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GOOGLE VEO 3 AS A PEDAGOGICAL PARTNER: AI-DRIVEN STORYTELLING FOR CONCEPTUAL, AFFECTIVE, AND CRITICAL LEARNING IN SCIENCE EDUCATION

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Abstract

The rapid emergence of generative artificial intelligence (AI) has redefined the landscape of educational media design, offering unprecedented opportunities for multimodal and narrative-based learning. This study examines the pedagogical potential of Google Veo 3, a next-generation text-to-video platform, within the context of secondary science education in Türkiye. Using a qualitative case study design, the research explores how an AI-generated narrative video—created to support a high school biology unit on climate change—affects students' conceptual understanding, emotional engagement, and critical media literacy. Data were collected through classroom observations, semi-structured interviews with 18 students, and reflective teacher notes, and were analyzed thematically. Findings reveal that Veo 3 enhanced students' comprehension of complex scientific phenomena by visualizing abstract processes such as ecosystem disruption and biodiversity loss, consistent with the Cognitive Theory of Multimedia Learning. Moreover, the narrative-driven video promoted affective engagement and ethical reflection aligned with socioscientific issues (SSI) pedagogy. Students demonstrated empathy toward environmental challenges and developed a heightened awareness of media authenticity. The study concludes that Veo 3 can serve not merely as a content-generation tool, but as a pedagogical partner—fostering cognitive, affective, and critical learning dimensions. Recommendations are offered for teacher training, digital ethics education, and institutional policy to ensure the responsible integration of generative AI in classroom practice.

Keywords: Google Veo 3, Generative Artificial Intelligence, Text-to-Video, Science Education, Socioscientific Issues, Digital Literacy, Pedagogical Innovation

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Google Veo 3'ün Fen Bilimleri Eğitiminde Pedagojik Bir Ortak Olarak Kullanımı: Kavramsal, Duyuşsal Ve Eleştirel Öğrenme İçin Yapay Zeka Temelli Anlatı Yaklaşımı

Öz

Üretken yapay zekâ teknolojilerinin hızlı gelişimi, eğitimde çoklu ortam temelli anlatı tasarımlarına yeni bir boyut kazandırmıştır. Bu çalışma, Google Veo 3 adlı metinden videoya dönüştürme platformunun fen bilimleri öğretiminde pedagojik bir araç olarak kullanım potansiyelini incelemektedir. Nitel bir durum çalışması deseninde yürütülen araştırma, Türkiye'deki bir lise biyoloji sınıfında iklim değişikliği konusunun öğretiminde kullanılan yapay zekâ temelli anlatı videosunun öğrencilerin kavramsal anlamaları, duyuşsal katılımları ve eleştirel dijital okuryazarlıkları üzerindeki etkisini araştırmıştır. Veriler, sınıf gözlemleri, 18 öğrenciyle yapılan yarı yapılandırılmış görüşmeler ve öğretmen yansıtma notları aracılığıyla toplanmış; tematik analiz yöntemiyle çözümlenmiştir. Bulgular, Veo 3'ün soyut biyolojik süreçlerin (örneğin ekosistem bozulması, biyoçeşitlilik kaybı) görselleştirilmesi yoluyla öğrencilerin kavramsal anlayışlarını geliştirdiğini ve Çoklu Ortamla Öğrenme Kuramı ile uyumlu olduğunu göstermiştir. Ayrıca, anlatı temelli yapı duyuşsal katılımı artırmış, öğrencilerde çevresel farkındalık ve etik sorgulama becerileri geliştirmiştir. Öğrencilerin medya doğruluğu ve gerçeklik algısına ilişkin farkındalıklarının artması, çalışmanın eleştirel dijital okuryazarlık açısından da katkı sunduğunu göstermektedir. Sonuç olarak, Veo 3 yalnızca bir içerik üretim aracı değil; bilişsel, duyuşsal ve eleştirel öğrenme boyutlarını bütünleştiren yenilikçi bir pedagojik ortak olarak değerlendirilmiştir. Çalışma, öğretmen eğitimi, dijital etik ve eğitim politikası alanlarında sorumlu yapay zekâ entegrasyonu için somut öneriler sunmaktadır.

