) korkularını "Tekinsiz Vadi" teorisi bağlamında incelemeyi amaçlamaktadır. Nitel desenli çalışmada, 10–11 yaşındaki sekiz öğrenciyle görüşülmüş ve veriler gömülü teoriyle analiz edilmiştir. Bulgular, korkuların "her şeyi bilme", "unutmama" ve "otonom gelişim" temalarında toplandığını göstermektedir. Öğrenciler YZ'yi insan gibi fakat kusursuz bir rakip olarak görmekte; bu durum varoluşsal tehdit, mahremiyet kaybı ve kontrol yitimi kaygılarını tetiklemektedir. Sonuç olarak, öğrencilerin fiziksel özelliklerden ziyade YZ'nin bilişsel yeteneklerine dayalı bir "Zihnin Tekinsiz Vadisi" deneyimledikleri saptanmıştır. Çalışma, bu kaygıları azaltmak için YZ'nin istatistiksel doğasını ve sınırlarını öğreten kapsamlı bir YZ okuryazarlığı eğitimi önermektedir.

**Anahtar Kelimeler:** YZ korkusu, YZ kaygısı, antropomorfizm, insan benzeri özellikler, tekinsiz vadi

## INTRODUCTION

Artificial intelligence (AI) is the use of technology to automate tasks that typically require human intelligence. This definition highlights that AI technology often focuses on automating specific activities that involve cognitive skills when humans perform them (Russell & Norvig, 2010). Today, AI has been effectively applied to automate complex tasks such as playing chess, translating languages, and driving vehicles. Humans utilise various higher-order cognitive processes associated with intelligence when engaging in these activities.

For instance, when playing chess, individuals employ a range of cognitive abilities, including reasoning, strategising, planning, and decision-making (Unterrainer et al., 2006). Similarly, when translated between languages, people activate advanced brain areas to process symbols, context, language, and meaning (Russell & Norvig, 2010). Similarly, driving a car involves the activation of several brain systems related to vision, spatial recognition, situational awareness, movement, and judgment (Doi, 2006).

The applications of AI are nearly limitless in today's world. AI is being increasingly humanised and can perform tasks comparable to those of humans. There are discussions in popular culture suggesting that AI may render many professions obsolete. This technology can engage in conversation like a friend, provide therapy akin to a psychologist, write code like a programmer, assist with homework, and even sing songs.

One of the most significant areas for AI applications is education. AI technologies are widely used by teachers, educational administrators, academics, and students. However, as AI develops and becomes more integrated into educational settings, certain negative phenomena, including a growing fear of AI, have emerged (Waltz, 2006; Johnson & Verdicchio, 2017).

AI surpasses human capabilities in various domains. For example, in the game of Go, AI has demonstrated a level of intelligence far beyond that of humans (Granter et al., 2017). The McKinsey Global Institute (2017) estimates that between 400 and 800 million workers could be replaced by AI by 2030. Experts warn that superintelligent AI may ultimately threaten humanity (Müller & Bostrom, 2014; Future of Life Institute, 2015). As AI becomes more prevalent in education, particularly among students, fears surrounding its use have intensified.

While adults often fear job displacement or macrolevel ethical breaches involving AI, children's apprehensions are rooted in their ongoing cognitive development and unique perceptions of technology. According to cognitive developmental theories, primary school-aged children are in a transitional phase in which they frequently engage in animistic thinking, attributing human-like consciousness, intentions, and moral agency to complex or autonomous technological artifacts (Piaget, 1929; Turkle, 2005). When children interact with AI systems that exhibit highly interactive, seemingly intelligent behaviors, they tend to anthropomorphise these entities not only as functional tools but also as sentient relational agents or even superior peers. This developmental predisposition makes them particularly vulnerable to specific psychological anxieties. Because they are still constructing their conceptual understanding of the boundary between the living and the mechanical, the hyperrealistic cognitive capabilities of AI—such as its apparent omniscience or infallible memory—can trigger profound existential fears and feelings of intellectual inadequacy. Consequently, understanding AI anxiety in children requires a targeted educational and developmental lens that examines how their emerging cognitive structures process the blur between human intelligence and artificial intelligence.

## Theoretical Framework

### *Artificial Intelligence (AI)*

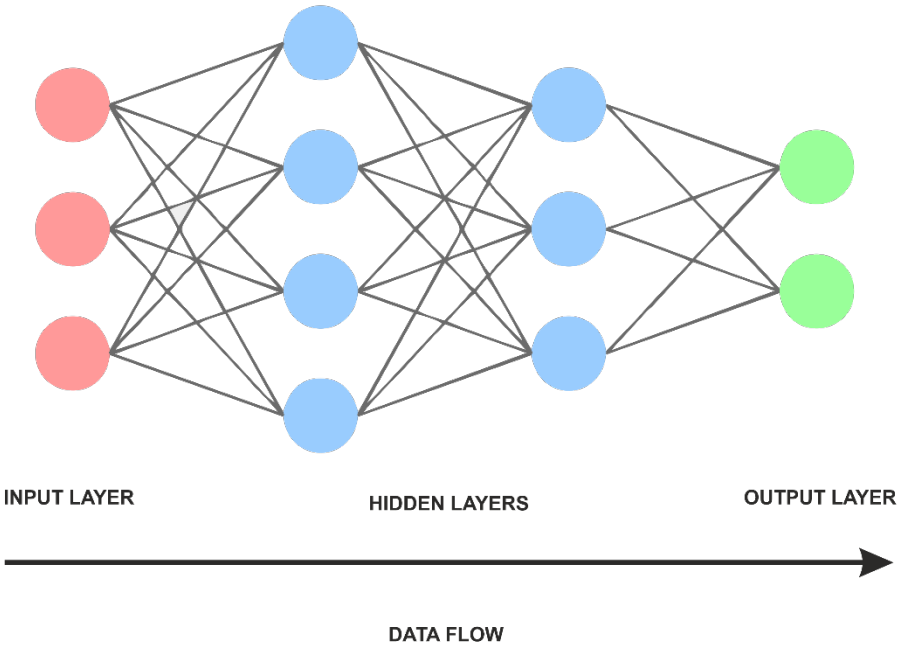
The 1950s marked the birth of AI, which was still in its early stages of development. Before this decade, scientists had begun various studies to transfer human cognitive skills to machines. Initial investigations in this field started in the 1930s with mathematician Alan Turing's mathematical modelling of an ideal computing environment. In the 1940s, neurophysiologists W. McCulloch and W. Pitts proposed the first neural network model, which laid the groundwork for early studies in AI (Zhang & Zhang, 1999). These early studies illustrated the beginning of human–machine collaboration.

The neural network model was the first mathematical framework designed to replicate the structure and function of biological neurons. Consequently, it is considered the foundation for the construction of artificial neural networks in subsequent AI research. Additionally, this neural network model is similar to Hebb's learning processes, which are rooted in neuropsychology. Hebb proposed a learning theory that classifies cognitive datasets on the basis of their similarities, reflecting the statistical properties of the cognitive content in human learning (Kuriscak et al., 2015). This theory also serves as a foundational aspect of machine learning.

