

ILLUSTRATION ASSET DESIGN FOR THE INTERACTIVE MULTIMEDIA APPLICATION “ECO QUEST” AS AN EDUCATIONAL MEDIA FOR WASTE SORTING

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Abstract

Waste sorting remains an environmental issue that requires educational media that is more engaging and easier to understand, especially for children. Interactive multimedia can serve as a fun learning medium by combining visual elements with a more communicative learning experience. In the development of interactive multimedia, illustrations play an important role as visual assets that help clarify information and assist users in understanding the material in a more engaging way. This article aims to describe the process of designing illustrative visual assets for the interactive multimedia application Eco Quest as an educational medium for waste sorting, as well as to analyze the role of illustrations in supporting the delivery of educational content. The study employed a qualitative approach using observation, literature review, and documentation methods. The illustration design process was carried out through several stages, including brief reception, concept brainstorming, sketching, outlining, coloring, finishing, and digital asset formatting. The results show that illustrations contribute to building the application's visual identity, facilitating user navigation, clarifying the recognition of waste categories, and supporting the visual communication of waste categories. Therefore, the implementation of illustrative assets in the Eco Quest interactive multimedia application demonstrates how illustrations can support the communication of waste sorting concepts in a communicative and engaging manner.

Keywords – Illustration, visual assets, interactive multimedia, waste sorting

Introduction

Waste management issues remain an environmental concern that requires serious attention. The increasing amount of waste, which is not accompanied by an effective management system, has led to various environmental problems (Chen et al., 2020). One of the main challenges in waste management is the low level of public awareness regarding waste sorting based on its type, such as organic waste, inorganic waste, hazardous waste, paper waste, and residual waste (Hutabarat & Mulyani, 2022). People with limited knowledge tend to demonstrate poor waste sorting practices, resulting in different types of waste being disposed of together without considering

their categories or types. This situation affects the effectiveness of waste processing and recycling activities, thereby increasing the risk of environmental pollution (Cristina et al., 2023).



Figure 1 – Mixed Waste Condition

Source: Authors 2026

According to Sari and Mahadewi (2025), the low level of public awareness regarding waste sorting is influenced by the ineffective delivery of educational content that are both engaging and easily understood by the society.

Education about waste types and categories is frequently delivered through conventional media that fail to attract learners' attention, thereby reducing their interest in understanding the material, particularly among children and teenager (Nurrita, 2018). However, Sahabuddin and Dirawan (2022) highlighted that environmental education introduced at an early age plays a significant role in shaping environmentally responsible attitudes and behaviors in the future.

The rapid advancement of technology has transformed the ways in which information is delivered and learning experiences are designed (Wijayati et al., 2019). Modern educational media extend beyond traditional text based approaches by incorporating visual, auditory, animation, and interactive components into integrated digital environments (Çeken & Taşkın, 2022). One of the educational media that has gained significant development in recent years is interactive multimedia.

Abdulrahman et al. (2020) defined multimedia as a combination of various digital media formats that enable users to interact directly with learning content during the educational process. Compared with conventional instructional media, interactive multimedia provides a more engaging and effective means of communication, enabling information to be delivered in a clearer and more appealing manner (Hadi et al., 2022).

Moreover, Waruwu (2022) explained that interactive multimedia enhances user engagement and facilitates knowledge acquisition by presenting information through visual and participatory learning experiences. Thus, the use of interactive multimedia contributes to improving users'

learning motivation and attitude (Novrizal et al., 2022).

In the development of interactive multimedia, visual elements play an important role in supporting the effectiveness of information delivery, with illustrations being one of the most influential visual components (Garreton et al., 2024). Beyond their decorative function, illustrations serve as powerful visual communication tools that support the presentation of information, improve clarity, and facilitate users' comprehension of learning materials (Wang, 2022).

Beyond facilitating information comprehension, illustrations play a significant role in establishing and strengthening visual identity within digital media environments (Laba, 2024). The consistent application of illustrations contributes to the creation of visually appealing and distinctive interfaces that are more easily recognized by users (Prasetyo et al., 2020). Furthermore, Setiawan et al. (2025) emphasized that illustrations in interactive multimedia function not only as visual representations of information but also as elements that support interaction flow and enhance user engagement through communicative, intuitive, and easily interpretable visual designs.

