Sensors and Materials, Vol. 38, No. 1 (2026) 391–403
MYU Tokyo

S & M 4306

Scientific Knowledge Communication on IoT Platform Environments: An Empirical Study on the Text and Short Videos

Hong-Yi Ding,[1] Yi-Xin Xiong,[2] Min-Chih Hsieh,[3*] and Cheng-Fu Yang[4,5**]

[1]Institute of Science and Technology Development, University of Shanghai for Science and Technology, Shanghai 200093, China
[2]School of Management, Tianjin University of Technology, Tianjin 300384, China
[3]Department of Industrial and Systems Engineering, Chung Yuan Christian University, Taoyuan City 320, Taiwan
[4]Department of Chemical and Materials Engineering, National University of Kaohsiung, Kaohsiung 811, Taiwan
[5]Department of Aeronautical Engineering, Chaoyang University of Technology, Taichung 413, Taiwan

(Received June 5, 2025; accepted January 22, 2026)

Keywords: scientific knowledge communication, communication effectiveness, text, short videos, dual coding theory, cognitive load theory, technology acceptance model

As science communication increasingly transitions from traditional text-based formats to multimedia content, short videos have emerged as a dominant form, particularly on IoT-enabled platforms that facilitate rapid information dissemination. However, the relative effectiveness of text versus short videos in communicating scientific knowledge remains underexplored. In this empirical study, we investigated how text and short videos perform in conveying information about climate change within IoT platform environments. A mixed-method experiment was conducted with 63 participants (32 men, 31 women), who were randomly assigned to receive content in either text or video format. A comprehensive, multidimensional evaluation framework was developed, grounded in dual-channel theory, cognitive load theory, and the technology acceptance model, and implemented via structured questionnaires. Descriptive statistics were analyzed using IBM Statistical Package for the Social Sciences (version 25), employing t-tests, one-way analysis of variance, Bartlett's test of sphericity, and the Kaiser–Meyer–Olkin test. Results indicate that short videos outperform text in terms of memory retention, reduced cognitive load ($p < 0.05$), perceived readability, usefulness, and viewer satisfaction. Text-based content, however, was rated higher in perceived academic rigor and credibility. Willingness to share content showed no significant difference between the two formats ($p = 0.134 > 0.05$). These findings underscore the effectiveness of short videos as powerful tools for science communication on IoT-enabled platforms, while also highlighting the continued value of text in contexts requiring academic depth and trust.

1. Introduction

With the increasing public demand for accessible scientific knowledge, enhancing the effectiveness of science communication has become a central concern within communication

[*]Corresponding author: e-mail: mchih_hsieh@cycu.edu.tw
[**]Corresponding author: e-mail: cfyang@nuk.edu.tw
https://doi.org/10.18494/SAM5792

studies. In the context of IoT platform environments, scientific knowledge dissemination involves two core considerations: what to communicate and how to communicate it. In this study, we focus on exploring the impact of different media forms, text and short videos, on the effectiveness of science communication in the digital era. Traditionally, scientific information has been delivered through static text formats, such as those found in newspapers, journals, and electronic documents accessed via reading. However, with the rapid evolution of digital media and the proliferation of smart IoT-connected devices, communication practices have significantly shifted. Short videos have emerged as a prevalent medium, particularly within social media ecosystems embedded in IoT infrastructures. Furthermore, the advancement of fifth-generation mobile communication technology and edge computing technologies has accelerated high-speed data transmission, allowing video content to increasingly replace text as the dominant mode of scientific expression in online interactions.(1)

According to data from the China Internet Network Information Center (CNNIC), by August 2024, the number of short video users in China had reached 1.10 billion, accounting for 95.5% of the country's total internet population, demonstrating the widespread integration of short-form video in digital knowledge dissemination.(2) Within IoT-enabled platforms, text and video each exhibit distinct communicative characteristics. Text remains valued for its conciseness, ease of processing, and searchability, making it well-suited for quick reference and the transmission of straightforward concepts. However, for more abstract or complex scientific ideas, text may appear dry or challenging to interpret, especially on mobile interfaces common to IoT devices. In contrast, short videos deliver a multisensory experience through the integration of visual and auditory stimuli. Their capacity for emotional engagement and illustrative demonstration makes them especially effective in conveying dynamic processes, tangible objects, and spatial relationships, features that align well with the immersive potential of IoT platforms. Nevertheless, producing high-quality video content requires considerable resources, including technical expertise and specialized equipment. Additionally, issues such as bandwidth limitations and device compatibility can affect video accessibility and performance, particularly in less-developed network environments.