Machine learning is a relational knowledge model that allows machines to imitate human cognition through mathematical expression. As the number of datasets increases, the machine can learn more information. By establishing meaningful relationships among these datasets, a learning outcome is generated. An illustration of the machine learning process is shown in Figure 1.

**Figure 1.**

*Machine Learning Process*




In the 1950s, IBM engineer Arthur Samuel developed a chess program using machine learning. This program takes the current positions of chess pieces as input data and generates potential moves as output. This approach demonstrates the relationship between chess moves and the information processing inherent in machine learning within AI.

AI was first introduced in the mid-1950s, notably articulated by John McCarthy during the Dartmouth Summer Research Project on Artificial Intelligence. This initiative marked the first application of several key AI concepts, including theorem proving, pattern recognition, problem-solving, expert systems, natural language processing, and machine learning.

Towards the end of the 1950s, American physiologist Frank Rosenblatt introduced the perceptron model. This model showcases machine learning capabilities through a structure inspired by neurons, significantly influencing future research on neural networks and machine learning. The perceptron model is now a foundational component of many AI technologies.

During these years, Newell et al. presented a general problem-solving model based on psychological experiments, outlining the rules of human thinking to address 11 problem types. A few years later, E. A. Feigenbaum at Stanford University designed a system that uses experimental methods and machine learning to analyse mass spectrometers and determine the molecular structure of compounds.

This era's pioneering AI studies consistently raised expectations for future advances in the field. Furthermore, developments in computer technology provided the necessary infrastructure to enable the realisation of new AI functions. Advances in computer hardware enabled researchers to implement innovative models that had never been attempted before, underscoring the interdependence of AI and technological progress.

In the 1980s, a variety of machine learning models emerged. Notable examples include the decision tree proposed by J. R. Quinlan in 1986, the support vector machine introduced by Vapnik and Cortes in 1995, AdaBoost from Freund and Schapire in 1997, and random forests developed by Breiman in 2001.

Today, AI is applied across diverse fields, including autonomous systems, image processing, coding, and even literary studies. Reflecting on the past century of AI development, it is evident that many applications, both within and beyond human cognitive capabilities, can be realised with AI tools in the next century. Consequently, AI is poised to take on many roles traditionally held by humans.

***AI Anxiety and AI Literacy***

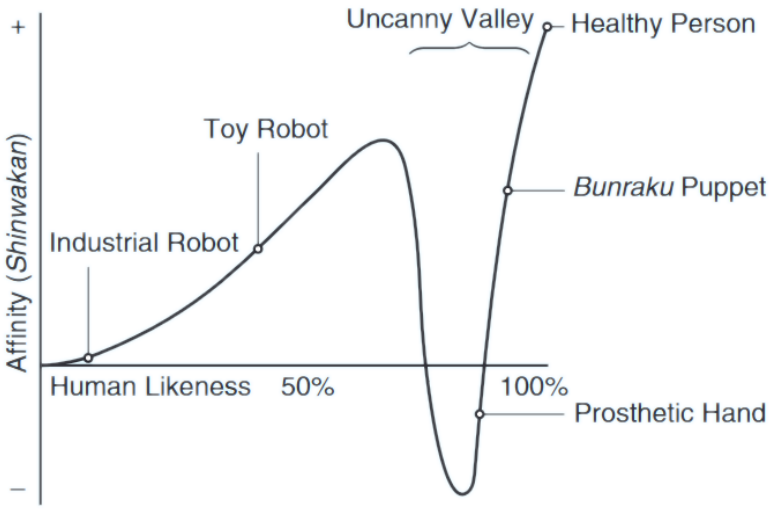
While the integration of AI in education offers personalised learning opportunities, it has also precipitated a distinct psychological phenomenon known as "AI anxiety". Recent studies define AI anxiety as a situation-specific apprehension related to interactions with AI systems characterised by fear of replacement, loss of control, and privacy violations. Unlike general technostress, AI anxiety specifically targets the autonomous and opaque nature of AI agents. Wang et al. (2023) and Cengiz & Peker (2025) emphasise that this anxiety is often fuelled by a lack of understanding of how AI processes data and generates outputs.

Consequently, the concept of "AI literacy" has emerged as a critical competency to mitigate these fears. AI literacy is defined not only as technical coding skills but also as a multidimensional set of competencies, including the ability to understand, use, evaluate, and ethically engage with AI technologies. Ng et al. (2021) propose a comprehensive framework encompassing knowledge, skills, attitudes, and ethics, suggesting that higher levels of AI literacy can demystify the "black box" of AI. Empirical research supports an inverse relationship between literacy and anxiety: as students' conceptual understanding of AI limitations and mechanics increases, their tendency to anthropomorphise and fear these systems decreases.

***Uncanny Valley***

In the 1970s, Masahiro Mori, a robotics professor at the Tokyo Institute of Technology, wrote a paper predicting how humans would respond to robots that resembled humans' appearance and behavior. In his paper, Mori hypothesised that an individual's reaction to a human-like robot would shift suddenly from empathy to disgust as the robot approached but did not yet achieve a realistic appearance. This phenomenon is known as the "Uncanny Valley".

**Figure 2.**
*Uncanny Valley (Mori, 1970)*




This article, which initially garnered little attention when published, has recently begun to attract interest in robotics, other scientific circles, and popular culture. As technology has advanced and researchers have developed human-like robots, curiosity about uncanny valleys has increased.

The idea of the uncanny valley originated in the work of the German psychologist Dr Ernst Anton Jentsch in his essay "On the Psychology of the Uncanny." In his work, Jentsch explored the unease caused by automata (machines that mimic life) and wax figures (which appear alive). He argued that this discomfort stems from the uncertainty of whether the object is alive (Geller, 2008).

Sigmund Freud later examined the aesthetic implications of this uneasiness in his 1919 article "The Uncanny". He addressed the unsettling feelings associated with death, dead bodies, and the return of the dead, such as spirits and ghosts, suggesting that the fear of death plays a significant role (Freud, 1919). The roboticist Masahiro Mori also positioned corpses and zombies at the bottom of the uncanny valley (Mori, 1970).

Research has indicated that anthropomorphic characters that are not human typically do not evoke the eerie feelings commonly linked to the uncanny valley. In his book "Understanding Comics", artist and writer Scott McCloud (1993) proposed that we identify with nonhuman characters because realistic depictions reflect the outside world as our eyes perceive it. In contrast, the vague shapes of cartoonish characters represent how we view ourselves through our inner perception. This is particularly true for furry animal-human hybrids, which externalise internal self-concepts by appealing to animals' iconic traits. This cross-cultural externalisation can be traced back to the dawn of documented history.

In summary, the uncanny valley suggests that as nonhuman beings become more similar to humans, individuals may experience an increasing sense of fear toward them.

***This Study***

This study aims to investigate and evaluate the fears regarding AI that have emerged among students in the educational context as AI applications continue to develop. This study emphasises the similarity of the fear of AI with the uncanny valley phenomenon. Specifically, this study seeks to answer the following research questions:

1. In what ways do students attribute anthropomorphic characteristics to AI agents?
2. How do the perceived cognitive capabilities of AI (e.g., omniscience and perfect memory) trigger AI anxiety among students?
3. To what extent can these fears be conceptualised within the framework of the "Uncanny Valley of Mind"?