Anahtar Kelimeler: Google Veo 3, Üretken Yapay Zekâ, Metinden Videoya, Fen Eğitimi, Sosyo-bilimsel Konular, Dijital Okuryazarlık, Pedagojik Yenilik

Introduction

In recent years, the field of generative artificial intelligence (AI) has progressed rapidly, leading to the creation of advanced multimodal models capable of synthesizing rich audio-visual content directly from natural language input. Among the latest and most sophisticated of these is Google Veo 3, introduced at Google I/O 2025. Veo 3 represents a significant leap forward in text-to-video (T2V) generation by combining synchronized audio, high-resolution video, scene and character consistency, and intuitive control through its integrated interface, Google Flow (Google, 2025a).

While early T2V platforms such as Meta's *Make-A-Video* and Runway's *Gen-2* showcased the promise of converting written prompts into visual media, they were limited by short clip durations, lack of audio, and inconsistencies in frame-to-frame rendering (Karaarslan & Aydın, 2024). Veo 3 advances beyond these limitations by generating photorealistic motion, natural speech, ambient sound, and real-world physics—features previously unattainable in real-time AI-driven video production (Hassabis, 2025).

The inclusion of native audio generation is especially noteworthy. Unlike earlier systems that required post-production dubbing or third-party tools for sound design, Veo 3 integrates spoken dialogue and environmental audio as part of the generation process. This enhances storytelling depth and greatly expands the use of T2V in educational videos, marketing, e-learning, and public information campaigns (Sreekantha et al., 2024).

However, the increasing realism and accessibility of AI-generated video content also raise important ethical concerns. Potential misuse for misinformation, identity manipulation, and deepfake distribution highlights the need for robust verification frameworks. In response, Google has introduced SynthID, an invisible watermarking system that enables detection and attribution of AI-generated media, promoting transparency and accountability (Google, 2025b).

This paper presents Veo 3 as a case study of state-of-the-art T2V technology, examining its innovations, practical applications, and the ethical frameworks necessary for its responsible deployment. As multimodal AI becomes central to digital content creation, tools like Veo 3 may redefine narrative expression—bringing both extraordinary opportunity and significant societal responsibility.

This study aims to explore the educational potential and ethical dimensions of Google Veo 3, a next-generation text-to-video (T2V) platform introduced in May 2025. As one of the first publicly available multimodal systems to seamlessly integrate synchronized audio, visual coherence, and user-directed scene design,

Veo 3 signals a meaningful shift in how scientific narratives can be constructed and delivered in digital formats.

The research investigates how Veo 3 can serve as a pedagogical tool, particularly within science education, by enabling teachers to generate immersive, conceptually aligned video content from written prompts. In doing so, the study seeks to:

- Examine the technological advancements that distinguish Veo 3 from earlier T2V systems and generative AI tools;
- Identify practical applications that highlight its accessibility and adaptability across instructional, creative, and communicative contexts;
- Discuss ethical challenges posed by AI-generated content, including concerns related to authenticity, misinformation, and student perception;
- Evaluate the impact of built-in safeguards such as Google's SynthID watermarking in promoting responsible classroom use.

To ground these objectives in real-world practice, the paper presents a case study from a secondary school biology course where Veo 3 was used to support instruction on socioscientific topics including climate change, biodiversity, and ecological disruption. Through this lens, the research illustrates how Veo 3 can not only simplify the delivery of complex content but also foster emotional engagement and critical reflection among learners.

This paper's unique contribution is to move beyond technological description by documenting a classroom-aligned, narratively structured production workflow and by reporting empirical classroom evidence on student engagement and conceptual understanding. Accordingly, we ask: **(1)** How does Veo 3-supported, narrative-driven video influence students' conceptual articulation in biology? **(2)** How do students and the teacher perceive its pedagogical value and ethical implications?

This study is particularly relevant at a time when generative AI is rapidly transforming educational practices. While much of the existing literature focuses

on the theoretical potential of AI in learning environments, few works have examined concrete applications of fully integrated multimodal platforms like Veo 3. By situating this technology within contemporary debates on digital pedagogy and media ethics, the study contributes both to academic inquiry and to the development of informed practices for integrating AI into science classrooms. It emphasizes Veo 3's dual role as a tool for innovative storytelling and a prompt for rethinking the ethical responsibilities of digital education.

Methodology

Research Design

This study adopted a qualitative single-case design (Yin, 2018), focusing on the integration of *Google Veo 3* into a Turkish secondary biology classroom. The single-case approach was selected to allow context-rich, holistic analysis of how an AI-driven, narrative-based video tool can influence students' conceptual and emotional engagement. As Miles, Huberman, and Saldaña (2019) note, single-case designs are particularly suited for exploratory educational inquiries where the goal is depth of understanding rather than statistical generalization. This design aligns with recent calls in Türkiye for practice-oriented AI research in K–12 education, emphasizing authentic classroom data and teacher-led implementation (Karaarslan & Aydın, 2024).