Owing to the inherent differences between text and short video formats, the effectiveness of science communication is significantly affected by the chosen mode of dissemination. In the context of IoT platform environments, which increasingly support both media types, it becomes crucial to compare their respective impacts on science communication in order to develop more precise and adaptive strategies. Such comparisons can help determine the most appropriate formats and platforms for conveying specific types of scientific content, especially in environments characterized by ubiquitous connectivity and user interaction through smart devices. Despite growing interest in science communication, most existing studies have examined text and video separately, offering limited direct comparisons between the two. Moreover, earlier research has often approached communication effectiveness from a structural or channel-centric perspective, focusing on the content format, media richness, or information delivery pathways, while overlooking the subjective experiences of users, particularly as mediated by IoT devices and interfaces.

These studies have frequently relied on simplified evaluation methods, failing to capture the full cognitive and emotional dimensions of the communication process. In addition, the role of sensing mechanisms embedded in IoT platforms, such as the continuous acquisition of user interaction data, perceptual feedback, and behavioral responses, has rarely been explicitly incorporated into the evaluation of science communication effectiveness. To address these research gaps, in this study, we introduce a multidimensional evaluation framework that integrates principles from dual coding theory, cognitive load theory, and the technology acceptance model (TAM).[3] This framework evaluates communication effectiveness based on several key dimensions, including information retention (memory), cognitive load, subjective perception, user satisfaction, and willingness to share content. By combining both objective performance metrics and subjective user feedback, the model offers a more comprehensive and nuanced understanding of how different media formats affect audiences within IoT-enabled environments. The integration of these theoretical models allows for a robust analysis of how users process and respond to scientific information delivered via text or short video.

Importantly, the proposed framework is designed to operate within IoT platforms that inherently rely on sensing concepts, where user responses are treated as sensor-derived data streams captured through smart devices, interactive interfaces, and platform-level monitoring mechanisms. Moreover, by embedding the evaluation system into IoT platforms that support real-time interaction and data collection, the system also functions as an intelligent feedback mechanism. It leverages sensing technologies to monitor user responses and optimize content delivery dynamically. As a result, the platform not only facilitates the dissemination of science knowledge but also adapts and evolves through empirical feedback. Through the sensing and aggregation of multidimensional user response data, the framework enables the dynamic assessment and optimization of science communication strategies, thereby extending the application scope of sensors from physical environment monitoring to cognitive and perceptual evaluation. In this study, we thereby construct a theoretical foundation rooted in dual coding theory, cognitive load theory, and TAM, and develop research hypotheses accordingly. We aim to compare the communication effects of text and short videos within IoT ecosystems, with a particular focus on how these media formats affect audience cognition, engagement, and subjective perception.

2. Theoretical Basis and Research Hypothesis

2.1 Dual coding theory and hypothesis

The dual coding theory, introduced by a Canadian psychologist, Allan Paivio, in the 1970s, posits that human cognition involves two functionally independent but interconnected systems for processing information: the verbal system, which handles linguistic input such as spoken or written language, and the nonverbal (imagery) system, which processes visual information such as images, diagrams, and spatial layouts.[4] This theoretical model suggests that information presented through both verbal and visual channels is more likely to be effectively encoded, retained, and retrieved by dual-channel processing. In particular, multimedia formats that integrate audio, visual, and textual elements, such as short videos, can stimulate both cognitive systems simultaneously, thereby enhancing memory retention and comprehension. This provides a theoretical explanation for the observed advantages of short videos over text-only formats in communication effectiveness. On the basis of this theoretical foundation, the following hypothesis is proposed.

H1: When conveying the same information, short videos lead to greater knowledge retention than text.

