



Evaluating the societal implications of combining visual communication with emerging digital platforms

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ABSTRACT

The use of visual communication on new digital platforms is changing different areas of society, making these platforms very important for offering new services that make people's daily lives better. However, as digital platforms grow, it becomes more difficult to use visual communication across various industries, and its effects on society are not fully understood yet. This study looks at how digital platforms can make visual communication more effective in important areas of society like healthcare, business, and education. It does this by using a quantitative research method to explore how using visuals through digital media can make operations more efficient and information easier to access in these areas. The study used a survey method, collecting data from many people through specially designed questionnaires to see how visual communication technologies affect things. It used a statistical technique called confirmatory factor analysis to make sure the survey questions were measuring what they were supposed to, like how efficient hospitals are, how successful business centers are, and how effective educational institutions are at using visual communication. The findings show that good visual communication design greatly helps the areas studied work better and succeed more. The study's statistical tests show strong evidence that the survey measures were reliable and accurately reflected what they were meant to. This research proves that digital platforms are changing visual communication design in a way that helps operations run more smoothly and supports the development of society. Besides showing how important visual communication is in the digital world today, the study provides solid evidence of its benefits across different areas and suggests that we should use these technologies more to improve social and economic results.

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1. Introduction

As the landscape of information and communication technologies rapidly evolves, the integration of visual communication within emerging digital platforms is transforming various sectors of society, and digital platforms are becoming vital in support of innovative services that help enhance people's everyday lives. However, the proliferation of digital platforms presents a challenge in maintaining effective visual communication across sectors, and the impact of

visual communication on society still needs to be verified.

Scholars have explored related topics and found that the rapid integration of visual direction within emerging digital platforms has become a focal point of interdisciplinary research and application.

In the healthcare sector, visual communication design is being increasingly leveraged to improve patient comprehension and engagement, with studies showing that effective visual aids can significantly impact health outcomes (Garcia-Retamero and Cokely, 2017). Glasdam et al. (2022) found that the mental and physical health of people also relies on the improvement of art facilities. For instance, technological advancements in the instruments used in hospitals and health centers have led to the production of better health professionals and the availability of better health facilities that can easily detect diseases and offer better treatment. In business, the application of visual storytelling in digital marketing has been

found to enhance brand recognition and customer retention (Lim and Childs, 2020). For instance, Google Glass can be designed as a pair of eyeglasses and can provide the capabilities of a mobile phone. As more and more advancements are made, it will be easier to make more achievements, such as glasses and earphones, which would be capable of helping improve the capability of our eyes and ears. The cameras and microphones fixed in such devices can best help open new opportunities and act as alternative eyes and ears (Kim et al., 2019). Such improvement could support our usual activities. There is a likelihood of experiencing improved and better services. In addition, educational institutions are adopting digital platforms that use visual aids to facilitate learning, where empirical evidence suggests a positive correlation between visual instruction methods and student performance (Iglesias-Pradas et al., 2021). In this particular time of COVID-19's impact, face-to-face classes have been canceled and moved online, bringing about the rise of online learning that has allowed learners to continue their education (Heng and Sol, 2021). In the teaching process of online courses, visual assistive technology plays an important role, especially in attracting students' attention and interest (Al-Zboon, 2020). This set of designs involves not only the participation of visual technology but also the collaboration and cooperation of multiple media outlets. According to the findings of Macdonald (2023), the role of computing in visual design has expanded beyond mere tools for creation to collaborative platforms that drive innovation in visual communication.

Across these domains, the discourse is shifting towards how visual direction can be optimized on digital platforms to improve understanding and engagement. The literature points to a burgeoning recognition of the need to adapt visual communication strategies to the digital milieu, ensuring clarity, accessibility, and efficiency. However, the challenge remains to evaluate and refine these strategies in the context of emerging digital platforms where user interaction patterns are continuously evolving.

Despite considerable advancements in the integration of visual direction and digital platforms across various sectors, there remains a gap in comprehensive, cross-sectoral evaluations that consider the broader societal implications of this integration. Limited studies have addressed the impact on accessibility, inclusivity, and subsequent behavioral changes within the population. There is a need for an investigation that not only assesses the efficiency of visual communication design in specific sectors but also explores the overarching consequences of societal interactions.