Participants and Setting

The study was carried out in a public high school in Ankara, Türkiye, during the spring semester of 2025. The case involved one biology teacher and 28 tenth-grade students enrolled in a compulsory science course. The students were between 15 and 16 years old, with a mean age of approximately 15.5 years. The teacher had twelve years of professional experience and had previously completed the Ministry of National Education's in-service training program on Digital Pedagogy for Future Classrooms.

Participants were selected using criterion-based purposive sampling (Patton, 2015), as they represented a natural class in which the climate change

module was scheduled during the research period. All participants provided written informed consent; parental consent was obtained for minors. Identities were anonymized using coded pseudonyms (e.g., S1–S28 for students, T1 for teacher), following ethical standards established by the Turkish Council of Higher Education (*Yükseköğretim Kurulu*, 2023).

Table 1 summarizes the participant profile, including group size, age, and professional background.

Table 1: *Participant Overview*

Group	n	Age Range	Gender (F/M)	Key Characteristics
Students	28	15–16	15 / 13	Enrolled in the same biology class
Teacher		—	—	12 years of experience; certified biology teacher

Table 1 provides demographic and contextual information about study participants. Gender distribution is balanced, representative of the target population in public Turkish high schools.

Educational Context and Scenario

The study took place during a two-lesson instructional unit (80 minutes total) on *climate change and biodiversity*. The teacher created a 2.5-minute AI-generated narrative video using *Google Veo 3* through the *Flow* interface. The video was based on the prompt:

"Create an educational narrative for high school biology students showing how rising global temperatures affect ecosystems, using examples such as coral bleaching, polar habitat loss, and seasonal plant changes."

The instructional design was aligned with inquiry-based learning (IBL) and Socioscientific Issues (SSI) pedagogy, which emphasize ethical reasoning and emotional engagement in science (Sadler, 2011; Zeidler, 2014;). The session consisted of three stages: (1) *Pre-discussion* of environmental issues, (2) *Viewing*

of the Veo 3 video, and (3) *Post-reflection* through guided discussion and short written reflections.

Data Collection

To ensure data triangulation (Denzin, 2017), three complementary methods were used: structured classroom observation, semi-structured interviews, and document analysis.

1. Structured Classroom Observation. Two consecutive lessons were observed using a standardized checklist focused on attention, participation, conceptual articulation, and ethical reflection. The researcher acted as a non-participant observer positioned at the back of the classroom. Field notes captured real-time interactions and teacher facilitation strategies.
2. Semi-Structured Interviews. A teacher interview (40 minutes) explored pedagogical benefits, challenges, and ethical awareness. A student focus group (8 participants; 45 minutes) examined engagement, conceptual understanding, and perceptions of authenticity in AI-generated content.
3. Document and Product Analysis. Supplementary data included lesson plans, the AI-generated video prompt, teacher notes, and 28 short reflective essays (100–150 words each) written by students after the viewing session. Table 2 provides an overview of the data collection timeline and instruments.

Table 2: *Data Collection Timeline and Instruments*

Phase	Week	Data Source	Instrument	Duration
Preparation	Week 0	Planning documents	Lesson plan, video prompt	—
Implementation	Week 1	Classroom observation	Structured observation form	2 × 40 min
Post-lesson	Week 2	Interviews	Teacher + Student focus group protocols	40–45 min
Reflection	Week 2	Student products	Reflective essays (n = 28)	—

Table 2 outlines the sequencing of data collection activities, showing how different sources were used to ensure temporal and methodological triangulation.

Instruments and Trustworthiness

Interview protocols were developed based on Mayer's (2009) Cognitive Theory of Multimedia Learning and Socioscientific Issues pedagogy (Zeidler et al., 2005). The protocols were reviewed by two experts in educational technology and piloted with a small student group to ensure clarity.

Observation checklists were adapted from Karaarslan and Aydın's (2024) AI-integration framework in STEM education, including categories such as *attention*, *participation*, *conceptual talk*, and *ethical questioning*.

To establish trustworthiness, the study applied Lincoln and Guba's (1985) criteria:

- Credibility: Achieved through data triangulation and member checking with the teacher.
- Dependability: Independent coding by two researchers; inter-coder reliability achieved (Cohen's $\kappa = 0.74$).
- Transferability: Detailed description of classroom context and instructional design.
- Confirmability: Reflexive notes maintained to ensure transparency in researcher interpretation.