2.2 Cognitive load theory and hypotheses

Cognitive load theory (CLT), developed by a cognitive psychologist, John Sweller, explains the interaction between working memory limitations and long-term memory structures during learning and information processing.[5] The theory emphasizes that working memory has a limited capacity, and the efficiency of learning depends on how instructional design manages the cognitive load—defined as the mental effort required to process information. According to CLT, different presentation modalities affect the cognitive load to varying degrees. Effective multimedia learning environments reduce the extraneous cognitive load by aligning verbal and visual elements in a coherent and synchronized manner, thereby supporting the construction of more efficient mental schemas.[6] In contrast, text-based content often imposes higher intrinsic and extraneous cognitive demands, as it requires the learner to actively generate mental representations using prior knowledge. In comparison, short videos, through their integrated use of imagery, narration, and contextual cues, reduce processing demands by facilitating intuitive multimodal encoding. On the basis of CLT principles, the hypothesis is proposed as follows.

H2: Text-based information delivery produces a higher cognitive load than video-based delivery.

2.3 TAM and hypotheses

TAM identifies two primary factors that affect user acceptance of technology: perceived usefulness (the degree to which a system enhances task performance) and perceived ease of use (the degree of effort required to operate the system). According to TAM, these two factors jointly affect users' behavioral intention, which ultimately determines actual system adoption.[7] Furthermore, external variables such as content format, platform design, and user experience indirectly affect behavioral intention by shaping users' perceptions of usefulness and ease of use. Recent studies have provided empirical support for the communicative advantages of video-based formats. For instance, Mirkovski *et al.* demonstrated that scripted video content significantly improved objective comprehension.[8] Similarly, Wang and Wei highlighted the cognitive and affective benefits of short video use in mobile learning environments, including enhanced user engagement and preference.[9] Building on the TAM framework and these empirical findings, in this study, we evaluate the communication effectiveness of text and short video formats across four dimensions: perceived readability (ease of use), perceived usefulness, user satisfaction, and willingness to share (behavioral intention). On the basis of this framework, the hypotheses are proposed as follows.

H3: Video-based delivery methods are perceived as more readable than text-based formats.

H4: Video-based information shows a higher perceived usefulness than text-based information.
H5: Video consumption leads to a higher learning satisfaction than text-based learning.
H6: Individuals show a stronger willingness to share video content than text-based content.

3. Materials and Methods

3.1 Construction of IoT-based system

In this study, an IoT-based system was conceptualized to facilitate and evaluate the effectiveness of scientific knowledge dissemination through different media formats, namely, text and short videos. The primary purpose of this system is to illustrate how sensing concepts and IoT architectures can be employed to support a multidimensional evaluation framework for science communication, rather than to describe a fully deployed experimental platform. The proposed system envisions users interacting with science communication content via an IoT-enabled interface, such as a web-based or mobile platform, capable of delivering both textual and short-video formats under consistent informational conditions. Within this conceptual framework, user responses to scientific content are treated as sensor-derived data, encompassing cognitive, perceptual, and behavioral dimensions. From a system design perspective, the framework allows for the potential integration of multimodal sensing components, such as electroencephalogram (EEG) devices for cognitive workload assessment, eye-tracking sensors for visual attention analysis, and physiological sensors for emotional arousal monitoring, to capture rich user-response signals. These sensing modules are presented as extendable components of the IoT architecture, demonstrating how advanced sensing technologies can be incorporated in future implementations.

In this empirical study, however, we implemented the system at the platform-interaction level. As described in Sect. 3.4, participants interacted with text or short-video content through a digital interface while wearing headphones to ensure consistent audio presentation. User interaction data (e.g., content viewing duration and navigation behavior) and structured questionnaire responses constituted the primary data sources for analysis. These data streams were collected and managed through a centralized platform, reflecting the core sensing concept of IoT systems—namely, the continuous acquisition, aggregation, and analysis of user-related data. Through this conceptual system design, in this study, we highlight how IoT platforms can extend the application of sensing concepts beyond physical environments to the evaluation of cognitive and perceptual responses in science communication contexts, while maintaining consistency with the actual experimental procedure adopted in this work.