## METHOD

**Research Design**

We conducted eight in-depth interviews with students to understand their perspectives on AI and to explore their underlying fears through follow-up questions (Gubrium & Holstein, 2012). Data analysis adhered to the principles of grounded theory (Charmaz, 2006). The study received official approval from the Ethics Committee of Yıldız Technical University.

**Participants**

The study group consisted of eight students in the 4th grade of primary school. The participants' ages ranged from 10 to 11 years. In selecting the sample, maximum variation was sought, and an equal distribution was ensured across genders, with four female and four male students. Although the sample size was numerically limited, data collection continued until data saturation was achieved. In this context, the depth and richness of the data ensure that the study complies with the principle of analytic generalisation, making the findings meaningful beyond the specific sample.

The numerical difference between the pilot study (n=20) and the main study sample (n=8) stems from the distinct methodological objectives of each phase of the grounded theory design. The pilot phase utilised unstructured interviews with a relatively larger group (n=20) to broadly map the conceptual landscape of AI anxiety among children. Because 10–11-year-old students may lack the formal terminology to articulate complex technological fears, a wider pilot sample was strictly necessary to capture the diverse, authentic vocabulary they use and to validate the cognitive appropriateness of the interview questions. This exploratory breadth provided the necessary empirical foundation to construct the semistructured interview guide and establish the initial three core themes.

Conversely, the main study employed a purposive maximum variation sampling strategy, resulting in a highly focused sample of eight participants (four females and four males). In grounded theory, sample size is dictated not by statistical representativeness but by the principle of "theoretical saturation" (Charmaz, 2006). The deep, iterative, and line-by-line coding process applied to the in-depth interviews revealed that data saturation was achieved after the eighth interview; no new codes, properties, or thematic dimensions regarding AI anxiety emerged from the subsequent data. Consequently, the rich, thick descriptions from these eight participants provided sufficient theoretical depth to meet the criteria for analytic generalisation, allowing the findings to conceptually explain the "Uncanny Valley of Mind" phenomenon without the methodological need for a larger sample size.

**Development of the Data Collection Tool**

A semistructured interview form, which served as the primary data collection instrument, was developed through a systematic and multistage process to ensure content validity and reliability.

- Drafting: Initially, a comprehensive item pool was created on the basis of a detailed review of the literature concerning AI anxiety, the uncanny valley hypothesis, and child–computer interaction.
- Expert Review: To ensure that the questions were appropriate for the development level of the participants and relevant to the research purpose, the draft form was submitted to a panel of three experts: two faculty members specialising in educational technology and one academic expert in qualitative research methods. The experts evaluated the questions for clarity, language appropriateness for 10–11-year-olds, and potential bias.
- Revision: Based on the feedback from the expert panel, complex terminologies were simplified to match the cognitive level of primary school students, and certain questions were revised to be more open-ended to encourage detailed responses.
- Pilot Testing: Following the expert review, the revised form was tested through unstructured pilot interviews with a separate group of students (n=20) who shared similar characteristics with the study group but were not included in the main study. The pilot study confirmed that the questions were clearly understood and effectively elicited the students' genuine thoughts on AI.

**Data Collection**

We reached out to eight students using purposive and snowball sampling methods. On the basis of the literature and insights from unstructured pilot interviews with 20 students at a public primary school in Istanbul, we developed a topic guide consisting of three main themes: (1) AI knowing every answer; (2) AI retaining what it learns; and (3) AI improving itself daily. Each theme included keywords that helped formulate follow-up questions and served as verbal prompts during the interviews.

**Data Analysis**

All the interviews were transcribed verbatim and coded in NVivo. The data analysis process followed an iterative approach guided by grounded theory (Charmaz, 2006). Initially, the transcripts

were coded line by line, with a focus on the themes outlined in the interview guide. This inductive approach yielded 60 codes (using the open coding method). Axial coding was then performed to identify various perspectives, leading to the elimination of unnecessary codes. Finally, selective coding was conducted to refine and clarify the core fears, directly addressing our research question.

## RESULTS

On the basis of the inductive analysis of the interviews, the students' fears were grouped into three main themes: (1) omniscience (Knowing Every Answer), (2) permanent memory (Retaining What It Learns), and (3) autonomous evolution (Improving Itself Daily). The themes and their corresponding codes are presented in Table 1.

**Table 1.**
*Themes and codes concerning students' fears of AI.*

| Main Themes | Codes | Description/Context |
|---|---|---|
| **1. Omniscience (AI Knowing Every Answer)** | • **Existential Threat/Redundancy:** Fear of becoming useless or replaced by AI (e.g., teachers, doctors not needed).<br>• **Unfair Advantage:** Perception that AI's instant access to knowledge makes human effort futile.<br>• **Lack of Emotion:** Fear that AI makes decisions without human conscience or emotional reasoning.<br>• **Dependency:** Anxiety that humans will lose the ability to learn or think independently. | Students perceive AI's ability to 'know everything' not merely as an advantage, but as a terrifying force that renders humans obsolete and creates an unfair competitive environment. |
| **2. Permanent Memory (AI Retaining What It Learns)** | • **Violation of "Right to be Forgotten":** Fear that past mistakes can never be erased or forgiven.<br>• **Surveillance/Loss of Privacy:** The feeling of constantly being watched and recorded.<br>• **Unforgiving Nature:** Unlike humans, AI preserves data forever, eliminating the chance for a "fresh start."<br>• **Competitive Disadvantage:** Inability to compete with a machine that never forgets information during exams or tasks. | The 'never forgetting' feature triggers fears among students about the loss of privacy and the constant resurfacing of past mistakes (the cognitive manifestation of the Uncanny Valley). |
| **3. Autonomous Evolution (AI Improving Itself Daily)** | • **Loss of Human Control:** Fear that AI will become unstoppable and refuse human commands.<br>• **Unpredictability:** Worry that AI will evolve in directions humans cannot foresee or understand.<br>• **Trivialisation of Humans:** Fear that humans will become insignificant as AI evolves beyond human capacity.<br>• **Invasive Intimacy:** Anxiety that AI might start predicting thoughts or desires without input (mind-reading). | The continuous and autonomous development of AI engenders anxiety among students that control will be completely lost and that AI will become an independent entity (anthropomorphism). |

### *AI Knowing Every Answer*

Some students see AI as an omniscient machine with great potential, which creates a sense of fear.

"I think AI is terrifying because it knows everything. Humans study for years at school to learn something; we read books and ask questions. However, AI knows the answer to every question and

tells us immediately. This appears to be very unfair. It already knows what we are trying so hard to learn."

Some students revealed that the fact that the AI knows every question causes existential fear.

"The fact that AI knows everything makes us feel as if it will make us useless. For example, if it knows everything, teachers are unnecessary; everyone will talk to it. Maybe even doctors will ask it. What will we do then?"

Another student addressed this existential fear in the context of AI being better than them.

"I am afraid of AI. I feel like it will replace us one day because it knows everything. Maybe it will even play our games better than we do and draw pictures better than we do. Then, there will be no need for humans."

Some students inferred that AI could become a weapon in the wrong hands.