In addition to supporting information delivery, illustrations significantly influence user engagement and learning experiences (Nugrahani et al., 2021). According to Eng et al. (2020) illustrations designed according to the characteristics of the target audience can enhance attention, comprehension, and retention of educational content. In the context of waste sorting education, illustrations help users identify waste categories through simple visual representations (Cao et al., 2023). The strategic use of colors, characters, and visual symbols can enhance users' ability to differentiate waste categories accurately and efficiently (Schloss et al., 2018).

Several interactive multimedia applications have been developed to introduce waste sorting through game based learning. For example, Garbage Gobblers presents waste sorting activities within a space themed environment, offering an entertaining gameplay experience through imaginative visual settings. Meanwhile, Recycle Game focuses on waste classification through interactive gameplay; however, the application primarily emphasizes playing activities without providing a dedicated learning section that introduces waste categories before users begin the game. These examples demonstrate that existing applications have successfully incorporated game mechanics into environmental education but place relatively less emphasis on the systematic design of illustrative visual assets as visual communication elements that support learning content, navigation, and interface consistency. In contrast, Eco Quest integrates both learning and gameplay sections while adopting illustrations specifically designed around environmental themes.



Figure 2 – Several Recycle Game
Source : Authors 2026

Several previous studies have demonstrated that interactive multimedia is an effective educational medium, as it can enhance user engagement throughout the learning process (Wibawanto & Nugrahani, 2018). However, most existing studies have primarily focused on the general effectiveness of interactive multimedia or its technical development aspects (Kisworo et al., 2022; Poernamasari et al., 2022; Rizqa et al., 2023). Comparatively little attention has been given to the design of illustrative visual assets as a central component for facilitating waste sorting

education within interactive multimedia environments. This gap highlights the need for further investigation into how visual illustration design can support the communication of waste sorting concepts and enhance learning effectiveness.

In response to the identified research gap, this study focuses on the design of illustrative visual assets for Eco Quest, an interactive multimedia application developed to support waste sorting education. Unlike previous studies that primarily emphasize the effectiveness or technical development of interactive multimedia, this research specifically investigates the process of designing digital illustrations as the primary visual assets that support visual identity, navigation, and the delivery of educational content. The novelty of this study lies in its exploration of illustrations as a visual communication medium and its contribution to understanding how illustration design can support the effectiveness of waste sorting education within an interactive multimedia environment.

This study aims to examine the process of designing illustrative visual assets for Eco Quest, an interactive multimedia application for waste sorting education, and to analyze how illustrations contribute to the communication of educational content. Additionally, illustrations are explored for their ability to enhance user engagement and communicate waste sorting concepts through an accessible and visually appealing learning experience.

Method

This article adopted a qualitative research methodology with a design oriented approach to investigate the process of developing illustrative visual assets for Eco Quest, an interactive multimedia application for waste sorting education. The approach was chosen because the research emphasizes the development of digital illustrations and examines how visual elements contribute to the communication

of educational content. To obtain data relevant to visual design requirements and the application of illustrations within an interactive multimedia environment, multiple data collection techniques were employed to support a comprehensive and systematic analysis. This methodological approach enabled a detailed exploration of the illustration design process and its educational function.

Data collection was conducted through observation, literature review, and documentation. Observation was carried out by examining existing waste sorting educational applications, particularly Garbage Gobblers and Recycle Game, to identify the implementation of visual elements, illustration styles, navigation systems, and learning features. The observation revealed that existing applications primarily emphasized gameplay activities, while providing limited integration between learning content and illustrative visual assets.

These findings served as the design foundation for developing *Eco Quest*, particularly in integrating dedicated learning materials with consistent environmental-themed illustrations that support visual communication and user navigation. The literature review involved the analysis of journals, books, and previous studies related to illustration design, interactive multimedia, visual communication, and environmental education, providing theoretical references to support the illustration design process and design decisions. Documentation was used to collect visual records, including preliminary sketches, digital illustration development processes, and the final visual assets implemented in the *Eco Quest* application.