3.2 Selection of experimental materials

In this study, we designed the questionnaire to systematically assess participants' cognitive and perceptual responses to science communication content delivered in different media formats. Participants were randomly assigned to either view a short video or read a text passage, both of which conveyed comparable scientific content related to climate change. The video stimulus, titled “Global Warming Ignites 5 Climate Tipping Points,” had a duration of 114 s and was sourced from the WeChat video account Sanye Academic. It focused on the impacts of global warming and introduced five climate tipping points that have already been triggered. The text-based stimulus consisted of a 1,195-word article explaining the concept and mechanisms of climate tipping points and was accompanied by two static visual aids, including an image of a glacier and a map illustrating the global distribution of nine identified climate tipping points, to support comprehension. Following content exposure, participants completed a structured questionnaire consisting of multiple sections: memory retention, cognitive workload, subjective communication effectiveness (including clarity, readability, and perceived usefulness), perceived credibility and academic rigor, user satisfaction, and willingness to share the content. Except for the memory retention test, all questionnaire items were evaluated using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Cognitive workload items measured perceived mental effort, processing difficulty, and attentional demand during content consumption, with higher scores indicating greater cognitive load. Subjective dimensions of communication effectiveness captured participants’ perceptions of how clearly and effectively the scientific information was conveyed. The memory retention test was conducted immediately after questionnaire completion and consisted of several multiple-choice questions directly derived from the key factual content presented in both the video and text stimuli. Each correct response was assigned one point, and the total score represented the participant’s memory retention performance. Identical questions were used for both media conditions to ensure comparability. To ensure measurement quality, the questionnaire items were developed on the basis of relevant literature and theoretical constructs and were subsequently examined for validity. Construct validity was assessed using the Kaiser–Meyer–Olkin (KMO) test and Bartlett’s test of sphericity, confirming the suitability of the data for factor-based analysis. Internal consistency reliability was evaluated using Cronbach’s alpha, with all questionnaire sections demonstrating acceptable reliability.

3.3 Questionnaire design

On the basis of preceding analyses, the survey questionnaire was designed to incorporate subjective, objective, and process evaluations, thus creating a comprehensive multidimensional assessment system for communication effectiveness, as depicted in Fig. 1. The questionnaire comprised four distinct sections. The first section focused on gathering basic demographic information from the participants. In the second section, a six-item content memory test was included to evaluate participants’ recall and comprehension of the material presented in both text and video formats. The third section assessed participants’ cognitive workload during their engagement with the text and video. It consisted of five items dedicated to each format, aimed at measuring the mental effort involved in processing the respective content. The final section of the questionnaire evaluated four subjective dimensions of communication effectiveness: perceived readability, perceived usefulness, learning satisfaction, and willingness to share. A total of 16 items were included to assess these dimensions. The perceived readability dimension

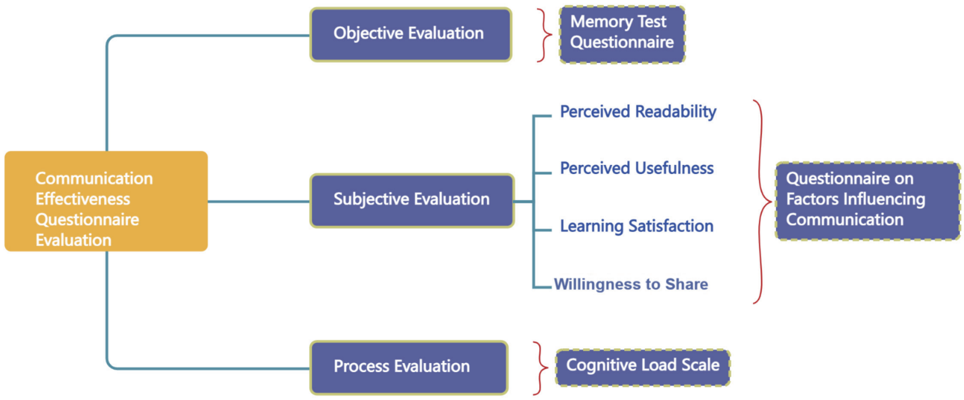

Fig. 1. (Color online) Multidimensional assessment system for communication effectiveness.

was evaluated across five criteria: interest, richness, professionalism, credibility, and ease of understanding. For perceived usefulness, the focus was on three aspects: ease of memory, attention engagement, and immersion. Learning satisfaction was assessed by measuring participants' experiences in terms of interest stimulation, content acceptance, and overall enjoyment. Lastly, willingness to share was gauged through participants' inclination to bookmark, comment on, share, or follow the content.