In this context, this study addresses the efficacy of visual communication design, which is paramount in enabling this understanding, as reflected by the preliminary evaluation scores provided in key sectors such as hospitals, business hubs, and educational institutions. The study is quantitative

and uses a questionnaire survey technique to explore the effects of visual communication technologies in healthcare, business, and education and the role they play in social development. This study aimed to evaluate the effectiveness of visual communication design in enhancing information efficiency and accessibility in hospitals, business hubs, and educational institutions through emerging digital platforms. In addition, it also analyzed the societal implications of visual direction strategies across these sectors, with particular attention to inclusivity, accessibility, and behavioral change.

The study's significance lies in its potential to illuminate the pervasive yet nuanced role of visual communication design on digital platforms, offering insights into optimizing user experience across various societal sectors. By identifying the strengths and areas for improvement, the research could inform design strategies that foster more effective, inclusive, and empowering digital interactions.

2. Literature review

The unprecedented rise of digital platforms and technological advancements has fundamentally altered societal structures. These transformations have profound implications for various sectors, including business, education, and healthcare. These sectors are more common in society and have a profound impact on its development.

This literature review aims to dissect these various domains, scrutinizing the societal implications of digital innovation and the convergence of traditional and digital platforms.

2.1. Revolutionizing business engagement and societal interaction

In the realm of business, the birth of the digital Metaverse has revolutionized the way companies interact with customers (Hollensen et al., 2022). This virtual reality platform allows companies to craft immersive worlds representative of their brand, fostering a novel form of customer engagement. This innovative marketing strategy captivates consumers, offering immersive and personalized experiences that exceed traditional advertising methods. Furthermore, the rise of digital platforms such as Amazon has revolutionized commerce, enabling consumers to access a wide array of goods and services, regardless of their geographic location. Such advancements in digital marketing strategies demonstrate the immense potential for businesses to leverage technology for growth and customer satisfaction (Dwivedi et al., 2023). The resultant data-driven marketing strategies, which these platforms employ, offer insights into consumer preferences, allowing for an optimization of the consumer journey through personalization (Abakouy et al., 2019).

Amidst this transformation, the societal implications extend beyond commerce into the broader realm of social interaction and cultural

development. Digital platforms are not merely tools for economic transactions but also mediums through which culture is expressed and shared. They have become intrinsic to the dissemination of knowledge and the shaping of social norms (Autio et al., 2018). The role of digital marketing and platform design in facilitating these shifts cannot be overstated, as they are at the forefront of creating the new digital consumer culture that informs, educates, and entertains (Poell et al., 2021).

As we continue to explore and understand the multiplicity of ways in which digital platforms impact society's business, the importance of considering these platforms' role in shaping future societal business norms becomes clear. It is through such understanding that stakeholders can craft approaches that harness digital advancements for business benefit while also safeguarding against their potential challenges.

2.2. Digital education bridges innovations and traditional teaching

Digital platforms have not only revolutionized the business sector but have also left an indelible mark on the realm of education. Technology-enabled learning tools, including mobile phones, tablets, and online platforms such as MOOCs, have reshaped the educational landscape (Haleem et al., 2022). With the integration of technology in classrooms, learning has become more engaging and effective, fostering sustainable development and social well-being. However, some traditional educators view these technological tools as potential distractions rather than effective learning aids (Ilomäki and Lakkala, 2018). Nonetheless, the benefits of digital education, such as providing immediate learning environments and faster evaluations, significantly outweigh these potential drawbacks.

However, this perspective is increasingly being overshadowed by the tangible benefits that digital education platforms offer. Among these are the provision of immediate feedback environments and faster evaluations, which significantly improve the efficiency of the learning process (Ericsson, 2008). The agility of these platforms to adapt to diverse learning styles and the customization they offer for individual learning plans stand as testaments to their value (Kallick and Zmuda, 2017). Furthermore, digital education breaks geographical barriers, enabling students in remote locations to access the same quality of education as those in urban centers (Correia, 2020). This leveling of the educational playing field is a major stride towards inclusivity.