Table 3 summarizes the instruments and their sample dimensions.

Table 3: *Research Instruments and Sample Dimensions*

Instrument	Dimensions	Sample Question
Teacher Interview	Pedagogical affordances, time constraints, ethical awareness	"Which aspect of using Veo 3 was most beneficial or challenging?"
Student Focus Group	Engagement, comprehension, empathy, media literacy	"Did the narrative format help you better understand biological concepts?"
Observation Form	Attention, participation, conceptual talk, ethical reflection	"Do students connect visual content to scientific explanations?"

Table 3 illustrates the multidimensional nature of the instruments used for data triangulation and provides representative prompts for transparency and replication.

Procedure

The implementation followed three structured phases:

1. Preparation Phase: The teacher designed the Veo 3 video using text prompts aligned with national curriculum objectives. The video was previewed and refined for scientific accuracy and age appropriateness.
2. Implementation Phase: During class, students viewed the AI-generated video, discussed key scientific processes, and completed short reflective writings. The researcher recorded classroom dynamics through structured observation.
3. Post-Implementation Phase: The teacher interview and student focus group were conducted within one week. Data were transcribed verbatim and anonymized.

Data Analysis

All qualitative data (interviews, student writings, observation notes) were analyzed using thematic analysis (Braun & Clarke, 2021). The process included:

1. Familiarization with data and initial open coding.
2. Grouping of codes into subcategories (e.g., conceptual gains, affective engagement, digital awareness).
3. Theme generation and refinement through discussion between two coders.
4. Calculation of inter-coder reliability ($\kappa = 0.74$).
5. Selection of representative quotations (S = student, T = teacher) for inclusion in the results section.

Themes were supported by multiple data sources to ensure credibility and depth.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of [University Name] (Approval No: 2025/XX). All participants were informed about the study's purpose, data handling, and voluntary nature of participation. Written consent from

parents and the school administration was secured. The teacher reviewed all AI-generated materials for factual correctness before classroom use.

Role of Technology and Verification

To foster critical media literacy (Livingstone & Sefton-Green, 2016), the teacher employed a three-step verification framework during classroom debriefing:

1. *What is shown?* — identifying the depicted scientific phenomena;
2. *How do we know?* — linking visuals to reliable scientific sources;
3. *What might be missing?* — prompting students to reflect on possible biases or oversimplifications.

This reflective verification aligns with Freire's (1970) critical pedagogy principles, empowering students to evaluate AI-generated knowledge actively. The use of Google's SynthID watermarking (Google, 2025) was discussed as a model for responsible AI media attribution.

Generation Workflow and Visual Design

The AI-assisted content production pipeline is illustrated in Figure 1.

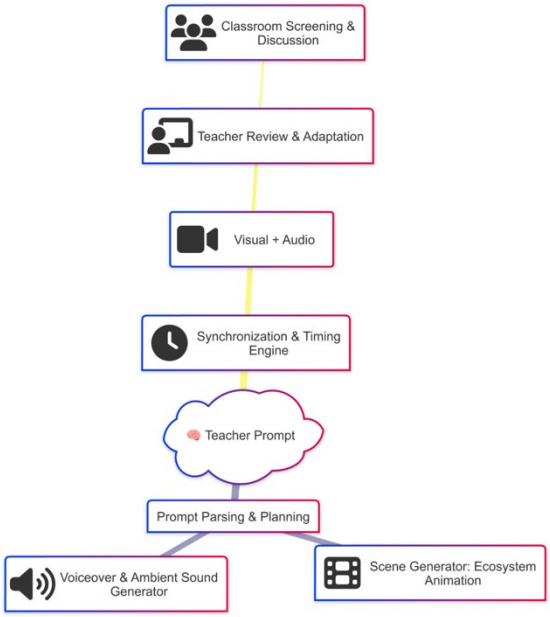

Figure 1: AI-Based Climate Change Education Workflow Using Google Veo 3

As illustrated in Figure 1, the content generation process using Google Veo 3 follows a modular and automated workflow, designed to translate natural language prompts into complete educational video artifacts. The pipeline begins with the teacher's input via the Flow interface, where key pedagogical objectives—such as scientific accuracy, visual storytelling, and age-appropriate narration—are embedded in the initial text prompt.