3.4 Procedure

The experiment was conducted in a controlled environment within a university library reading room to ensure consistency across participants. Ambient conditions, including lighting and temperature, were maintained at stable levels, and external disturbances were minimized throughout the experiment to enhance data reliability. Participants were recruited through campus-wide announcements and classroom invitations at a comprehensive university. Participation was voluntary, and all participants provided informed consent prior to the experiment. The inclusion criteria required that participants be university students with normal or corrected-to-normal vision and regular experience using smartphones and social media platforms. No participants reported prior professional training in climate science or science communication, thereby reducing potential expertise-related bias. A total of 63 participants completed the experiment. As part of the questionnaire design, the first section collected basic demographic information, including gender, age range, academic major (science/engineering vs non-science fields), and self-reported familiarity with short-video platforms. The sample consisted of 32 male and 31 female participants, with ages primarily ranging from early twenties to early thirties, reflecting a typical university student population. Descriptive statistics of these demographic variables were examined and revealed no significant differences between the text and video groups, indicating that demographic factors did not systematically affect the comparative outcomes. Given this balance, detailed demographic tables are not presented for brevity but were considered during analysis.

During the experiment, participants were organized into small groups of three to five individuals, with each group receiving the experimental materials via WeChat on their personal mobile devices. Participants were randomly assigned to either the text-based or video-based condition. To minimize auditory and visual distractions, all participants were instructed to wear headphones throughout the session. At the beginning of the experiment, the experimental procedure and relevant precautions were explained. Participants then scanned a WeChat QR code to join a designated group, through which they accessed the assigned content and completed the tasks. All experimental materials, including the stimulus content and questionnaires, were distributed through the WeChat platform. To eliminate potential order effects, the sequence of content presentation was randomized by the experimenter. Upon completing the viewing or reading task, participants immediately filled out the questionnaire on their mobile devices, including the memory retention test and subjective evaluation items. This immediate response design helped reduce recall bias and ensured the validity of participant responses. Following the completion of the formal experiment, the experimenter conducted brief informal discussions with a subset of participants to gather qualitative feedback on usability and overall experience; their comments were used solely for contextual understanding and did not enter the quantitative analysis. The entire experimental session lasted approximately 30 min per participant.

4. Data Analysis and Discussion

4.1 Memory retention effect analysis

The results of the memory tests are summarized in Table 1. Participants who read the text achieved an average score of 2.4762 ± 1.74926, while those who watched the video obtained a higher average score of 2.8571 ± 2.05456. A statistically significant difference between the two groups was found ($p < 0.05$), suggesting that the video-based learning modality led to superior memory retention. These findings provide support for H1, confirming that participants demonstrated better memory retention and content mastery when exposed to video-based information than to text-based information. The observed advantage of video-based learning in terms of memory retention aligns with prior research suggesting that multimedia presentations can enhance cognitive processing and engagement. Videos may provide more dynamic and multimodal cues, which can facilitate better encoding and retrieval of information. Future studies may further investigate the specific elements of video presentations (e.g., visual versus auditory stimuli) that contribute to this effect.

Table 1
Data analysis of memory test questionnaire.

Knowledge presentation mode	Mean	Standard deviation	Standard error of mean	t	Sig.
Text	2.4762	1.74926	0.22039	11.236	0.000
Video	2.8571	2.05456	0.25885	11.038	0.000

4.2 Cognitive load analysis

The mean values of descriptive statistics from the cognitive load questionnaire, as illustrated in Fig. 2, reveal notable differences in the average cognitive load experienced by participants when acquiring information through text versus video. Specifically, the average values across all five subjective dimensions, namely, mental demand, physical demand, time demand, effort level, and frustration level, were higher among participants who read the text than those who watched the video. However, these differences do not necessarily imply a direct correlation between the magnitude of the cognitive load and the mode of communication. To further investigate this, a one-way analysis of variance (ANOVA) was performed to compare the cognitive load scores between the text and video groups. The resulting F-value for the ANOVA was 10.518, with a p-value of 0.001, which is below the significance threshold of 0.05. This indicates a statistically significant difference in the cognitive load experienced by participants when processing textual versus video information. These findings suggest that text imposes a significantly higher cognitive load than video-based learning. Therefore, H2 is supported. The higher cognitive load associated with text-based learning is consistent with previous studies that highlight the potential difficulty of processing and integrating information presented in a purely textual format. Videos, with their multimodal nature, likely reduce the cognitive load by providing both visual and auditory cues that may facilitate information processing and reduce the mental effort required for comprehension. These findings emphasize the potential advantage of video as a learning medium, particularly for content that may otherwise demand more effort to understand when presented in text form. Further research can explore the specific aspects of video content (e.g., narration, visuals, and pacing) that most effectively mitigate cognitive load.

