

An Analysis of Static Infographic Content at Balai Cerap Selangor: Assessing Visual Communication and Information Delivery

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ABSTRACT

Astronomical observatories have become important educational spaces that help the public understand astronomy through visual communication. Static infographics are commonly used to simplify complex astronomical information, yet their effectiveness has received limited attention in Malaysian observatories. This study analyses five selected static infographics at Balai Cerap Selangor by focusing on typography, layout, colour, imagery, and information delivery. The findings suggest that although the infographics successfully communicate astronomical information, improvements are needed in readability, visual hierarchy, and information organisation to enhance visitor understanding and accessibility. Overall, this research highlights the importance of effective infographic design in strengthening science communication and improving educational experiences at astronomical observatories.

Keywords: *Observatories, Visual, Astronomy, Static Infographics, Visitor Engagement.*



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1 INTRODUCTION

Astronomy plays a crucial role in advancing scientific literacy, promoting public understanding of space sciences, and supporting educational and tourism-related initiatives. However, the development of astronomy in Malaysia continues to face various challenges. According to Astro Awani (2024), experts have highlighted that the country's astronomical development is significantly lagging behind more advanced nations, particularly in terms of research capacity, public awareness, and scientific infrastructure. In response to these challenges, astronomical observatories have become increasingly important institutions for disseminating astronomical knowledge and fostering public engagement with science.

In Malaysia, observatories serve multiple functions beyond astronomical observation. They act as educational centres, public outreach facilities, and platforms for astrofiqh activities, while simultaneously contributing to the growing field of astrotourism (Safai et al., 2022). Recent studies have suggested that observatories possess considerable potential to become key attractions within Malaysia's astrotourism sector, offering unique opportunities for visitors to engage with astronomical knowledge through educational experiences (Hanafiah et al., 2025; Ibrahim et al., 2021). Among these institutions, Balai Cerap Selangor has emerged as one of the prominent observatories in Malaysia,

serving as a centre for astronomical observation, educational programmes, and public awareness initiatives (Jabatan Mufti Negeri Selangor, 2024).

As observatories increasingly function as public educational spaces, the effectiveness of information delivery becomes an essential factor in ensuring meaningful visitor experiences. One of the primary methods used to communicate scientific information within observatories is through static infographics. Infographics combine textual and visual elements to simplify complex information, allowing audiences to process and understand content more efficiently. Previous studies have demonstrated that well-designed infographics can enhance knowledge acquisition, improve information retention, and increase audience engagement (Mohd Bakri & Mansor, 2024; Li & Kuang, 2021). Furthermore, the visual composition of an infographic, including its layout, typography, imagery, and colour application, plays a significant role in influencing audience perception and comprehension (Çaka & Dursun, 2022).

Despite the widespread use of infographics in educational and informational settings, research examining the effectiveness of static infographic content within Malaysian astronomical observatories remains limited. Existing studies on observatories in Malaysia primarily focus on aspects such as astronomical development, astrofiqh practices, astrotourism potential, and institutional management (Ismail et al., 2021; Ibrahim et al., 2020). Comparatively little attention has been given to the visual communication strategies employed within observatories, particularly the effectiveness of static infographics in delivering scientific information to visitors. Moreover, previous studies have shown that different infographic formats can influence learning outcomes and user engagement, suggesting that the design and presentation of information warrant further investigation (Ismaeel & Al Mulhim, 2021).

Given the growing importance of public science communication and visitor engagement within observatory environments, evaluating the effectiveness of existing infographic content has become increasingly relevant. Therefore, this study aims to analyse the static infographics displayed at Balai Cerap Selangor by examining their visual communication characteristics and information delivery strategies. Specifically, the study evaluates aspects such as typography readability and hierarchy, layout composition and information arrangement, colour application and visual contrast, use of imagery and supporting graphics, clarity of scientific information delivery, and audience accessibility. Through this content analysis, the study seeks to identify potential strengths and limitations of existing infographic materials and provide insights that may contribute to improving science communication practices within Malaysian observatories.

1.1 Research Objectives

To assess the visual communication and information delivery of static infographics at Balai Cerap Selangor through a content analysis of typography, layout composition, colour application, imagery usage, and scientific information presentation.

1.2 Problem Statements

Despite the recognition of infographics as powerful creative and innovative instructional tools for simplifying complex scientific information, current visual communication strategies in astronomical facilities face persistent challenges that hinder effective visitor engagement (Mustafa, 2021).