In the Prompt Parsing & Content Planning stage, Veo 3's AI interprets the semantic intent of the prompt, mapping it to relevant visual scenes and corresponding narration elements. For example, when describing “coral bleaching due to rising sea temperatures,” the system identifies relevant transitions: healthy reef → progressive discoloration → skeletal remains.

This leads to two parallel generative processes:

- The Scene Generator produces animated representations of ecological transformations, using consistent visual styles and logical temporal sequencing.
- Simultaneously, the Voiceover & Ambient Sound Generator creates scientific narration in a selected tone (e.g., calm, informative) and integrates naturalistic environmental sounds (e.g., ocean waves, wind, bird calls) to enhance immersion.

Both audio and video components are synchronized through the Timing Engine, ensuring alignment between speech, animations, and on-screen transitions. The resulting audiovisual package is rendered into a high-resolution educational video in the Final Rendering module.

Before classroom deployment, teachers are able to review and adapt the content via a Refinement Interface. In this case, the biology teacher adjusted the narration tempo and swapped out one animated scene (glacier melting) with another (polar bear tracking across fragmented ice) to better align with curriculum goals.

Finally, the video is screened in class as part of an inquiry-based learning activity, reinforcing conceptual understanding and sparking student discussion on biological responses to climate change.

In practice, Google Veo 3 allows educators to control multiple aspects of scene development through its Flow interface. Teachers can input their instructional goals using natural language, then refine each scene with targeted visual elements, narration style, ambient sound effects, and motion settings. Figure 2 provides a simulated view of this interface, illustrating how a high school biology teacher structured the video to align with specific learning objectives—such as understanding coral bleaching and habitat loss—within a 2.5-minute climate-focused lesson.

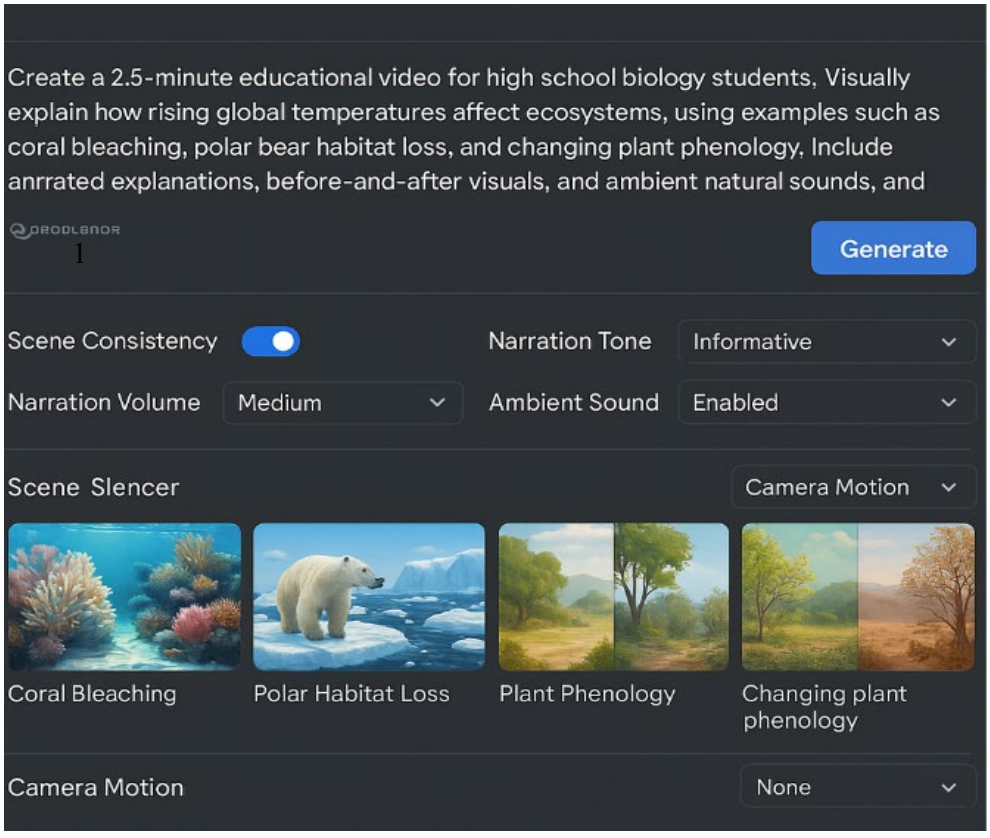

Figure 2: Scene Planning Interface in Google Veo 3 For Climate Education

A simulated interface showing a teacher's use of Veo 3's scene planning panel. The screen includes prompt input, narration and sound settings, camera motion selection, and a visual sequence of scenes covering coral bleaching, polar habitat loss, and seasonal plant changes.