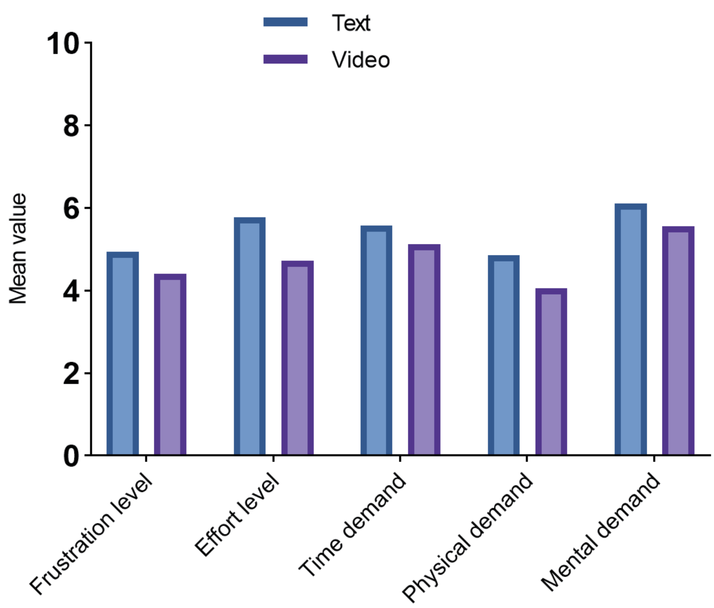

Fig. 2. (Color online) Mean values of cognitive load questionnaire under text and video communication modes.

4.3 Factors affecting communication effectiveness analysis

A validity analysis of the collected questionnaire data for the subjective dimensions was conducted using Bartlett's test of sphericity and the KMO test. For the questionnaire assessing text-based communication, the KMO value was 0.904 with a significance level of 0, indicating exceptionally high consistency and validity. In contrast, for the questionnaire evaluating video communication, the KMO value was 0.854 with a significance level of 0, suggesting high consistency and relatively strong validity, thus permitting further statistical analysis. Data collected from the questionnaire, which assessed the four subjective dimensions of communication effectiveness, were analyzed using IBM SPSS Statistics (version 25). The questionnaire comprised 16 items, and the results are presented in Fig. 3. As shown in Fig. 3, among the 16 items in the questionnaire, the average score for text-based communication exceeded that of video communication on only two items: "Strong academic rigor" and "High credibility." For the remaining 14 items, the average score was higher for video communication than for text-based communication. These findings suggest that text-based communication is perceived to convey greater academic rigor and credibility, despite both modes presenting similar content. The results indicate a clear divergence in how participants perceive text-based