First, there is a significant "intention–action gap" within Malaysia's astrotourism sector; while public interest in astronomy is exceptionally high at 92.3%, active participation in formal programs remains strikingly low at only 13.7% (Hanafiah et al., 2025). This disparity suggests that existing communication strategies are failing to effectively convert high motivational interest into actual participation and engagement (Hanafiah et al., 2025).

Second, many traditional educational materials remain text-intense rather than visual-intense, which contributes to a high "cognitive load" for the audience (Çaka & Dursun, 2022). Research indicates that

when information is presented in a monotonous or overly complex textual format, visitors often feel quickly fatigued, bored, and distracted, which ultimately has a negative effect on their ability to retain scientific knowledge (Shemy, 2022).

Third, specifically at Balai Cerap Selangor, the observatory has been recorded as being "less popular" and receiving low visitor reception, partly due to its remote location 20 km from the town centre and the need for more stimulating visual content (Mizan, 2021). Without a systematic analysis of its static infographic content specifically the effectiveness of layout, typography, and colour there is a risk that vital astronomical knowledge will fail to be transmitted effectively, thereby hindering the observatory's potential to enhance science literacy among the community (Harith, 2026).

2 LITERATURE REVIEW

The literature review provides a comprehensive understanding of static infographics as a medium for science communication in astronomical observatories. It examines key visual communication elements, including typography readability, layout organisation, colour contrast, imagery usage, visual hierarchy, and information delivery. The review aims to explore how these elements influence the effectiveness of communicating astronomical knowledge to visitors, enabling researchers and designers to evaluate existing infographic content and identify areas for improvement in observatory-based educational environments.

2.1 VISUAL COMMUNICATION IN SCIENCE EDUCATION

Infographics are visual communication tools that combine text and graphics to simplify complex information and make it easier for audiences to understand (Mustafa, 2021). The integration of visual and verbal elements supports effective learning by improving information processing and comprehension (Mayer, 2009). In observatories, visual communication helps transform complex astronomical concepts into accessible content for visitors, contributing to more effective knowledge sharing and educational experiences (Safiai et al., 2024).

2.1.1 Typography and Readability

Infographics are defined as a portmanteau of "information" and "graphics," functioning as creative and innovative instructional tools that transform complex scientific concepts into simplified visual narrations (Mustafa, 2021). In the context of multimedia learning, the integration of verbal and visual elements is essential to facilitate meaningful learning and easy information processing (Mayer, 2009). For scientific institutions like observatories, visual communication serves as a critical bridge between complex technical data and public understanding, fostering better visitor engagement through exhibition galleries and guided tours (Safiai et al., 2024).

2.1.2 Layout Organisation and Visual Hierarchy

Layout organisation is essential in infographic design because it affects how information is presented and understood by visitors. A clear and structured layout allows audiences to process information with less effort, while an appropriate balance between text and visual elements helps maintain attention and prevent information overload (Shemy, 2022; Krum, 2013). Furthermore, visual hierarchy guides visitors through the content by highlighting key information, contributing to a more effective and engaging learning experience (Chicca & Chunta, 2020).

2.1.3 Colour Contrast and Aesthetics

Colour plays a significant role in infographic design as it helps attract attention and improve the communication of information. The strategic use of colour and contrast can emphasise important

astronomical concepts, making complex information easier for visitors to understand and remember (Münchow et al., 2017; Çaka & Dursun, 2022).

2.2 Static Infographics

Static infographics present information using fixed visual elements such as text, graphics, illustrations, and charts (Aldalalah, 2021). Their structured format enables visitors to obtain information quickly, making them suitable for educational and exhibition settings (Mustafa, 2021). As a result, static infographics are commonly used in institutions such as observatories and science centres to communicate scientific concepts and provide concise explanations of complex topics (Abdel & Heba, 2019).

2.3 Cognitive Load and Information Delivery

Cognitive Load Theory posits that human working memory has a limited capacity to process information (Paas & van Merriënboer, 1993). Within educational environments like Balai Cerap Selangor, the efficacy of information delivery is determined by its success in minimizing this mental effort (Harith, 2026). In this context, visual-intensive infographics significantly lower cognitive load compared to text-only materials, which visitors often find exhausting, monotonous, and overly lengthy (Çaka & Dursun, 2022). Consequently, integrating verbal and visual elements accelerates information processing, thereby enhancing visitors' ability to comprehend and recall scientific knowledge effectively (Siricharoen, 2013).