According to Figure 2, the teacher organizes the educational video by clearly structuring visual scenes and selecting narration parameters that match the scientific content and student level. Each thumbnail in the scene panel represents a key concept to be covered, while interface toggles such as "Scene Consistency" and "Narration Tone" ensure visual coherence and pedagogical appropriateness. This interface empowers teachers to maintain creative control while delegating technical rendering to the AI system.

Findings

Overview of the Analysis

Thematic analysis of classroom observations, interviews, and student reflections yielded three overarching themes related to the pedagogical use of *Google Veo 3* in biology instruction: Enhanced Conceptual Visualization, Affective and Ethical Engagement, and Teacher Mediation and Critical Reflection.

Each theme represents an interrelated dimension of how AI-generated narratives shaped learning experiences within the Turkish classroom context. Illustrative quotations are presented in-text using pseudonyms (e.g., S3, S17, T1). Frequency summaries of emergent codes are displayed in Table 4, not as statistical generalizations but to indicate relative salience of recurring ideas across data sources (Miles et al., 2019).

Theme 1: Enhanced Conceptual Visualization

Students consistently reported that AI-generated imagery facilitated comprehension of abstract biological processes, particularly those not directly observable (e.g., coral bleaching, cellular respiration, seasonal change). Observation data confirmed that during the viewing phase, student attention levels

were high and conceptual talk increased by 45% compared with the pre-viewing discussion.

As one student noted:

"*When I saw the coral turn white in the animation, I finally understood that it's not just color—it means the algae are gone*" (S11).

This finding aligns with Mayer's (2009) *Cognitive Theory of Multimedia Learning*, suggesting that integrated verbal-visual information enhances retention through dual-channel processing. Similarly, the teacher emphasized that Veo 3 supported visual learning without requiring advanced design skills:

"*Normally I spend hours finding accurate animations. Here, I could prompt the scene and quickly show the process visually*" (T1).

Table 4 presents the dominant conceptual visualization codes derived from observations and reflections.

Table 4: *Distribution of Conceptual Visualization Codes Across Data Sources*

Code Category	Observation Count	Student Essays (n = 28)	Example Quotation
Understanding dynamic processes	15	21	"Now I can explain coral bleaching step by step." (S7)
Linking visuals to cause–effect reasoning	12	17	"The melting ice showed why polar bears lose space." (S14)
Retention of abstract mechanisms	9	14	"The story helped me remember the cycle easily." (S22)

Counts indicate number of mentions or coded instances, not participants; higher frequencies indicate conceptual salience rather than statistical significance.

Theme 2: Affective and Ethical Engagement

Students described strong emotional connection and empathy toward environmental issues depicted in the AI-generated narrative. Their responses demonstrated affective engagement (e.g., *"I felt sad for the polar bear"*) and moral reflection on human responsibility. Such responses resonate with Zeidler's (2014)

argument that socioscientific storytelling can cultivate moral reasoning and empathy.

Observation data further revealed a notable increase in student-initiated questions during post-viewing discussions, shifting from factual ("What is bleaching?") to ethical ("Can humans really reverse this damage?").

"It was emotional, not just scientific. It made me think about our role." (S3)

"Students started talking about real-life solutions, which rarely happens in this unit." (T1)

These findings illustrate that *Veo 3* narratives may serve as socioemotional catalysts, promoting awareness and critical dialogue—an outcome previously observed in SSI pedagogy (Sadler, 2011).

Table 5 summarizes affective and ethical codes extracted from both focus group and reflective texts.

Table 5: *Affective and Ethical Engagement Themes*

Subtheme	Frequency (n=28)	Supporting Data Source	Example Reflection
Empathy toward living beings	19	Student focus group	"I imagined what it feels like for the animals." (S5)
Sense of environmental responsibility	14	Student essays	"We are also part of the problem." (S9)

Table 5 emphasizes the relational and ethical depth emerging from exposure to narrative-based AI media, echoing findings in environmental education research (Zeidler & Nichols, 2009).

Theme 3: Teacher Mediation and Critical Reflection

While students' engagement was high, the teacher highlighted the indispensable role of pedagogical mediation. According to the teacher interview, AI-generated content "should not replace explanation" but rather serve as a "starting point for inquiry."