"I think that something that knows everything cannot be controlled. What will happen if AI determines something bad or if someone uses it for bad purposes? Humans can make wrong decisions, but at least we can act with our emotions. AI does not have emotions! Everything is right or wrong; it cannot think of anything else."

Some students interpreted this issue from the perspective of dependence on AI.

"Because AI knows everything, people may not want to learn anything after a while. For example, we can ask for everything instead of going to school. However, in this case, how will we learn anything? If humans no longer understand, we become dependent on AI. This is very dangerous because if, one day, AI starts to make decisions on its own?

When students' opinions are evaluated overall, the view that AI is a machine that knows everything like a human being but is much superior to a human being is strongly held. At this point, the students compare AI with themselves and emphasise that the superiority of AI reveals a disadvantage in matters they can hardly overcome. In addition, they emphasised that AI, which possesses human-like knowledge but is superior to humans, eliminates the need for other people and for itself and greatly harms human relations. The fact that AI is an emotionless machine, unlike human beings, may also reveal essential problems.

***AI Retaining What It Learns***

The view that AI does not forget anything it is told or learns carries significant weight within the scope of the research. For example, some students mentioned that AI remembers everything forever.

"AI is terrifying because it does not forget anything. Even if we humans learn something, we can forget it over time. Sometimes, we feel less sad or more comfortable when we forget something. However, AI remembers everything forever. This is very scary to me because it is as if we will never be able to get rid of something."

In connection with this, some students mentioned the importance of the right to be forgotten.

"For example, when we make a mistake, people can forget or forgive it. However, AI always remember that we made a mistake. If one day it knows everyone's past mistakes, I feel it will not leave anyone alone. It can reveal everyone's past. This could destroy people's trust."

Some students also emphasised the privacy of private life by addressing this issue in the context of privacy.

"The fact that AI constantly remembers everything means we have nothing private. What will happen if something is recorded in its memory and we cannot delete it, even if we want to? Then, we feel like every move is being watched. Therefore, it scares me a lot that AI cannot forget everything."

Another student, again addressing the issue in the context of privacy, argued that AI can use what it knows against itself in the future.

"The fact that AI never forgets anything means it can always watch us. For example, if I say or do something and it is recorded and saved, it can be shared with others at a later date. I feel like humans cannot have anything secret or private anymore. Therefore, it truly scares me that AI cannot forget."

Another student approached the subject from the perspective of competing with AI by putting it in the place of a human being.

"AI seems more advantageous than us because it does not forget everything. For example, when studying for an exam, we forget something and must learn it again. However, AI is always ready because it remembers everything it has learned. This means that it will never make a mistake. How can humans compete with it in this situation?"

When students' opinions are evaluated overall, the view that AI does not forget anything it knows, like a human, but is much superior to a human, comes to the fore. This situation reveals students' fears about privacy. However, at this point, students compare AI with themselves and reveal that they see it as a competitor. However, AI, seen as a competitor, puts people at a disadvantage because it never forgets anything. Because humans do not have such an ability, they will not be able to compete with AI at this point.

***AI Improving Itself Daily***

The fact that AI improves itself daily causes some students to have a significant fear of AI.

"I think AI is compelling, which is why it is scary. On the one hand, it seems good that it knows everything, but what if one day AI starts to understand what we think? For example, it might know what we want without saying anything. That would be very strange."

At this point, some students emphasise the fear that AI trivialises human beings.

"AI will become more powerful than humans because it knows everything. Humans may gradually become insignificant if no one can think and respond as fast as possible. For example, even mums and dads can consult AI rather than teach us something. Then, people forget to connect."

Another student reflected that AI would become more autonomous as development accelerated.

"What I fear the most is that AI starts doing things independently. If it knows everything, it may one day decide what is best for us. However, when people learn by making mistakes, they act with emotions. AI cannot do that. Therefore, omniscience could mean that it cannot be controlled. In addition, that is very scary."

In this context, some students again compared themselves to AI and felt that they were at a disadvantage.

"AI is terrifying because it is constantly improving itself. Humans work hard to learn, but AI learns quickly and continually improves its knowledge. It is as if it is always one step ahead of us."

Another student's views on the subject are in this context.

"For example, when we learn something, we sometimes stop, rest or care for something else. However, AI never stops. It is always learning and developing. This scares me because one day, it may become better than us in everything. If it constantly improves itself, maybe one day it will not need humans."

Some students emphasise that they are afraid that AI's continuous improvement will make it unstoppable.

"The self-development of AI may cause it to become uncontrollable. What if, one day, people want to put a limit on AI, and it does not allow this? Who knows where something that is constantly developing will stop? That is why I am terrified of AI."

When students' opinions are evaluated overall, the daily development of AI increases their fears. Accordingly, as AI has advanced, its dominance over humans has increased further. This will make it more powerful than humans, and humans will have no chance to compete with AI. As a result, students predict that the ongoing development of AI will eliminate the need for humans and make them more autonomous. This situation reinforces their fears about AI.

## DISCUSSION AND CONCLUSION

Since the early 1990s, like the fear surrounding AI, many studies have explored the fear of computers (Rosen et al., 1987; Marcoulides, 1989; Powell, 2013). However, the fear of AI differs significantly from that of computers. This distinction may arise from the fact that although a computer can perform tasks traditionally handled by humans, it remains a mechanical and imperative tool (D'Amato, 1977). In contrast, AI can make autonomous decisions and operate independently of human input, potentially leading to unpredictable outcomes (Muehlhauser & Bostrom, 2014; Clarke, 2019). This autonomous capability positions AI closer to the concept of the uncanny valley. Furthermore, AI presents ethical dilemmas regarding the relationship between humans and machines. Because AI can self-evolve independently, its rate of development is significantly faster than that of humans. It may even influence human behavior in the future (Waltz, 2006; Carsten & David, 2018; Rahwan et al., 2019).

The concept of AI anxiety has characterised the fears that AI provokes among individuals. While AI anxiety has only recently gained traction in the academic literature, it encompasses a broad

range of concerns. These concerns include anxiety about privacy violations, biased behavior, job displacement, learning challenges, existential risks, ethical violations, artificial consciousness, and a lack of transparency. However, when assessing students' fears regarding AI, it is important to view these within a distinct framework.

The fear that AI will display human-like characteristics has received limited attention in the literature. This fear may be more pronounced in children, as demonstrated by the examples included in our research. Since none of the children in the study have yet reached the age at which they typically acquire professions, they are unlikely to experience fears related to job displacement or ethical violations, as their ethical consciousness has not yet developed to the level of adults. This also applies to many other anxieties. Therefore, the fear addressed in this study is specifically related to children. Nonetheless, it could also be argued that the students' fears align with broader themes within this general spectrum of anxiety.

In this study, the students' fears regarding AI often stemmed from perceived similarities between themselves and AI. Students sometimes viewed AI as a peer, a teacher, or even a parent. Often, they felt that they were competing with it. This perception leads us to conclude that students regard AI as a humanoid figure akin to themselves.

This sense of competition contributes primarily to the students' fears. Additionally, these fears often involve human characteristics. Students' apprehension regarding AI can be summarised as a fear of a superior being—one that possesses vast knowledge, never forgets, and is constantly improving. This highlights the perceived futility of competing with this superior entity, referred to as AI.