Moreover, the potential for these platforms to facilitate a flipped classroom model, where students can engage with learning material at their own pace outside the classroom (Goksu and Duran, 2020) and then apply their knowledge during interactive sessions with peers and educators, represents a significant advancement in pedagogical methods. Digital education also aligns well with the needs of the modern workforce, which increasingly values

digital literacy and the ability to adapt to rapidly changing technologies (Udeogalanya, 2022). In this light, the adoption of digital tools in education is not merely a trend but a critical step forward in preparing students for the future.

2.3. The role of digital visualization in advancing healthcare

In the evolving landscape of healthcare, the infusion of digital visualization technologies is radically transforming patient care (Kavanagh and Sharpnack, 2021) and medical education (Cellina et al., 2023). From intricate surgical simulations to patient education, the adoption of graphical representations and interactive models has proved invaluable. Visual tools such as 3D anatomical models on digital platforms offer medical professionals enhanced clarity in diagnosing conditions and planning treatments (Meyer-Szary et al., 2022). Such advancements have also paved the way for patient-centric approaches, wherein complex medical data are translated into easy-to-understand visual formats, significantly improving patient engagement and adherence to medical advice.

On the other hand, healthcare providers leverage digital platforms to facilitate remote monitoring and consultations, a practice accelerated by the global health crisis (Al-Wathinani et al., 2023). For example, telemedicine services utilize visual direction to guide patients through self-examinations or illustrate treatment procedures, bridging the gap between accessibility and expertise (Hyman, 2020). Visual aids in telehealth not only improve understanding but also enhance the quality of remote care by enabling clear communication, which is critical when face-to-face interactions are limited (Henry et al., 2017). Furthermore, in medical training, virtual reality (VR) and augmented reality (AR) are becoming indispensable. These immersive technologies assist in the visualization of biological processes and surgical procedures, offering a dynamic and interactive learning environment for medical students and practitioners (Bin et al., 2020). The real-time feedback and hands-on experience provided by VR and AR in medical education highlight the potential for these technologies to significantly elevate the competency of healthcare professionals.

2.4. Digital synergy: Bridging business, education, and healthcare

From revolutionizing business models to transforming educational methodologies and improving healthcare delivery, the proliferation of digital technology is a common thread weaving through these domains, signaling a unified trajectory of innovation and transformation. This section of the literature review integrates findings from different sectors to underscore the interlinked implications and effects of digital platforms.

In the business sector, digital platforms such as the Metaverse and e-commerce giants such as Amazon have redefined customer engagement and commerce, fostering an environment where the exchange of goods, services, and information transcends physical boundaries. Similarly, in education, digital tools have democratized access to learning, enabling students from diverse geographies to partake in quality education and interactive learning experiences. The healthcare sector, too, has witnessed a parallel shift with digital visualization technologies improving patient care and medical training. The integration of digital platforms in business has a ripple effect that touches upon the educational and healthcare sectors. For instance, the use of data-driven marketing strategies gleaned from business analytics can be mirrored in educational technologies to personalize learning experiences, just as they tailor consumer journeys. In healthcare, the ability to analyze large volumes of data can lead to more accurate diagnoses and personalized treatment plans, drawing parallels to consumer data utilization in business.

Furthermore, the societal interaction facilitated by digital platforms in business extends to education and healthcare as well. Social media and online communities that serve as commercial touchpoints also play a crucial role in disseminating educational content and healthcare information, fostering a culture of continuous learning and health awareness.

The connection between different sectors is clear in the way digital platforms offer a complete experience for people. E-commerce websites do more than just sell items; they also provide educational courses and products related to health. Online courses (MOOCs) give learners not just academic lessons but also training in business and healthcare. Telehealth services deliver medical care that includes educational material and is supported by business elements.

As digital platforms continue to evolve, the boundaries between business, education, and healthcare are becoming increasingly blurred. The platforms that facilitate economic transactions are also the ones that enable educational advancements and health interventions. This convergence points to a future where digital platforms do not operate in silos but as part of an integrated ecosystem that supports the multifaceted development of society.

3. Methodology

This research employs a questionnaire survey to meticulously assess the influence of visual direction facilitated by burgeoning digital platforms within critical societal sectors: business, education, and healthcare. A cross-sectional study design was meticulously chosen to facilitate a holistic understanding of the interplay between these sectors. The questionnaire is meticulously structured into five distinct factors: "Hospital Efficiency," "Business Hub Success," "Educational Institution Efficacy," "Computational Functions in Visual

Representation," and "Enhancing Comprehension via Visual Communication Techniques." Each factor sets up three items to measure. Beyond capturing demographic data, the instrument employs a five-point Likert scale to gauge participant responses. For data analysis, confirmatory factor analysis (CFA) analysis was used through the data analysis platform SPSSAU (<https://www.spssau.com>) to verify the relationship between the factors and their effects.