2.4 Context: Astronomical Observatories in Malaysia

Although public interest in astronomy in Malaysia is exceptionally high (92.3%), actual program participation remains low (13.7%), triggering an "intention-action gap" (Hanafiah et al., 2025). This issue is particularly evident at Balai Cerap Selangor, which is documented as less popular and located in a remote area (Mizan, 2021). Consequently, effective visual communication is essential to bridge this gap and boost visitor engagement (Hanafiah et al., 2025; Mizan, 2021).

3 RESEARCH METHODOLOGY

This study employs a qualitative Visual Content Analysis research design executed through a systematic four-tier process, beginning with the selection of three (3) static infographics at Balai Cerap Selangor. This targeted sampling ensures that the chosen visuals function as precise representations optimized for enhancing scientific education and public communication (Traboco et al., 2022). These samples are subsequently evaluated through a specialized framework focusing on visual communication and information delivery elements, specifically analysing typography to determine how structural text arrangements guide the viewer's reading pathway (Kuba & Jeong, 2023), and layout architecture, which is critical for managing cognitive load and ensuring visitor comprehension (Majooni et al., 2018). The framework further assesses the visual dimensions of colour, imagery relevance, and information clarity before undergoing a formal content analysis execution to produce objective, synthesized results.

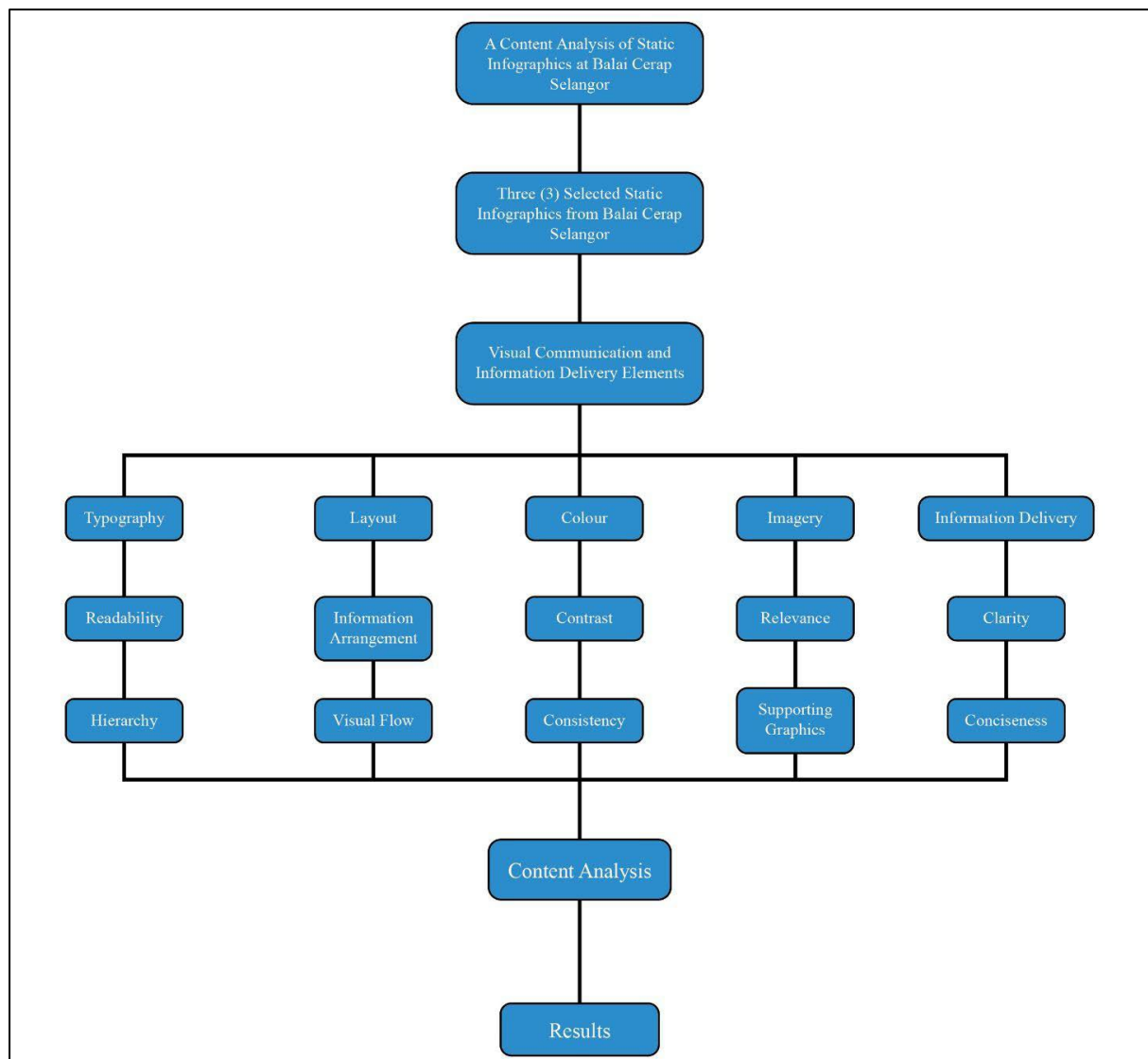


Figure 1 Framework of Study

4 SAMPLES

Table 1 Selection Sample of Static Infographics at Balai Cerap Selangor

Sample	Infographic Image	Title	Location
1		Earth & Quranic Verses	Exhibition Hall
		Institutional Identity & Cerapan Hilal	Exhibition Hall
		Falak Instruments & Hilal Observation Sites	Exhibition Hall

5 DATA ANALYSIS

Table 2 Data Analysis of Static Infographics at Balai Cerap Selangor

Analysis	Sample 1 - Earth & Quranic Verses
Typography	<p>Readability</p> <p>The panel presents a mix of large Arabic Quranic text and small English body copy. While the Quranic text is displayed at a prominent, legible scale, the scientific body text is rendered too small for comfortable reading from a typical visitor standing distance. The contrast of white and yellow text on a dark background supports basic legibility, but font size remains a key barrier to effective reading engagement.</p>
	<p>Hierarchy</p> <p>Visual hierarchy is anchored by the large-scale Quranic Arabic text and the dominant Earth image, which together establish the primary visual focus. Scientific headings and body text appear at a secondary level without sufficient size differentiation between heading and subheading levels. This causes visitors to perceive the spiritual content as more prominent than the scientific information.</p>
Layout	<p>Information Arrangement</p> <p>Information is arranged across a wide full-wall mural with the Earth image placed centrally and text panels distributed to the left and right. The arrangement creates an aesthetically immersive environment but lacks a logical sequential structure that would guide visitors through the content in a meaningful order. The placement of Quranic verses and scientific text at similar hierarchical positions without clear zoning makes it difficult to distinguish between the two types of content.</p>