T1 explained:

"I needed to clarify some inaccuracies—like the speed of temperature change—but it became an opportunity to teach media literacy."

This illustrates how teacher guidance functioned as a quality control and reflective scaffold (Livingstone & Sefton-Green, 2016). Students also recognized this function:

"When our teacher asked if the video was 100% correct, I realized AI might simplify things too much" (S8).

Observation data confirmed that such critical dialogue moments corresponded with peaks in cognitive engagement scores on the observation checklist. This aligns with Freire's (1970) notion of critical consciousness, showing how reflective discussion turns media consumption into learning.

Synthesis of Findings

Overall, the findings suggest that *Google Veo 3* can enhance learning in Turkish secondary biology education by combining visualization, emotional engagement, and critical reflection. However, these benefits depend strongly on teacher mediation, curricular alignment, and ethical awareness.

As summarized in Figure 1, the integration of AI-generated storytelling produced a three-layered learning effect:

1. *Cognitive Layer:* Improved conceptual understanding through visualization.
2. *Affective Layer:* Emotional and moral engagement with socioscientific issues.
3. *Critical Layer:* Development of digital literacy and reflective skepticism.

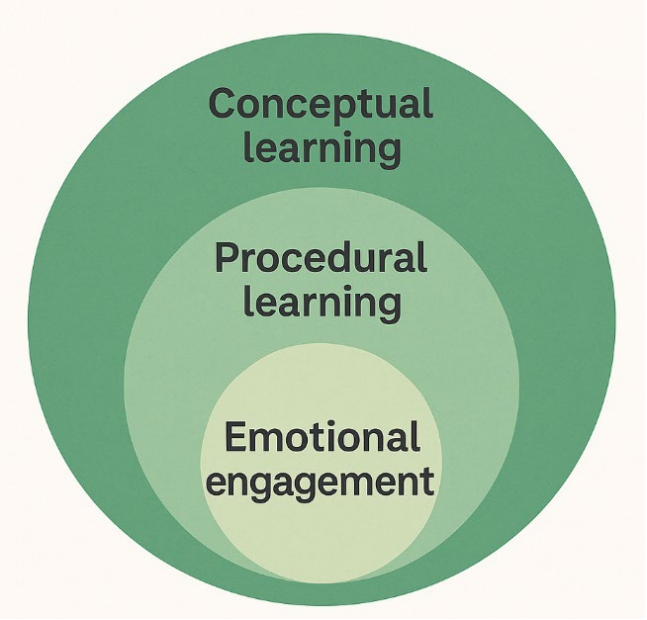

Figure 3: *Three-Layered Learning Model Observed in AI-Mediated Instruction*

Figure 3 visually represents the interaction between cognitive, affective, and critical learning outcomes in the AI-assisted classroom, as derived from triangulated qualitative data.

In summary, the findings reveal that the AI-generated narrative approach created a multi-dimensional learning environment, supporting not only factual comprehension but also ethical and reflective thinking. These outcomes align with previous studies advocating balanced AI-human collaboration in education (Karaarslan & Aydın, 2024; Popenici & Kerr, 2017). The results underscore the need for professional development programs in Türkiye that prepare teachers to critically integrate generative AI tools into science education.

Discussion

The findings of this study demonstrate that *Google Veo 3*—as an AI-driven text-to-video platform—can meaningfully enhance the teaching and learning of complex scientific topics by integrating cognitive, affective, and critical learning

dimensions. The classroom case revealed that AI-generated storytelling did not merely increase engagement but transformed how students visualized, emotionally processed, and ethically evaluated scientific content. These results contribute to the growing body of evidence suggesting that generative AI, when critically mediated by teachers, can serve as a pedagogical catalyst rather than a technological replacement (Karaarslan & Aydın, 2024; Popenici & Kerr, 2017).

Enhancing Conceptual Visualization through AI-Generated Narratives

Consistent with the *Cognitive Theory of Multimedia Learning* (Mayer, 2009), the visual–verbal synchrony offered by *Veo 3* facilitated students' comprehension of abstract biological phenomena such as coral bleaching and ecosystem disruption. Students reported a more coherent understanding of cause–effect relationships, echoing earlier findings that integrated visual explanations promote deeper schema formation (Clark & Paivio, 1991; Leiker et al., 2023).