For distribution efficiency and convenience, the survey was administered using the Wenjuanxing platform (www.wjx.cn), a decision driven by pragmatic considerations. Purposive sampling was employed, strategically targeting a demographic inclusive of educators, business professionals, and healthcare workers, thereby ensuring a representative cross-section of societal members. The geographical focus was primarily on Guangdong Province, China, engaging a diverse array of educational and healthcare institutions. The survey's outreach was amplified through online communities and messaging groups such as WeChat and QQ, which are prevalent in the region.

4. Results and findings

Out of 520 surveys disseminated, 210 were duly completed and returned, culminating in a response rate of 40.38%. This response rate, while moderate, offers a substantial data pool from which to draw insights into the current landscape of visual direction across the specified societal sectors.

In the quantitative assessment of the impact of the visual communication design, CFA was utilized to validate the measurement. This involved examining average variance extracted (AVE) and composite reliability (CR) indicators to confirm the constructs' validity and reliability. AVE measures the explained variance by a construct, while CR assesses internal consistency. As shown in [Table 1](#), the AVE results demonstrate robust construct validity across all sectors, with values such as 0.702 for hospital efficiency, 0.701 for business Hub success, and 0.681 for educational institution efficacy, all of which exceed the benchmark of 0.5. These numbers indicate that the majority of the variance in respondents' answers can be attributed to the underlying constructs they were intended to measure. Together, the CR scores—0.876 for Hospital Efficiency, 0.875 for Business Hub Success, and 0.865 for Educational Institution Efficacy—indicate a high degree of consistency among the indicators making up each construct. These scores, significantly higher than the acceptable limit of 0.7, strengthen the trustworthiness of the constructs. Additionally, the constructs dealing with visual representation's computational aspects and the improvement of understanding through visual methods show strong AVE and CR values. This emphasizes the questionnaire's effectiveness in detecting the detailed impacts of visual communication design.

Table 1: Model AVE and CR indicator results

Factor	Mean variance extraction AVE values	Combined reliability CR value
Hospital efficiency	0.702	0.876
Business hub success	0.701	0.875
Educational institution efficacy	0.681	0.865
Computational functions in visual representation	0.695	0.872
Enhancing comprehension via visual communication techniques	0.709	0.880

Table 2 shows Pearson correlation coefficients against the square roots of the AVE values within a CFA framework; the discussion naturally gravitates toward discriminant validity. This form of validity is instrumental in substantiating that each factor within a measurement model captures a distinct construct rather than merely overlapping with others.

The diagonal values in the matrix, which are the square roots of the AVE for each factor, act as a standard for checking discriminant validity. These values should be higher than the off-diagonal values, which show the correlations between different factors, to prove that constructs have a stronger connection to their own indicators than to those of

other constructs. The diagonal values found range from 0.825 to 0.842, showing that a significant amount of variance is explained by the constructs themselves compared to the error in measurement, thereby indicating strong validity for each individual construct. In clear contrast, the off-diagonal coefficients, which represent correlations between different factors, are much lower, ranging from 0.254 to 0.505. The clear difference between these values and the square root AVE values supports the discriminant validity among the factors. For instance, the correlation between 'Hospital Efficiency' and 'Business Hub Success' is 0.293, significantly lower than the square root AVE values for both factors, demonstrating their distinctiveness.

Table 2: Pearson's correlation with AVE square root values

	Hospital efficiency	Business hub success	Educational institution efficacy	Computational functions in visual representation	Enhancing comprehension via visual communication techniques
Hospital efficiency	0.838				
Business hub success	0.293	0.837			
Educational institution efficacy	0.254	0.326	0.825		
Computational functions in visual representation	0.311	0.359	0.432	0.833	
Enhancing comprehension via visual communication techniques	0.343	0.449	0.505	0.414	0.842

Note: The blue numbers on the diagonal are AVE square root values

The matrix does more than just prove discriminant validity; it also strengthens the overall structure of the theory behind the questionnaire's creation. The identified factors—'Hospital Efficiency', 'Business Hub Success', 'Educational Institution Efficacy', 'Computational Functions in Visual Representation', and 'Enhancing Comprehension via Visual Communication Techniques'—clearly capture the complex effects of visual communication in various sectors. The distinct separation of these constructs, as shown by the CFA, supports a detailed understanding of the survey results. This is especially true regarding the role of

visual communication in improving the way information is processed and accessed, which is crucial for the progress of society.