	<p>Visual Flow</p> <p>The large Earth image at the centre of the mural draws the eye immediately upon entry, establishing a natural focal starting point. However, from the central image, visual flow does not guide the visitor clearly toward either the Quranic text or the scientific body text in a directed sequence. Eye movement is likely to be exploratory rather than guided, which may result in uneven engagement with the panel's content.</p>

Colour	Contrast	The dark cosmic background provides strong contrast for white and yellow text in most areas of the panel, supporting basic readability. However, in zones where photographic imagery particularly the bright Earth image and lighter sky areas bleed into adjacent text regions, contrast is significantly reduced. This uneven contrast across the panel creates inconsistent legibility depending on where visitors direct their attention.
	Consistency	The dark space-themed colour palette is applied consistently throughout the mural, using a cohesive combination of near-black backgrounds, blue-green planetary imagery, and white or yellow text. This colour consistency creates a unified aesthetic identity for the panel. However, colour is not used consistently as a semantic or information-coding tool; it functions primarily for aesthetic atmosphere rather than as a systematic design language for communicating content structure.
Imagery	Relevance	The large photorealistic Earth image is directly relevant to the panel's astronomical and Quranic theme, serving as a powerful visual anchor for the content. The planetary surface imagery displayed on the adjacent vertical panels (Mars, Moon) extends the celestial theme and reinforces the broader context of the Islamic-astronomy relationship. All visual elements are thematically coherent with the observatory's scientific and religious mandate.
	Supporting Graphics	No dedicated scientific diagrams, labelled illustrations, or explanatory icons are incorporated into the panel. The display relies entirely on large-scale photographic imagery and text blocks. The absence of supporting graphics such as labelled Earth cross-section diagrams, lunar orbit illustrations, or astronomical measurement charts limits the panel's capacity to convey complex scientific concepts clearly and reduces its overall educational effectiveness.
Information Delivery	Clarity	The panel communicates its Islamic-astronomical theme clearly at a broad conceptual level through the combination of the Earth image and Quranic text. However, the clarity of specific scientific information is limited by the small size of the English body text, the absence of labelled diagrams, and the lack of a defined reading sequence. Visitors are likely to receive a general thematic impression rather than clear, retained scientific knowledge from this panel.
	Conciseness	The body text blocks contain extended descriptive passages that are not well-suited to the brief and dynamic engagement typical of exhibition visitors. The volume of text relative to the supporting visual elements means that visitors are unlikely to read the content in full. The panel would benefit from a reduction in body text length combined with the introduction of concise visual summaries, key facts, or infographic callout elements to convey core information more efficiently.