Based on the collected data, the illustration development process involved several stages, including brief development, visual reference gathering, concept exploration, sketch production, outlining, digital coloring, finalization, and the preparation

of visual asset formats for integration into the *Eco Quest* interactive multimedia application. Each stage was carried out systematically to ensure visual consistency, educational relevance, and communication of waste sorting concepts while maintaining coherence among visual elements throughout the interactive multimedia application development process.

Finding and Discussion

Illustration Brief

The design process began with the development of an illustration brief, which served as the primary guideline for visual asset development based on the learning media requirements and the communication objectives to be achieved through the illustrations. The brief contained information regarding the theme, learning objectives, target users, visual style, color palette, and technical requirements such as canvas size and file format. Through this brief, the desired visual direction was clearly defined, allowing the design process to proceed in accordance with the requirements of the *Eco Quest* interactive multimedia application. The brief also served as a foundation for establishing consistent visual characteristics, ensuring that all illustration assets maintained a unified style and complementary functions.

Table 1. Brief

Aspect	Description
Project Name	<i>Eco Quest</i> Interactive Multimedia
Primary Function	Educational media for waste sorting
Target Users	Children and teenager
Design Approach	Cartoon style illustrations
Illustration Style	Cartoon friendly, communicative, educational, and engaging
Color Palette	Bright and contrasting colors (green, blue, brown, and orange)
Mascot Character	Female sanitation worker

Educational Objects	Various waste types and categories
Waste Bins	Organic, inorganic, hazardous, paper, and residual
User Interface Icons	Navigation icons, back button, sound settings, and other supporting interface elements
Background Elements	Urban park environment, sky, and trees
Supporting Elements	Information boards, level indicators, timer indicators, and other user interface elements
Final Output Format	PNG illustrations with transparent backgrounds, trimmed and ready for desktop implementation

Illustration Design Process

The illustration design process was conducted through a series of structured stages to ensure that the resulting visual assets were not only aesthetically appealing but also engaging and aligned with the educational goals of the application. To facilitate the development process, several software applications were employed, including IbisPaint for digital illustration production, Canva for user interface layout composition, and Adobe Photoshop for final asset refinement, including trimming and file quality optimization. The integration of these tools supported an efficient design workflow and contributed to the production of high quality visual assets that were fully prepared for implementation within the *Eco Quest* interactive multimedia application.



Figure 3 – IbisPaint, Canva, and Photoshop as Supporting Software
Source : Google 2026

1. Understanding Briefs and Brainstorming

The design process began with a review of the project brief and the waste sorting concepts to be communicated through the

application. During this stage, visual references related to environmental illustrations, character design, waste classification icons, and interactive multimedia interfaces were collected and analyzed to establish an appropriate visual direction. These references were primarily gathered from Pinterest, which provided diverse examples of illustration styles, color palettes, character designs, and interface layouts that supported concept development.

After reviewing the brief, a brainstorming process was conducted to develop various visual concepts. This stage aimed to determine character forms, illustration styles, color schemes, and other visual elements that supported the delivery of educational content. The selection of objects, characters, and colors was carefully considered to ensure that information could be understood quickly while supporting the educational objectives of the interactive multimedia application. The target users were also analyzed to ensure that the illustrations were appropriate for their level of understanding.



Figure 4 – Moodboard
Source : Authors 2026

2. Concept Development and Sketching

The second stage focused on visual concept development and sketch creation. A simple cartoon style illustration approach was selected to produce a friendly and easily recognizable visual appearance for the target audience. This visual style was considered appropriate for supporting educational communication within the interactive multimedia application.

During this stage, sketches were produced manually on paper using an H pencil. The primary purpose of sketching was to establish the overall composition of the illustrations and define the proportions of the visual elements. At this stage, the drawings consisted of rough construction lines, providing flexibility for the exploration and refinement of object forms.



Figure 5 – Mascot Sketch
Source : Authors 2026

These preliminary sketches served as the foundation for the subsequent digitalization process and functioned as visual references throughout the development of the final illustration assets.