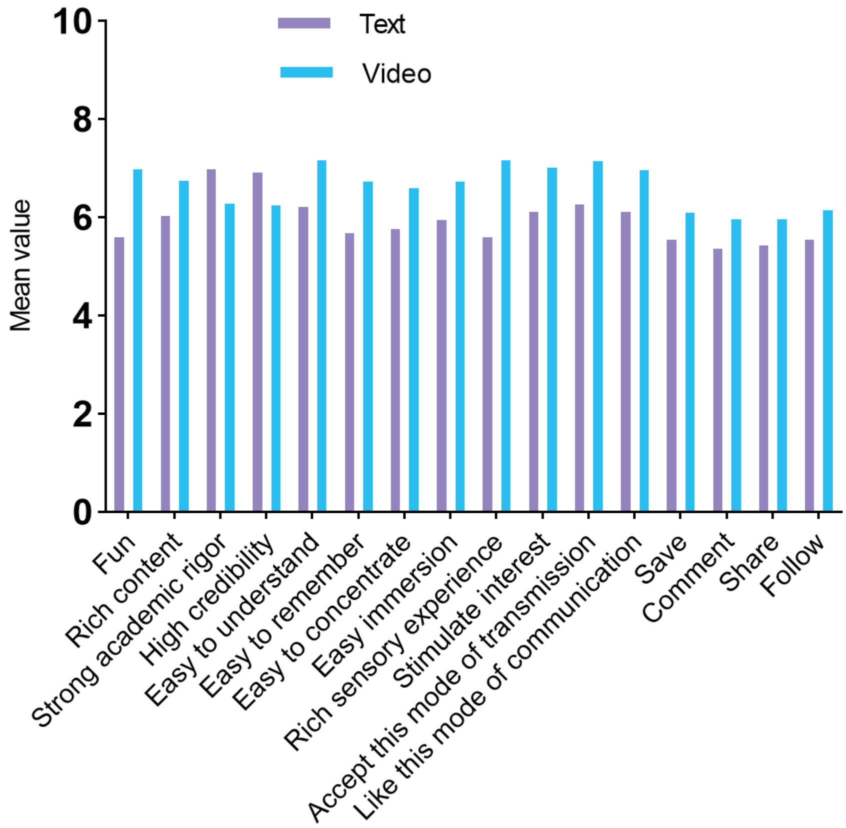

Fig. 3. (Color online) Mean values of questionnaire data group on subjective dimensions of communication effectiveness.

and video communication, particularly regarding academic rigor and credibility. It is possible that the more formal and structured nature of text-based content lends itself to perceptions of higher credibility and academic rigor. On the other hand, video communication, with its dynamic and multimodal presentation, may be perceived as more engaging, which can explain its higher ratings on most of the subjective dimensions related to communication effectiveness. This suggests that while text-based communication may be more authoritative in certain contexts, video communication may be more effective in terms of engagement and ease of understanding. Future research can further explore the interplay between perceived credibility and engagement in different media formats to better understand the underlying factors affecting communication effectiveness.

A *t*-test was conducted on the collected data using IBM SPSS Statistics (version 25), as shown in Table 2. The mean differences in perceived readability, perceived usefulness, and satisfaction between text and video were negative, indicating that participants perceived higher readability, usefulness, and satisfaction with video than with text. The significance levels for these three dimensions were 0.014, 0.009, and 0.006, respectively, all of which were below the 0.05 threshold, providing support for H3, H4, and H5. However, no significant difference was observed in participants' dissemination intentions between the text and video information (sig. = 0.134 > 0.05). As a result, H6 was rejected. The results indicate that video-based communication is perceived more favorably than text-based communication in terms of readability, usefulness, and satisfaction. This suggests that participants find video content more engaging and easier to comprehend, which is consistent with prior research on the advantages of multimedia learning. However, the lack of a significant difference in dissemination intention highlights that the willingness to share information may not be affected by the mode of communication, or it may depend on factors beyond perceived content quality, such as personal preferences or the context in which the information is shared. Future studies can explore the factors that affect dissemination intention more deeply, including social influence, content type, and audience characteristics.

4.4 Discussion

From the perspective of memory retention, participants' performance on memory tests after viewing the short video was significantly higher than that after reading the text, with the difference being statistically significant ($p < 0.05$). This advantage of short videos in enhancing memory retention can be attributed to the integration of both visual and auditory stimuli, a

Table 2
Independent samples test of four dimensions of communication effectiveness.

Influence factor	*t*	Sig. (two-tailed)	Average difference (text-video)	Standard error difference	Difference with 95% confidence influence	
					Lower limit	Upper limit
Perceptual readability	−2.497	0.014	−5.92063	2.37106	−10.61363	−1.22764
Perceived usefulness	−2.660	0.009	−0.88889	0.33419	−1.55034	−.22744
Learning satisfaction	−2.777	0.006	−1.73016	0.62300	−2.96325	−.49707
Willingness to share	−1.510	0.134	−2.26984	1.50326	−5.24521	0.70552

combination known to enhance cognitive processing by leveraging multiple sensory channels. Research has shown that such multimodal stimuli significantly enhance the breadth and depth of memory retention.(10) In the context of IoT platform environments, short videos can convey complex data and real-time information through dynamic visualizations and auditory cues, making the transmission of IoT data more vivid and engaging. This facilitates deeper impressions and better retention of technical content related to IoT systems and their applications. In terms of cognitive load, participants reported a higher cognitive load when acquiring information from the text than when obtaining the same information from the video. A one-way ANOVA revealed an F-value of 10.518 and a p-value of 0.001, which is below the 0.05 threshold for statistical significance. This result confirms findings from previous research, which suggest that presenting information through multiple sensory channels, specifically visual and auditory, expands the cognitive load on working memory.(11,12)