Table 3 Data Analysis of Static Infographics at Balai Cerap Selangor

Analysis		Sample 1 - Institutional Identity & Cerapan Hilal
Typography	Readability	Jawi calligraphic text on the blue wall is rendered at a large decorative scale suitable for identification but not for extended reading. The notice board below uses a very small font that requires visitors to approach closely. On the adjacent Cerapan Hilal panel, body text size is insufficient for reading from a standing distance despite adequate colour contrast with the dark background.
	Hierarchy	The institutional logos occupy the highest position in the visual hierarchy, followed by the Jawi text, the district map, and the notice board. This hierarchy is functionally appropriate for an entrance identification panel. However, it does not direct visitors toward any scientific or educational content, as no such content is assigned a prominent hierarchical position in this display.
Layout	Information Arrangement	The display is split into two distinct zones the blue institutional wall on the left and the dark Cerapan Hilal mural on the right without a clear visual or structural connection between them. Within the blue wall, institutional elements (logos, Jawi text, map, notice board) are stacked vertically without a defined reading path. The two-zone arrangement reflects two separate functions (institutional identity and astronomical content) but does not integrate them into a cohesive informational flow.
	Visual Flow	Visual flow on the blue wall moves naturally downward from the logos to the Jawi text, the district map, and the notice board, following a conventional top-to-bottom pattern. However, the transition between the blue wall and the Cerapan Hilal panel is not designed to guide visitor flow from one zone to the other. A visitor engaging with the institutional wall may not naturally move to engage with the astronomical content on the adjacent panel
Colour	Contrast	The bright blue wall delivers strong contrast for the white and gold Jawi lettering and institutional logos, ensuring they are clearly visible. On the adjacent dark mural, yellow and white text generally maintains adequate contrast against the dark background. However, the abrupt visual transition between the vivid blue and the near-black mural creates an uncomfortable contrast shift that may be visually jarring for visitors moving between the two zones.
	Consistency	Colour consistency is limited within this combined display. The blue wall uses a bright institutional blue palette that is entirely distinct from the dark atmospheric colour scheme of the adjacent Cerapan Hilal mural. The notice board introduces an amber and dark colour combination that does not align with either adjacent zone. The absence of a shared colour language across the three zones reduces the display's overall visual coherence as a unified communication system.
Imagery	Relevance	The Selangor district map is directly relevant to the observatory's geographic and administrative context, providing visitors with a spatial reference for the <i>balai cerap's</i> jurisdictional coverage. The institutional logos are appropriate identity markers for the entrance display. The Cerapan Hilal mural imagery is thematically relevant but not well integrated with the institutional content of the blue wall, creating a thematic discontinuity within the combined display.
	Supporting Graphics	The Selangor district map is the only element that functions as a supporting graphic in the conventional informational sense. No scientific illustrations, <i>falak</i> diagrams, crescent visibility charts, or educational icons are present. The panel functions as an institutional identification and welcome display rather than an educational infographic, and the absence of supporting scientific graphics reflects this limited informational scope.
Information Delivery	Clarity	Institutional information, the identity and jurisdiction of Balai Cerap Selangor, is communicated clearly through the logos, Jawi text, and district map. However, scientific or astronomical information is not clearly delivered in this panel. The Cerapan Hilal section introduces relevant content through Quranic text and explanatory paragraphs, but text density, small font

		size, and the absence of visual summaries limit the clarity of this scientific communication for general visitors.
	Conciseness	The blue wall section is concise by nature, presenting institutional identity through symbols, a map, and brief labels rather than extended text. However, the Cerapan Hilal section contains lengthy Arabic and Malay text passages that are not concise for a public exhibition context. The combination of a minimal institutional display alongside a text-dense astronomical panel creates an uneven informational experience within a single combined display.