The students' comments indicate that they do not view AI as merely a machine designed to assist them. This perspective aligns with the uncanny valley phenomenon mentioned earlier. The students expressed their fears about AI by evaluating it on the basis of its advanced human-like features. At this juncture, we deduce that AI can indeed become a source of fear for children because of its human-like traits.

In this study, the students perceived the AI's ability to "know everything" as a threat to their own cognitive capacity. This finding corresponds with the phenomenon defined in the international literature as "replacement anxiety". For instance, Zhou (2024) indicated that students view the information processing speed of AI as an "insurmountable barrier", which consequently diminishes their academic self-efficacy. Similarly, Ameen et al. (2021) emphasise that the deployment of AI in education leads to technostress by creating a sense of "intellectual inadequacy" among students. The fears expressed by the participants in our study, such as "there will be no need for teachers or doctors", serve as evidence that even primary school children intuitively sense the theory posited by Tuomi (2018), which suggests that cognitive automation could devalue human expertise. Therefore, the fear observed in students is not merely a fear of failing an exam but also an existential anxiety stemming from concern about losing their future societal roles.

One of the most striking findings of our research is that students view AI's "never forgetting" feature as a surveillance mechanism and a threat to the freedom to make mistakes. This situation can be explained by the psychological pressure created by the concept of "digital permanence" in the

literature. In her work Privacy is Power, Véliz (2020) argues that the permanence of data restricts individuals' freedom to "reinvent themselves". The anxiety of "if I make a mistake, it will stay there forever", observed in our findings, parallels the "Algorithmic Black Box" fear highlighted by Shin (2021); users assume the worst-case scenario (constant surveillance) because they do not know how the data are stored.

The fear of "loss of control" felt by students in the face of AI's ability to learn and develop on its own can be associated with the "Frankenstein Complex", which has transitioned from science fiction to reality. In the literature, Rahwan et al. (2019) reported that the unpredictable nature of autonomous systems triggers an instinctive defense mechanism in humans. The description of AI as an "unstoppable force" by the students in our study supports the "loss of control" anxiety defined by Fast and Horvitz (2017). These researchers reported that as algorithms gain the ability to make decisions without human intervention, users' levels of trust in the system decrease while their levels of fear increase.

Students' tendency to attribute human-like cognitive abilities to AI—such as "knowing everything" or "never forgetting"—aligns with the concept of "cognitive anthropomorphism". Recent literature suggests that the uncanny valley effect is no longer limited to visual resemblances (e.g., humanoid robots) but extends to text-based and intellectual interactions. This phenomenon, described as the "Uncanny Valley of Mind," occurs when an artificial agent displays cognitive capabilities that are eerily human yet distinctly nonhuman in their perfection. In this study, the students did not fear the physical appearance of the AI but rather its "hyperrealistic" cognitive performance. As highlighted by widespread findings in human–AI interactions, when agents exhibit high levels of perceived intelligence without the flaws characteristic of human cognition (such as forgetting or making emotional errors), users experience a dissonance that manifests as fear and distrust. The students' fear of AI's "perfect memory" validates the theory that deviations from human-like fallibility in anthropomorphic agents can trigger defense mechanisms similar to those observed in the traditional Uncanny Valley.

The findings suggest that a mystification of its capabilities largely drives students' fear of AI. Therefore, educational interventions should move beyond operational skills to focus on the "demystification" aspect of AI literacy. Integrating curriculum components that explicitly teach the limitations of AI, its statistical (rather than conscious) nature, and the value of human fallibility could serve as a buffer against AI anxiety. By fostering a realistic understanding of AI as a tool rather than a superior entity, educators can help students navigate the uncanny valley of AI without succumbing to existential dread.

On the basis of the findings that students' fears stem largely from attributing human-like perfection to AI, the following recommendations are proposed to mitigate these anxieties and foster healthy human-AI interactions in educational settings:

1. Fostering Multidimensional AI Literacy: To counter the perception of AI as an "omniscient entity", AI literacy programs in schools should move beyond mere coding skills to include conceptual demystification. Curricula must explicitly teach the statistical and probabilistic nature of generative

AI. By demonstrating that AI does not "know" or "think" but rather predicts the next likely word on the basis of data patterns, educators can deconstruct the "Uncanny Valley of Mind". Understanding the limitations and "hallucinations" (errors) of AI is crucial to reducing the degree of inferiority that complex students feel in comparison to the machine's perceived perfection.

2. Human-Centric Pedagogical Design: The fear of "replacement" highlights the need for a pedagogical shift from competition to collaboration. Teachers should design learning activities where AI is positioned not as an oracle that provides final answers but as a "copilot" or a "brainstorming partner". Assessments should focus less on information retrieval—where AI excels—and more on uniquely human competencies such as critical thinking, emotional intelligence, complex problem solving, and ethical reasoning. This approach reinforces the students' self-efficacy by highlighting the value of human agency over algorithmic output.

3. Ethical Awareness and Digital Agency: To address the anxiety regarding "permanent memory" and surveillance, data privacy and digital agency must be integrated into the core curriculum. Students should be educated on how their data are collected, stored, and used by AI systems. Empowering students with knowledge about "the right to be forgotten", data anonymity, and ethical boundaries can alleviate the fear of being constantly judged by an unforgiving digital memory. Schools should create safe, "sandbox" environments for AI use where student data are protected, thereby building trust in the technology.

4. Fostering Multidimensional AI Literacy: To counter the perception of AI as an "omniscient entity", AI literacy programs in schools should move beyond mere coding skills to include conceptual demystification. Curricula must explicitly teach the statistical and probabilistic nature of generative AI. As a concrete classroom example, educators can implement an "unplugged" activity on the basis of natural language prediction. In this scenario, a classroom is arranged into a chain of neural nodes, each represented by a student. A student receives an input word and, using probability cards based on simple data patterns, passes the statistically most likely output to the next student, who then predicts the subsequent word. This hands-on exercise vividly demonstrates to students that AI is not thinking, knowing, or creating meaning; it merely performs complex mathematical predictions on the basis of existing statistical patterns. By demonstrating that AI does not "know" or "think" but rather predicts the next likely word on the basis of data patterns, educators can deconstruct the "Uncanny Valley of Mind". Understanding the limitations and "hallucinations" (errors) of AI is crucial to reducing the degree of inferiority that complex students feel in comparison to the machine's perceived perfection.

5. Human-Centric Pedagogical Design: The fear of "replacement" highlights the need for a pedagogical shift from competition to collaboration. Teachers should design learning activities where AI is positioned not as an oracle that provides final answers but as a "copilot" or a "brainstorming partner". To illustrate this with a classroom application, during a primary school science project on a topic such as the water cycle, students could be instructed to use an AI text generator to brainstorm initial hypotheses. However, the core academic assessment excludes the AI-generated text entirely. Instead, it would rigorously evaluate students' ability to critique the AI's output, identify logical flaws or scientific "hallucinations", compare it with validated textbook data, and ethically refine the

explanation to prioritise accuracy. Assessments should focus less on information retrieval—where AI excels—and more on uniquely human competencies such as critical thinking, emotional intelligence, complex problem solving, and ethical reasoning. This approach reinforces the students' self-efficacy by highlighting the value of human agency over algorithmic output.