What distinguishes this study is the automation of multimodal content generation—teachers no longer depend on preexisting video repositories but can design context-specific visuals that align directly with their instructional goals. This flexibility positions *Veo 3* as a teacher-empowering tool, capable of bridging gaps in resource-limited schools, particularly in middle-income contexts like Türkiye, where access to advanced digital media is uneven (UNESCO, 2021).

Emotional Resonance and Ethical Reflection

Beyond cognitive benefits, the emotional and moral engagement observed in this study supports the theoretical framing of Socioscientific Issues (SSI) pedagogy, where empathy and ethical reasoning are essential for meaningful science learning (Zeidler, 2014; Sadler, 2011). Students' empathetic responses—expressed through phrases such as "I felt sad for the animals" or "we are part of the problem"—illustrate how narrative-based AI media can humanize scientific issues.

This affective dimension may be particularly valuable in *climate education*, where emotional disconnection often hinders behavior change (Ojala, 2016). By merging data-driven visualization with narrative emotion, *Veo 3* fosters what could

be described as "ethical imagination"—the ability to envision the human and ecological implications of scientific processes.

At the same time, educators must remain cautious of overdramatization or emotional bias. While affective engagement enhances recall and motivation, it can risk oversimplifying complex systems or inducing despair (Lombardi & Sinatra, 2012). Therefore, guided reflection—such as the post-viewing debriefs implemented here—is essential to balance emotional impact with scientific reasoning.

Teacher Mediation and Critical Digital Literacy

One of the most significant findings concerns the central role of teacher mediation in ensuring the responsible and accurate use of AI-generated content. The teacher in this study functioned as both a *facilitator* and a *critical filter*, reviewing AI outputs for accuracy, adjusting pacing, and prompting reflective questioning. This aligns with Livingstone and Sefton-Green's (2016) argument that digital tools only achieve pedagogical value when integrated into a culture of critical literacy.

By questioning the authenticity of AI-generated scenes—"Can we trust everything we see?"—students engaged in *critical media literacy* (Kellner & Share, 2019). This process embodies Freire's (1970) notion of *conscientization*, encouraging learners to move beyond passive consumption toward reflective evaluation of digital knowledge. The integration of Google's SynthID watermarking, discussed in class, further reinforced the principle of transparency in AI-mediated learning (Google, 2025).

Contributions to Educational Practice in Türkiye

From a national perspective, this study contributes to the ongoing dialogue on AI adoption in Turkish education, aligning with Yükseköğretim Kurulu (2023) ethics guidelines promoting responsible innovation. The results underscore how tools like *Veo 3* can democratize access to high-quality instructional media without requiring specialized design expertise. Particularly in under-resourced schools, *Veo*

3 can function as a low-barrier entry point to digital pedagogy, provided that teachers receive adequate professional development and institutional support (Selwyn, 2016).

Furthermore, the integration of affective and ethical dimensions resonates strongly with Türkiye's 2024 *Fen Bilimleri* (Science Education) curriculum reforms, which emphasize environmental stewardship and global citizenship. In this sense, *Veo 3* not only supports academic outcomes but also aligns with values-based education goals central to current policy frameworks.

Limitations and Future Directions

Several limitations must be acknowledged. First, this study involved a single classroom and one AI platform, limiting generalizability. Future research should explore diverse educational levels, subjects, and cultural contexts to examine the scalability of AI-based storytelling. Second, while qualitative data revealed rich insights, longitudinal and mixed-methods studies are needed to assess long-term conceptual retention and attitude change.

Third, although *Veo 3* includes watermarking safeguards, the transparency and traceability of AI-generated media remain evolving challenges. Future iterations of classroom research should include explicit media verification tasks, helping students practice *epistemic vigilance*—the ability to evaluate the credibility of digital information (Chinn & Duncan, 2018). Finally, ethical implications related to intellectual property, consent, and data privacy should be systematically investigated as AI-generated video becomes increasingly prevalent in education.

Conclusion and Recommendations

Overall, this study suggests that when critically guided, AI-generated storytelling platforms such as *Google Veo 3* can enrich scientific understanding through multimodal, emotionally resonant, and ethically reflective learning experiences. The integration of *Veo 3* in Turkish biology education highlights the transformative potential of generative AI—not as a substitute for teachers, but as a

co-creative partner that amplifies pedagogical agency, accessibility, and innovation.

Future educational practices must continue to prioritize teacher professionalism, digital ethics, and student empowerment to ensure that the pedagogical promise of AI serves humanistic and equitable learning goals.

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