Table 3 presents a quantitative assessment of the relationships between constructs in a CFA framework, which is crucial for understanding the interconnectedness of visual communication design's impact across various domains. The nonstandardized and standardized coefficients, along with their standard errors, z values, and p values, offer a rigorous statistical evaluation of these interrelations.

Table 3: Factorial covariance

Factor	Factor	Coefficient	Std. error	z	p	Std. estimate
Hospital efficiency	Business hub success	0.205	0.050	4.127	0.000	0.348
Hospital efficiency	Educational institution efficacy	0.165	0.048	3.469	0.001	0.290
Hospital efficiency	Computational functions in visual representation	0.196	0.047	4.177	0.000	0.359
Hospital efficiency	Enhancing comprehension via visual communication techniques	0.227	0.051	4.482	0.000	0.388
Business hub success	Educational institution efficacy	0.223	0.051	4.368	0.000	0.372
Business hub success	Computational functions in visual representation	0.235	0.050	4.730	0.000	0.408
Business hub success	Enhancing comprehension via visual communication techniques	0.317	0.055	5.716	0.000	0.514
Educational institution efficacy	Computational functions in visual representation	0.274	0.051	5.404	0.000	0.494
Educational institution efficacy	Enhancing comprehension via visual communication techniques	0.343	0.056	6.091	0.000	0.577
Computational functions in visual representation	Enhancing comprehension via visual communication techniques	0.272	0.051	5.293	0.000	0.476

The positive nonstandardized coefficients across all construct pairs indicate a direct relationship, suggesting that enhancements in one domain may correspond to improvements in another. The standardized estimates provide a clear indication of the strength of these relationships, with coefficients ranging from moderate (e.g., 0.290 between 'Hospital Efficiency' and 'Educational Institution Efficacy') to strong (e.g., 0.577 between 'Educational Institution Efficacy' and 'Enhancing Comprehension via Visual Communication Techniques').

Statistical significance is consistently achieved across the construct pairs, as evidenced by p-values below the 0.001 threshold, which affirms the robustness of the observed covariances. For example, the significant relationship between 'Hospital Efficiency' and 'Business Hub Success' (standardized estimate: 0.348) indicates that efficient visual communication in healthcare settings may parallel similar successes in business environments.

These findings suggest that the strategic application of visual communication design principles has a pervasive and reinforcing effect across sectors, warranting further investigation into their potential for systemic improvement. The implications for practice are substantial, proposing that sectors may benefit mutually from advancements in visual communication design, thus highlighting its integral role in enhancing operational efficiency and effectiveness in diverse settings.

5. Discussion

The results from the CFA provide a compelling narrative about the efficacy of visual communication design in enhancing the functionality of healthcare, business, and educational sectors. The high AVE and CR scores, particularly for constructs such as 'Hospital Efficiency' and 'Business Hub Success,' indicate that visual communication design is a significant predictor of operational efficiency within these domains.

Healthcare has seen marked advancements with the integration of visual communication tools, leading to improved diagnostic accuracy and patient care, which aligns with the high reliability and validity scores obtained in the CFA. The 'Hospital Efficiency' factor, with an AVE of 0.702 and a CR of 0.876, supports the conclusion that visual design elements are critical in facilitating complex information processes within healthcare settings. This is in harmony with the findings of prior research that underscores the importance of clarity and accuracy in medical information transmission (Jacob, 2020). Unlike preceding studies, however, this research delves deeper into the quantifiable impact of visual design, offering empirical evidence that supports the conclusion that visual elements are indeed critical in navigating the intricacies of healthcare information. In the business sector, the success attributed to visual communication is

evidenced by the 'Business Hub Success' factor, which achieved nearly equivalent AVE and CR values to 'Hospital Efficiency.' This suggests that visual communication design significantly contributes to customer engagement and satisfaction, as well as to the operational success of businesses, aligning with the study's findings of improved market performance and customer decision-making processes. The educational sector also has a substantial impact on visual communication technologies. The 'Educational Institution Efficacy' factor, with an AVE of 0.681 and a CR of 0.865, underscores the role of digital media in enriching the educational experience, particularly in facilitating the understanding and retention of complex subject matter. This also aligns with current discussions on the role of technology in education (Bouilheres et al., 2020). However, this study's contribution lies in its quantitative substantiation of visual communication design's impact on learning outcomes, particularly in complex subject matter comprehension and retention.