Table 4 Data Analysis of Static Infographics at Balai Cerap Selangor

Analysis	Sample 1 - Falak Instruments & Hilal Observation Sites	
Typography	Readability	Yellow bold section headings are rendered at a legible scale for visitor navigation. However, body text paragraphs throughout the panel are set at a very small font size, making detailed descriptions of the <i>peralatan falak</i> and observation sites difficult to read without proximity. The multi-column grid layout further compresses the text, exacerbating readability issues.
	Hierarchy	Yellow section headings establish a clear and consistent typographic hierarchy that distinguishes content areas from body text, allowing visitors to scan and identify topics. However, within each section the hierarchy does not descend clearly; body text, captions, and supplementary notes appear at similar visual weights, making it difficult for visitors to identify key information from supporting detail.
Layout	Information Arrangement	The panel uses a multi-column grid to organise content about multiple <i>balai cerap</i> facilities and <i>hilal</i> observation sites. Each column contains a photograph at the top and a text block below, providing a consistent internal arrangement. However, the grid contains a high density of columns and sections across a wide wall panel, which makes it difficult for visitors to determine where to begin or how to move through the information systematically.
	Visual Flow	Yellow section headings provide visual anchors that support a left-to-right scanning flow across the panel. However, within each column section, visual flow is not clearly directed, as body text, images, and supplementary text compete for attention without a defined reading path. The high information density across the full wall reduces the likelihood of visitors engaging with all content sections in a complete and ordered manner.
Colour	Contrast	The consistent dark background across the panel provides good contrast for both the yellow section headings and the white body text. This colour approach ensures that text elements remain legible throughout the panel, even at small font sizes. Contrast is the strongest visual communication asset of this panel and contributes positively to the overall readability of section titles across the multi-column grid.
	Consistency	Yellow is applied consistently to all section headings across the panel, establishing a reliable and recognisable colour-coding convention that supports visitor navigation. The dark background is uniform throughout, reinforcing the space-themed aesthetic identity. This consistent application of colour yellow for headings, white for body text, dark for backgrounds is the most systematic colour approach observed across the three samples.
Imagery	Relevance	Photographs of the various <i>balai cerap</i> facilities and <i>hilal</i> observation sites are directly relevant to the panel's informational purpose, allowing visitors to visually identify and associate the institutions and locations described in the accompanying text. The use of both architectural photographs and astronomical background imagery reinforces the connection between the physical observatory spaces and their scientific and religious function.
	Supporting Graphics	Minimal supporting graphics are present beyond the photographic imagery. Small circular graphic elements that likely represent celestial bodies appear in some sections but are rendered at insufficient scale and detail to function effectively as informational diagrams. The panel would benefit substantially from the inclusion of labelled <i>peralatan falak</i> diagrams, annotated site maps

		for <i>hilal</i> observation locations, and crescent visibility illustrations to strengthen the scientific communication function.
Information Delivery	Clarity	The panel communicates information about the history and geographic distribution of <i>balai cerap</i> facilities and <i>hilal</i> observation sites with moderate clarity. Yellow section headings effectively identify content areas, and the photographic imagery supports recognition of the locations described. However, the scientific and procedural details of <i>hilal</i> observation and <i>peralatan falak</i> usage are embedded in dense small-font paragraphs, reducing the clarity of the most substantive scientific content.
	Conciseness	The panel contains a high volume of text distributed across multiple columns, with detailed descriptive paragraphs accompanying each observatory and observation site. The density of text is excessive for a public exhibition context where visitor dwell time is typically short. Condensing the body text into key bullet points, dates, and facts alongside stronger visual elements would significantly improve the conciseness and communicative efficiency of this infographic.

6 RESULTS & DISCUSSION

This section presents the findings of the visual content analysis conducted on the three selected static infographic displays at Balai Cerap Selangor. The evaluation is structured around the five core dimensions of visual communication design: (1) Typography & Readability, (2) Layout Composition & Visual Hierarchy, (3) Colour Application & Visual Contrast, (4) Use of Imagery & Supporting Graphics, and (5) Scientific Information Delivery.

6.1 Overall Assessment of Visual Communication Elements

To provide a structured overview of the findings, a comparative evaluation matrix was established. The performance of each sample across the design dimensions was rated based on the content analysis criteria, as summarised in Table 5.