In IoT contexts, where real-time data streams, sensor readings, and system updates are presented, using videos as a communication tool can complement textual descriptions, thereby reducing the cognitive load associated with the processing of complex technical content. By combining verbal and visual representations, external cognitive load is mitigated, enabling learners to transition more quickly from shallow semantic understanding to deeper comprehension and internalization of the IoT concepts and systems being discussed. This process ultimately supports the development of a more robust mental model of IoT environments and enhances knowledge retention in these highly dynamic, data-driven contexts.(6) Regarding the four subjective dimensions of communication effectiveness, further t-tests revealed that the significance levels for perceived readability, perceived usefulness, and satisfaction were all below 0.05, indicating significant differences in communication effectiveness between text and short videos in these three dimensions, with short videos demonstrating superior effectiveness. This finding is consistent with the study by Mirkovski *et al.*, which suggests that video outperforms text in terms of memory retention, mastery, user satisfaction, and perceived ease of use.(8)

One potential explanation for these results is that video, being multisensory, conveys information through both visual and auditory channels, making it more intuitive and comprehensive. This multimodal delivery enhances both understanding and retention. Furthermore, the engaging visual elements and dynamic nature of videos are effective in capturing viewers' attention, fostering greater interest, and sustaining focus. However, the significance level for willingness to share was 0.134, which exceeds 0.05, indicating that the communication format does not significantly affect individuals' willingness to share. This result suggests that text may be more effective in conveying complex concepts and detailed information, making it a superior medium for disseminating intricate content, particularly when considerations of feasibility and reliability are paramount. Additionally, the precise wording and sentence structures available in written text reduce the risk of verbal errors and visual distractions. As a result, text is often perceived as more authentic and credible than videos.(9)

5. Conclusions

In this study, we explored the effectiveness of science communication on IoT platforms using climate-related content presented in both text and short video formats. Quantitative analysis via SPSS was used to test the proposed hypotheses. Results showed that participants who viewed short videos had significantly better information retention and reported lower cognitive load than those who read text content. Under TAM, four communication dimensions were assessed: perceived ease of use, perceived usefulness, user satisfaction, and communication intention. Short videos outperformed text in the first three dimensions, whereas communication intention showed no significant difference between the two formats. These findings support the hypothesis that short videos are generally more effective for science communication within IoT-enabled environments. In this study, we also introduced a multidimensional evaluation framework combining dual coding theory, cognitive load theory, and TAM. This framework integrated both objective indicators (e.g., memory tests) and subjective measures (e.g., perceived cognitive load and satisfaction), providing a comprehensive approach to assess media effectiveness in digital contexts. Findings highlight short videos as a suitable medium for science communication, especially on IoT-integrated platforms where content needs to be fast, engaging, and accessible. However, the sample's homogeneity, mostly students under 30 from the same institution, limits generalizability. Future research should expand participant diversity to strengthen result validity. Although the evaluation system proposed here marks an innovation, further refinement is necessary to fully assess different media formats and improve science communication strategies in dynamic, technology-driven environments.

References

1 N. Hassan, K. -L. A. Yau, and C. Wu: IEEE Access **7** (2019) 127276.
2 China's netizen population nears 1.1 billion: report: https://english.www.gov.cn/archive/statistics/202408/29/content_WS66d01325c6d0868f4e8ea52f.html (accessed August 2024).
3 H. Taherdoost: Procedia Manuf. **22** (2018) 960.
4 A. Paivio: Mental representations: A dual coding approach. (Oxford University Press, London, 1986).
5 W. Leahy and J. Sweller: Appl. Cognit. Psychol. **25** (2011) 943.
6 R. D. Liu, Y. Zhao, S. Z. Chai, and J. Xu: J. Beijing Norm. Univ. **5** (2007) 22.
7 F. D. Davis: MIS Q. **13** (1989) 319.
8 K. Mirkovski, J. E. Gaskin, D. M. Hull, and P. B. Lowry: Inf. Syst. J. **29** (2019) 1153.
9 C. Y. Wang and J. J. Wei: Journalism Commun. Rev. **74** (2021) 13.
10 R. E. Mayer, J. Heiser, and S. Lonn: J. Educ. Psychol. **93** (2001) 187.
11 J. Sweller, J. J. G. van Merrienboer, and F. Paas: Educ. Psychol. Rev. **10** (1998) 251.
12 W. Schnotz and C. Kürschner: Educ. Psychol. Rev. **19** (2007) 469.