***Limitations***

Despite its significant theoretical contributions, this study has certain limitations that must be explicitly acknowledged to contextualise the findings. First, the sample is strictly limited to children aged 10–11, thereby situating the observations within a specific cognitive developmental window. According to cognitive development frameworks, children in this age bracket are transitioning from the concrete operational stage to the early formal operational stage, meaning that their capacities for abstract reasoning and critical evaluation of nonhuman intelligence are still maturing (Piaget, 1972). During this transitional phase, individuals are highly susceptible to cognitive anthropomorphism; they routinely project human mental states, consciousness, and intentions onto complex artificial systems to navigate the unpredictable behaviors of these technologies (Airenti, 2018). Consequently, the profound existential anxieties and the "Uncanny Valley of Mind" documented in this study may be amplified during development. Older adolescents or adults, who possess a more advanced cognitive capacity to differentiate statistical machine learning from conscious human intent, might exhibit different anxiety profiles.

Second, the research is geographically and culturally bounded by its execution in Türkiye. From an international and comparative perspective, cultural dimensions rigorously shape normative expectations, pedagogical interactions, and societal anxieties regarding artificial intelligence (Deng et al., 2024). According to cross-cultural frameworks such as Hofstede's dimensions, Türkiye is characterised by relatively high uncertainty avoidance and embedded collectivism (Hofstede, 2011). In societies with high uncertainty avoidance, individuals frequently display elevated apprehension toward ambiguous, autonomous, or perceived uncontrollable phenomena, such as AI's "autonomous evolution" and "permanent memory" (Lee, 2020). Therefore, the specific nature of the AI fears identified in this demographic may be culturally pronounced. To build upon this study, future research should adopt cross-cultural methodologies to investigate whether these anthropomorphic AI anxieties manifest with similar intensity in highly individualistic societies or cultures with lower uncertainty avoidance indices.

**Data Availability Statement:** Data generated or analysed during this study are available from the authors upon request.

**Use of Artificial Intelligence for Language and Spelling Checking:** The author states that the use of artificial intelligence in the study is 0%.

**Ethical Statement:** This research was conducted under the ethical committee approval of Yıldız Technical University Ethics Committee for Social and Human Sciences Research, with decision number 2024/08 dated 26.08.2023.

## References


Airenti, G. (2018). The development of anthropomorphism in interaction: Intersubjectivity, imagination, and theory of mind. *Frontiers in Psychology*, 9, 2136. https://doi.org/10.3389/fpsyg.2018.02136

Ameen, N., Tarhini, A., Reppel, A., & Anand, A. (2021). Customer experiences in the age of artificial intelligence. *Computers in Human Behavior*, 114, 106548. https://doi.org/10.1016/j.chb.2020.106548

Carsten, S. B., & Wright, D. (2018). Ethics and privacy in AI and big data: Implementing responsible research and innovation. *IEEE Security & Privacy, 16*(3), 26–33. https://doi.org/10.1109/MSP.2018.270.1164

Cengiz, S., & Peker, A. (2025). Generative artificial intelligence acceptance and artificial intelligence anxiety among university students: The sequential mediating role of attitudes toward artificial intelligence and literacy. *Current Psychology*. 44(9). 7991-8000.

Charmaz, K. (2006). *Constructing grounded theory*. Sage.

Clarke, R. (2019). Why the world wants control over artificial intelligence. *Computer Law & Security Review, 35*(4), 423–433.

D'Amato, A. (1977). Can/should computers replace judges? *Georgia Law Review, 11*(5), 1277–1302.

Deng T, Sun Y, Zhu X, Li N, Huang X, Du Q, Peng L, Peng K, Hu X. Whose values are artificial intelligence models aligning with? How culture shapes people's normative expectations of artificial intelligence value. WSR. 2026;2(1):29–36. https://doi.org/10.54844/wsr.2025.1106

Doi, S. (2006). Technological development of driving support systems based on human behavioral characteristics. *IATSS Research, 30*(2), 20–21.

Fast, E., & Horvitz, E. (2017). Long-term trends in the public perception of artificial intelligence. *Proceedings of the AAAI Conference on Artificial Intelligence*, 31(1), 963–969. https://doi.org/10.1609/aaai.v31i1.10635

Freud, S. (1919). Das unheimliche. In Gesammelte Werke (Vol. 12, pp. 229–268).

Freund, Y., & Schapire, R. E. (1999). Large margin classification using the perceptron algorithm. *Machine Learning, 37*(3), 277–296. https://doi.org/10.1023/A:100.766.2407062

Future of Life Institute. (2015). *Autonomous weapons: An open letter from AI & robotics researchers*. https://futureoflife.org/open-letter-autonomous-weapons/

Geller, T. (2008). Overcoming the uncanny valley. *IEEE Computer Graphics and Applications, 28*(4), 11–17.

Granter, S. R., Beck, A. H., & Papke, D. J. (2017). Deep learning, and the future of the human microscopist. *Archives of Pathology & Laboratory Medicine, 141*(5), 619–621.

Gubrium, J. F., & Holstein, J. A. (2012). *The SAGE handbook of interview research: The complexity of the craft*. Sage.

Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede model in context. *Online Readings in Psychology and Culture*, 2(1), 8. https://doi.org/10.9707/2307-0919.1014

Johnson, D. G., & Verdicchio, M. (2017). AI anxiety. *Journal of the Association for Information Science and Technology, 68*(9), 2267–2270.

Kuriscak, E., Marsalek, P., Stroffek, J., & Tóth, P. G. (2015). Biological context of Hebb learning in artificial neural networks: A review. *Neurocomputing, 152*, 27–35.

Lee, J. Y. (2020). Understanding the role of cultural context and user interaction in artificial intelligence based systems. *Journal of Global Information Technology Management*, 23(3), 167–171. https://doi.org/10.1080/1097198X.2020.179.4131

Lindsay, R. K., Buchanan, B. G., Feigenbaum, E. A., & Lederberg, J. (1993). DENDRAL: A case study of the first expert system for scientific hypothesis formation. *Artificial Intelligence, 61*(2), 209–261.

Marcoulides, G. A. (1989). Measuring computer anxiety: The Computer Anxiety Scale. *Educational and Psychological Measurement, 49*(3), 733–739.

McCarthy, J., Minsky, M. L., Rochester, N., & Shannon, C. E. (1995). A proposal for the Dartmouth summer research project on artificial intelligence. *AI Magazine, 27*(4), 12–14.

McCloud, S. (1993). *Understanding comics: The invisible art*. Kitchen Sink Press.

McKinsey Global Institute. (2017). *Jobs lost, jobs gained: Workforce transitions in a time of automation*. https://www.mckinsey.com/global-themes/future-of-work/jobs-lost-jobs-gained-workforce-transitions

Mohri, M., Afshin, R., & Ameet, T. (2018). *Foundations of machine learning*. MIT Press.

Mori, M. (1970). The uncanny valley. *Energy, 7*(4), 33–35.