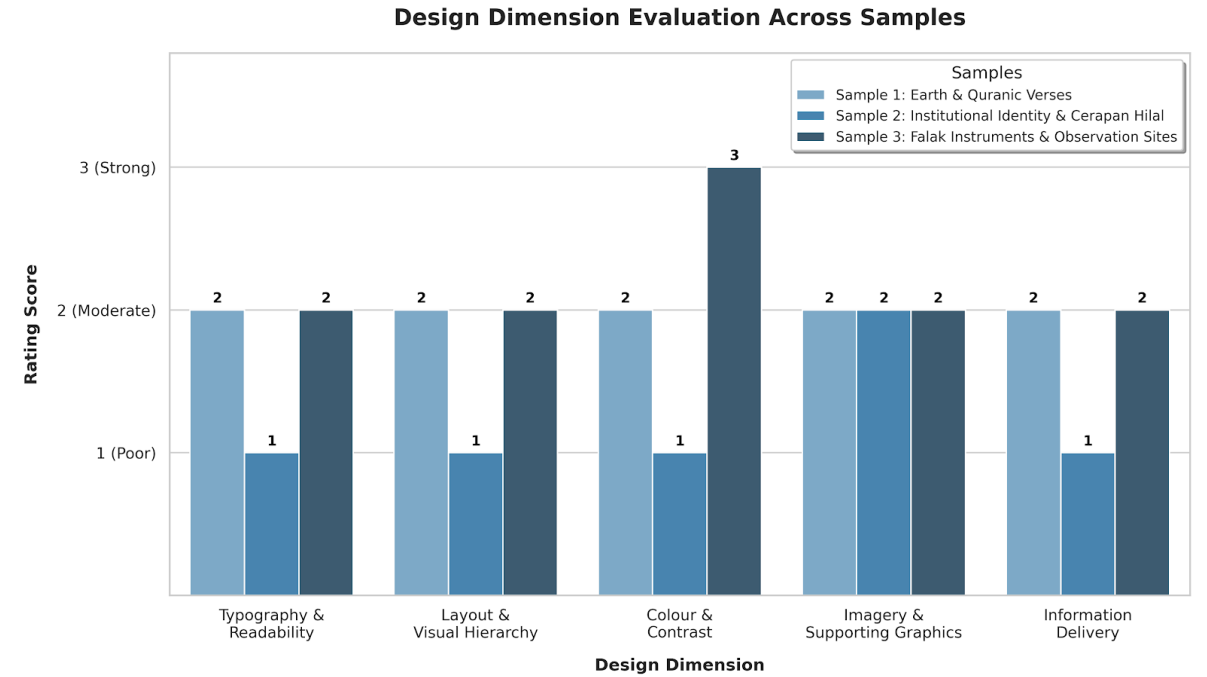


Figure 2 Visual Communication Design Evaluation Matrix for Balai Cerap Selangor Infographics

6.2 Typographic Barriers and Readability Issues

The content analysis reveals a persistent structural issue across all three samples regarding text scale and spatial accessibility for museum visitors. While the primary headers, such as the bold yellow titles in Sample 3 and the prominent Arabic calligraphy in Sample 1, successfully establish a macro-hierarchy that catches the eye, the accompanying body text consistently fails to sustain effective science communication. In all analysed samples, the font size used for detailed descriptions is structurally minor, which creates an immediate "standing distance gap". This layout deficiency forces visitors to stand less than 0.5 metres away from the mural walls to process the scientific facts comfortably, causing a breakdown in casual reading engagement. Furthermore, a multilingual hierarchy distortion is observed in Sample 1, where the dramatic scale difference between the spiritual Arabic text and the English or Malay scientific text accidentally skews the visitor's focus. This structural imbalance positions the scientific data as secondary, undermining the observatory's core educational mandate.

6.3 Layout Density and Cognitive Load

The physical arrangement and composition of information within the gallery space contribute significantly to the audience's cognitive load, validating the foundational concerns raised by Çaka and Dursun (2022). Sample 2 suffers from severe spatial and thematic discontinuity, as the display is fractured into two isolated zones: a vivid blue institutional wall on the left and a pitch-black Cerapan Hilal mural on the right. The abrupt graphic transition between these two zones creates an uncomfortable visual fracture, which fails to guide the visitor's eyes through a logical or continuous reading path. Similarly, while Sample 3 utilizes a strict multi-column grid that successfully categorizes various geographical sites, the high structural density of the columns creates an overwhelming "wall of words" effect. This text-heavy composition demands excessive mental effort from a casual viewer, triggering rapid visual fatigue and distraction as outlined by Shemy (2022). Consequently, this high cognitive load explains the systemic "intention–action gap" highlighted in recent Malaysian astro-tourism data (Hanafiah et al., 2025), where high initial public interest is bottlenecked by non-stimulating visual layouts.