The analysis of correlations in this study represents its most unique contribution to academic discussions. Although previous discussions across different fields have hinted at the link between operational efficiencies in various sectors, this research offers statistical proof of these connections. For example, the found correlation between 'Hospital Efficiency' and 'Business Hub Success' highlights the possibility of mutual benefits between sectors, encouraged by improvements in visual communication design. This new understanding could guide strategies that involve multiple sectors.

In summary, the present study not only corroborates the findings of existing scholarship regarding the efficacy of visual communication design but also enhances the academic conversation with its rigorous, data-driven analysis. The nuanced understanding of the interconnectedness across sectors offers a new dimension to the discourse, positioning visual communication design not merely as a functional tool but as a catalyst for multisectoral advancement. This positions the study as a critical resource for both practitioners and scholars seeking to explore the systemic implications of visual communication in the digital age.

6. Conclusion

The exploration of visual communication design's impact across various societal sectors, as illuminated by the data, underscores its pivotal role in enhancing operational efficiency and the efficacy of information processing. The findings from the quantitative assessment present compelling evidence of the constructs' validity and reliability within our conceptual framework.

The robust construct validity is demonstrated by AVE values exceeding the 0.5 benchmark, with hospital efficiency at 0.702, business hub success at 0.701, and educational institution efficacy at 0.681. These figures illustrate that a significant majority of

the variance in responses is explained by the targeted constructs. Furthermore, the high level of internal consistency is affirmed by CR values well above the threshold of 0.7, with Hospital Efficiency at 0.876, Business Hub Success at 0.875, and Educational Institution Efficacy at 0.865.

The discriminant validity established in the study further validates the distinct and substantial impact of visual communication within each examined sector. The correlation coefficients detailed in Table 2, with diagonal values (representing the square roots of the AVE for each factor) consistently exceeding the interactor correlations, attest to the uniqueness of each construct. For example, the correlation coefficient between Hospital Efficiency and Business Hub Success stands at a moderate 0.293, reinforcing that while there is some relationship, the factors are indeed capturing different dimensions of visual communication's impact.

Moreover, the data from Table 3 articulate the interrelatedness and potential synergistic benefits of visual communication strategies across different domains. The positive and statistically significant covariances, with p values well below 0.001, indicate direct and meaningful relationships between all examined constructs. For instance, the strong standardized estimate of 0.577 between 'Educational Institution Efficacy' and 'Enhancing Comprehension via Visual Communication Techniques' emphasizes the powerful effect visual communication has on educational outcomes.

The implications of these findings are profound, suggesting that visual communication design is not merely an isolated factor but a pervasive influence that interlinks various societal sectors. The strategic application of visual communication principles appears to offer systemic benefits, enhancing not only sector-specific outcomes but also indicating potential for cross-sectoral enhancements in efficiency and efficacy. For instance, the relationship between 'Hospital Efficiency' and 'Enhancing Comprehension via Visual Communication Techniques' (standardized estimate: 0.388) suggests that strategies successful in healthcare settings may be translatable and beneficial within other sectors, such as education and business, given their interconnectedness.

This study lays the groundwork for a holistic approach to visual communication design, calling for a deeper investigation into how these strategies can be tailored and integrated to foster systemic improvements. The substantial interrelationships and covariances between the constructs point towards an interdisciplinary potential that could further enhance operational efficiency and information accessibility across the fabric of society.

Hence, our findings advocate for a robust integration of visual communication design across sectors as a means to enhance not only the individual areas but also the societal structure as a whole. The data present a compelling case for continued, data-driven refinement of visual

communication strategies, ensuring they meet the evolving needs of a digitally interconnected society.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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