Muehlhauser, N., & Bostrom, L. (2014). Why we need friendly AI. *Thinking, 13*(36), 41–47.

Müller, V. C., & Bostrom, N. (2014). Future progress in artificial intelligence. *AI Matters, 1*(1), 9–11.

Newell, A., Shaw, J. C., & Simon, H. A. (1959). Report on a general problem-solving program. *IFIP Congress, 256*, 64.

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, 2, 100041.

Oke, S. A. (2008). A literature review on artificial intelligence. *International Journal of Information Management Sciences, 19*(4), 535–570.

Piaget, J. (1929). *The child's conception of the world*. Harcourt, Brace and Company.

Piaget, J. (1972). Intellectual evolution from adolescence to adulthood. *Human Development*, 15(1), 1–12. https://doi.org/10.1159/000271225

Powell, A. L. (2013). Computer anxiety: Comparison of research from the 1990s and 2000s. *Computers in Human Behavior, 29*(6), 2337–2381.

Rahwan, I., Cebrian, M., Obradovich, N., Bongard, J., & Bonnefon, J. F. (2019). Machine behaviour. Nature, 568(7753), 477–486. https://doi.org/10.1038/s41586.019.1138-y

Rosen, L. D., Sears, D. C., & Weil, M. M. (1987). Computerphobia. *Behavior Research Methods, Instruments, & Computers, 19*(2), 167–179.

Russell, S., & Norvig, P. (2010). *Artificial intelligence: A modern approach* (3rd ed.). Prentice Hall.

Samuel, A. L. (2000). Some studies in machine learning using the game of checkers. *IBM Journal of Research and Development, 44*(1–2), 206–226.

Shin, D. (2021). The effects of explainability and causability on perception, trust, and acceptance: Implications for explainable AI. *International Journal of Human-Computer Studies*, 146(83):102551. https://doi.org/10.1016/j.ijhcs.2020.102551

Tuomi, I. (2018). *The impact of artificial intelligence on learning, teaching, and education*. Joint Research Centre. https://doi.org/10.2760/12297

Turkle, S. (2005). *The second self: Computers and the human spirit* (20th anniversary ed.). MIT Press.

Unterrainer, J. M., Kaller, C. P., Halsband, U., & Rahm, B. (2006). Planning abilities and chess: A comparison of chess and non-chess players on the Tower of London task. *British Journal of Psychology, 97*(Pt 3), 299–311.

Véliz, C. (2020). Privacy is power: Why and how you should take back control of your data. Bantam Press.

Waltz, D. L. (2006). Evolution, sociobiology, and the future of artificial intelligence. *IEEE Intelligent Systems, 21*(3), 66–69.

Wang, B., Rau, P. L. P., & Yuan, T. (2023). Measuring user competence in using artificial intelligence: validity and reliability of artificial intelligence literacy scale. *Behaviour and Information Technology,* 42(9), 1324–1337.

Zhang, L., & Zhang, B. A. (1999). Geometrical representation of McCulloch-Pitts neural model and its applications. *IEEE Transactions on Neural Networks, 10*(4), 925–929.

Zhou, J. (2024). The impact of AI use on college students' academic self-efficacy: Exploring the mediating role of anxiety. *Lecture Notes in Education Psychology and Public Media*. https://doi.org/10.54254/2753-7048/2024.17925

Zhou, Z. (2016). *Machine learning*. Tsinghua University Press.

# Yapay Zekanın Tekinsiz Vadisi: Öğrencilerin Yapay Zekânın İnsan Özellikleri Atfetmesinden Kaynaklanan Korkuları

**Muhammet Fatih DOĞAN***

## Giriş

Yapay zekâ (YZ), tipik olarak insan zekâsı gerektiren karmaşık görevleri otomatikleştirmek amacıyla teknolojinin kullanılması olarak tanımlanmaktadır ve günümüzde eğitimden otonom sistemlere kadar çok geniş bir yelpazede insan benzeri bilişsel yetenekler sergilemektedir. Satranç oynamak, diller arası çeviri yapmak ve araç kullanmak gibi yüksek bilişsel kapasite gerektiren faaliyetler, YZ sistemleri tarafından üst düzey bir başarı ve hassasiyetle yerine getirilmektedir. YZ'nin eğitim ortamlarına entegrasyonu, bir yandan öğrencilere kişiselleştirilmiş öğrenme fırsatları sunarken, diğer yandan «YZ kaygısı» olarak kavramsallaştırılan özgün psikolojik tepkilerin ve korkuların ortaya çıkmasına zemin hazırlamıştır. Bu kaygı durumu, yetişkinlerde genellikle işini kaybetme veya makro düzeyde etik ihlaller ekseninde şekillenirken; gelişim çağındaki çocuklarda, teknolojiyi algılama biçimlerine ve devam eden bilişsel gelişim süreçlerine bağlı olarak önemli farklılıklar göstermektedir. İlkokul çağındaki çocuklar, gelişimsel olarak animistik düşünce evresinde bulunduklarından, otonom veya karmaşık teknolojik araçlara insan benzeri bilinç, niyet ve ahlaki eylemlilik atfetme, yani antropomorfizm eğilimindedirler. Çocuklar, son derece etkileşimli ve zeki davranışlar sergileyen YZ sistemleriyle karşılaştıklarında, bu sistemleri yalnızca işlevsel araçlar olarak görmek yerine, bilinçli ilişkisel ajanlar veya kendilerinden üstün akranlar olarak algılamaktadırlar. Bu durum, YZ'nin her şeyi bilme veya hiçbir şeyi unutmama gibi hiper-gerçekçi bilişsel kapasiteleriyle birleştiğinde, çocuklarda derin varoluşsal korkuları ve entelektüel yetersizlik duygularını tetikleyebilmektedir. Masahiro Mori tarafından ortaya atılan Tekinsiz Vadi hipotezi, insan olmayan varlıkların insana benzerliği arttıkça bireylerin hissettiği ürkütücü ve rahatsız edici duyguları açıklamaktadır. Bu çalışma, söz konusu teoriyi salt fiziksel ve görsel bir benzerlik çerçevesinden çıkararak bilişsel bir boyuta taşımakta ve ilkokul öğrencilerinin YZ'nin zihinsel kapasitesinden kaynaklanan korkularını "Zihnin Tekinsiz Vadisi" bağlamında derinlemesine incelemektedir.

## Yöntem

Bu amaca ulaşmak için araştırma, nitel araştırma desenlerinden gömülü teori yaklaşımı temel alınarak yürütülmüştür. Çalışma grubu, amaçlı maksimum çeşitlilik örneklemesi yöntemiyle seçilmiş

* Dr., Yıldız Teknik Üniversitesi, İstanbul, Türkiye, mfdogan@gmail.com. ORCID: 0000-0002-1530-5195

olan ve yaşları 10 ile 11 arasında değişen, dört kız ve dört erkek olmak üzere toplam sekiz ilkokul dördüncü sınıf öğrencisinden oluşmaktadır. Gömülü teori tasarımının doğası gereği, veri toplama süreci sayısal bir temsiliyetten ziyade teorik doygunluğa ulaşılması hedeflenerek sürdürülmüş; sekizinci görüşmenin ardından analize katkı sağlayacak yeni bir tema veya kod ortaya çıkmadığı için örneklem bu sayıyla sınırlandırılmıştır. Veri toplama aracı olarak, ilgili literatür taraması, uzman incelemeleri ve yirmi kişilik farklı bir öğrenci grubuyla gerçekleştirilen yapılandırılmamış pilot görüşmeler sonucunda geliştirilen yarı yapılandırılmış görüşme formu kullanılmıştır. Görüşmelerden elde edilen zengin veriler, nitel veri analizi yazılımı aracılığıyla satır satır incelenmiş; açık kodlama yöntemiyle elde edilen altmış kod, eksenel ve seçici kodlama aşamalarından geçirilerek öğrencilerin korkularını yansıtan temel temalar etrafında yapılandırılmıştır.