6.4 Colour Application and Contrast Consistency

In terms of aesthetics and environmental integration, colour choice represents one of the strongest design assets at Balai Cerap Selangor, although its execution remains visually inconsistent. The uniform application of a space-themed dark palette in Samples 1 and 3 provides a solid background that accentuates white and yellow text blocks, rendering headlines highly scannable from a distance. In fact, Sample 3 establishes the most systematic colour-coding convention, using yellow consistently to mark navigation headers and white for instructional body copy. However, this high contrast is severely compromised in Sample 1 due to a graphic design flaw known as the "bleeding effect". In specific zones of the mural, the bright, photorealistic edge of the Earth graphic bleeds directly into adjacent white text blocks without a solid background layer or text shadow insulation. This lack of visual separation causes an uneven contrast shift, rendering the underlying scientific data almost invisible depending on the gallery's ambient lighting conditions.

6.5 THE "VISUAL-INTENSE" VS "TEXT-INTENSE" IMBALANCE

A critical finding derived from this visual content analysis is the total absence of dedicated instructional vector graphics, minimalist infographic callouts, or mathematical and astronomical diagrams across all museum panels. The exhibition displays rely entirely on static photography, such as building facades, landscape images, and celestial photographs, which fail to function as active learning mechanisms. While a high-resolution photograph can show a visitor what an instrument or location looks like, it possesses no pedagogical framework to explain how a specific scientific process works. For example, Sample 3 features historical *peralatan falak* (Islamic astronomy instruments), yet the display lacks any annotated line drawings, cross-sectional maps, or orbital flowcharts that explain

how these classical devices calculate celestial coordinates. By substituting educational diagrams with lengthy, text-heavy narrative paragraphs, the current static infographics operate efficiently as decorative background wallpaper but remain functionally weak as public science communication tools.

6.6 Summary of Empirical Findings

In summary, the existing static infographics at Balai Cerap Selangor succeed as visually appealing murals but face critical limitations as functional science communication tools. Empirical evidence reveals a profound "intention–action gap"; although public interest in astronomy is exceptionally high at 92.3%, this motivation is significantly bottlenecked by "text-intense" layouts that impose an excessive cognitive load on visitors, thereby hindering effective information retention (Hanafiah et al., 2025; Majooni et al., 2018).

Furthermore, the absence of a logical visual hierarchy and structured flow prevents this high level of enthusiasm from translating into meaningful astrotourism engagement (Hanafiah et al., 2025; Kuba & Jeong, 2023). To effectively foster public science literacy, these displays must transition from dense, narrative textual blocks to clear, concise, and visual-intense designs that optimize information processing (Calice et al., 2023; Traboco et al., 2022). Without these strategic visual enhancements, the current educational materials will continue to relegate visitors to the role of passive observers rather than active learners (Çaka & Dursun, 2022).

CONCLUSIONS

This study conducted a visual content analysis on the static infographics displayed at Balai Cerap Selangor to evaluate their effectiveness in public science communication and visitor engagement. The empirical findings indicate that while the existing panels succeed in establishing an aesthetically immersive, space-themed atmosphere through strong dark-palette colour contrasts and photorealistic imagery, they face critical limitations in structural information delivery.

The visual communication strategy is currently hindered by a "text-intense" presentation, characterized by minor body copy font sizes, low scannability, and an absence of explanatory vector diagrams or navigational visual flows. This heavy reliance on long narrative blocks significantly increases the visitors' cognitive load, causing rapid visual fatigue and reducing long-term knowledge retention. Furthermore, this design approach explains the systemic "intention–action gap" observed in Malaysia's astro-tourism sector; despite high initial public interest in astronomy, the dense and non-interactive nature of the static communication materials bottlenecks active, prolonged visitor engagement.

To fully unlock the potential of Balai Cerap Selangor as a community science literacy hub, its visual assets must shift from purely decorative background murals to dynamic, visitor-centric instructional tools.

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All authors contributed equally to the development and completion of this paper.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

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