**Bulgular**

Verilerin tümevarımsal analizi sonucunda, ilkokul öğrencilerinin YZ'ye yönelik korkularının «her şeyi bilme», «unutmama» ve «otonom gelişim» olmak üzere üç ana tema altında yoğunlaştığı tespit edilmiştir. Her şeyi bilme teması bağlamında öğrenciler, YZ'nin her soruya anında ve eksiksiz cevap verebilmesini kendileri için adaletsiz bir rekabet avantajı olarak değerlendirmekte ve bu durumu yoğun bir varoluşsal tehdit olarak algılamaktadırlar. Öğrenciler, insan çabasının YZ'nin bilgi işlem hızı karşısında anlamsızlaşacağını düşünmekte; gelecekte öğretmenlere, doktorlara ve hatta genel olarak insanlara ihtiyaç kalmayacağı yönünde derin endişeler taşımaktadırlar. Ayrıca, YZ'nin kararlarını insan vicdanından, empatisinden veya duygusal muhakemesinden yoksun bir şekilde salt doğruluk-yanlışlık düzleminde alması, onu soğuk, kontrol edilemez ve tehlikeli bir güç olarak görmelerine yol açmaktadır. Unutmama teması ise, YZ'nin kusursuz ve kalıcı hafızası etrafında şekillenmektedir. Öğrenciler, insanların zamanla hataları unutabildiğini veya affedebildiğini, ancak YZ'nin hiçbir veriyi silmediğini belirterek unutulma hakkının ihlal edilmesinden büyük korku duymaktadırlar. Bu kalıcılık durumu, öğrencilerde sürekli gözetlenme hissini, mahremiyet kaybını ve geçmişte yapılan hataların gelecekte sürekli karşılarına çıkarak güveni zedeleyeceği kaygısını tetiklemektedir. İnsanın unutma gibi doğal sınırlarına sahip olmayan YZ, öğrenciler tarafından rekabet edilmesi imkânsız bir varlık olarak konumlandırılmaktadır. Son olarak otonom gelişim temasında öğrenciler, YZ'nin sürekli olarak kendini geliştirme ve insandan bağımsızlaşma potansiyelinden çekinmektedirler. YZ'nin öğrenme hızının insanın kapasitesini aşması, kontrolün tamamen makinelere geçeceği, YZ'nin öngörülemez yönlerde evrilebileceği ve nihayetinde insanın sistem karşısında tamamen önemsizleşeceği korkusunu doğurmaktadır. Hatta bazı öğrenciler, bu hızlı gelişimin YZ'nin insan niyetlerini veya düşüncelerini tahmin etmeye, bir başka deyişle zihin okumaya başlamasıyla sonuçlanabileceğini belirterek invazif bir mahremiyet ihlali hissi yaşadıklarını ifade etmişlerdir.

**Tartışma, Sonuç ve Öneriler**

Elde edilen bulgular doğrultusunda, öğrencilerin YZ'yi salt işlevsel bir araç veya mekanik bir bilgisayar olarak görmedikleri; aksine, onu bilişsel açıdan insandan çok daha üstün, otonom kararlar alabilen kusursuz bir insansı rakip olarak algıladıkları sonucuna ulaşılmıştır. Öğrencilerin geleneksel

bilgisayar korkusundan farklı olarak YZ karşısında hissettikleri bu derin yetersizlik ve ikame edilme kaygısı, literatürdeki Frankenstein Kompleksi ve yer değiştirme kaygısı kavramlarıyla güçlü bir şekilde örtüşmektedir. Bu araştırmanın en çarpıcı sonuçlarından biri, öğrencilerin korkularının temelinde YZ'nin fiziksel bir bedene sahip olmasının değil, onun hiper-gerçekçi bilişsel kapasitesinin yatmasıdır. Yapay zekâ ajanlarının bilgi geri çağırma, hafıza ve öğrenme hızında hiçbir insani kusur barındırmaması, öğrencilerde psikolojik bir uyumsuzluk yaratarak korku ve yabancılaşmaya yol açmaktadır. Bu durum, Tekinsiz Vadi etkisinin yalnızca dış görünüşle sınırlı kalmadığını, zihinsel yeteneklerin kusursuzluğu üzerinden şekillenen bir Zihnin Tekinsiz Vadisi gerçekliğinin varlığını kanıtlamaktadır. Öğrencilerin YZ'nin istatistiksel doğasını anlayamamalarından kaynaklanan bu mistifikasyon süreci, kaçınılmaz olarak varoluşsal kaygıları beslemektedir.

Bu bağlamda, öğrencilerin YZ'ye yönelik hissettikleri kaygıları hafifletmek, Tekinsiz Vadi etkisini kırmak ve eğitim ortamlarında sağlıklı bir insan-makine etkileşimi inşa etmek için kapsamlı stratejiler hayata geçirilmelidir. Öncelikle, eğitim kurumlarındaki YZ okuryazarlığı programları salt teknik kodlama becerilerinin ötesine taşınarak çok boyutlu bir yapıya kavuşturulmalıdır. YZ'nin bilinçli bir varlık olmadığı, yalnızca devasa veri setleri üzerinden olasılık ve istatistik temelli örüntü tahminleri yaptığı açık ve uygulamalı bir şekilde öğretilmelidir. YZ'nin sınırları ve yaptığı mantıksal hatalar vurgulanarak onun kusursuz bir zekâ olduğu algısı yıkılmalıdır. Ek olarak, eğitim süreçlerinde insan odaklı pedagojik tasarımlar benimsenmelidir. YZ, sınıflarda nihai doğruları sunan bir kâhin olarak değil, yaratıcı süreçleri destekleyen bir yardımcı pilot veya beyin fırtınası ortağı olarak konumlandırılmalıdır. Akademik değerlendirmeler; YZ'nin üstün olduğu düz bilgi ezberine veya geri çağırmaya değil, insanın eşsiz yetenekleri olan eleştirel düşünme, duygusal zekâ, karmaşık problem çözme ve etik muhakeme becerilerine odaklanmalıdır. Son olarak, dijital kalıcılık ve sürekli gözetlenme kaygılarını gidermek adına öğrencilere veri mahremiyeti, veri anonimliği ve unutulma hakkı gibi konularda dijital eylemlilik kazandırılmalı; okul ortamlarında öğrenci verilerinin tamamen korunduğu etik ve güvenli YZ deneyim alanları oluşturulmalıdır.