3. Outline and Coloring

Following the completion and documentation of the sketches, the illustration development process proceeded to the outlining stage. The sketches were imported into IbisPaint and used as the foundational visual references for digital production. During this stage, a new layer was created above the sketch layer, and the outlines were developed using a tracing technique. This process involved redrawing the preliminary sketch lines to generate cleaner, more precise, and visually consistent linework, thereby establishing a strong structural foundation for the subsequent coloring stage.



Figure 6 – Brush For Outlining
Source : Authors 2026

Line refinement was performed using the NanaLineart brush with a brush size of 15 px and 100% opacity. These parameters were selected to produce consistent, clearly defined, and highly legible linework across all illustration assets. After the outlining stage, the illustrations displayed greater visual clarity while preserving the structural characteristics established during the manual sketching process. This resulted in clean and professional digital illustrations suitable for implementation within the Eco Quest interactive multimedia application.



Figure 7 – Outlining Process View
Source : Authors 2026



Figure 8 – Mascot Outline
Source : Authors 2026

Following the outlining stage, the illustrations entered the coloring phase, during which a color blocking technique was employed. This technique involved applying solid base colors to individual visual elements based on the predefined color palette, thereby establishing clear visual distinctions among the illustrated objects and providing a structured foundation for the subsequent shading and highlighting process.

Color selection was aligned with the waste classification system used in several regional regulations in Indonesia, including green for organic waste, yellow for inorganic waste, red for hazardous waste (B3), blue for paper waste, and gray for residual waste. The application of distinct color codes was intended to facilitate rapid visual recognition and differentiation of waste categories by users. At the same time, careful consideration was given to color harmony and visual balance to ensure that the illustrations remained aesthetically appealing, engaging, and comfortable for prolonged viewing within the interactive multimedia environment.



Figure 9 – Trash Bin Color Palette
Source : Authors 2026

The color coding system for waste bins in Indonesia has not been implemented under a uniform national standard. Instead, different regions apply varying color classifications according to local waste management policies. Consequently, the visual design adopted a reference framework providing a comprehensive waste classification to ensure clarity and consistency in the educational illustrations.

The coloring process was performed using the Bucket Tool to enable efficient and uniform color application across the illustrated objects. To support subsequent refinement procedures, each color element was assigned to a separate layer. This layer based workflow facilitated greater control during the finishing stage, particularly in the application of shadows and lighting effects, which contributed to enhanced visual depth and overall illustration quality.



Figure 10 - Coloring Process View
Source : Authors 2026



Figure 11 – Colored Mascot
Source : Authors 2026

The finishing stage represented the final refinement phase following the coloring process. At this stage, additional visual details, particularly shadows and highlights, were incorporated to enhance the overall quality of the illustrations. Shadows were applied to create visual depth and strengthen object volume, whereas highlights were used to represent illuminated areas and improve the visual realism of the illustrated elements. The combination of these effects contributed to a more dynamic and visually appealing representation of the educational assets.

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Figure 12 – Brush For Shadow And Highlight
Source : Authors 2026

The shadow and highlight effects were applied using the Pen (Fade) brush in IbisPaint with a brush size of 500 px and a thickness setting of 15%. These parameters were selected to produce smooth gradients between illuminated and shaded areas, thereby creating softer color transitions and a more refined visual appearance. The finishing process enhanced the clarity and visual quality of the illustrations while strengthening their sense of depth and dimensionality. Because of that, the final visual assets achieved a more engaging and aesthetically appealing appearance when integrated into the *Eco Quest* interactive multimedia environment.



Figure 13 - Coloring Process View
Source : Authors 2026



Figure 14 – Finished Mascot
Source : Authors 2026

4. Layouting

The final stage consisted of interface layout development and visual asset optimization. Following the completion of the finishing process, the illustration assets were organized within the user interface using Canva. The layout design process focused on arranging the position, scale, and spatial relationships of visual elements to establish a structured and visually coherent multimedia environment. This stage ensured the consistent placement of illustration assets across different application screens, thereby strengthening visual continuity and the whole interface consistency.

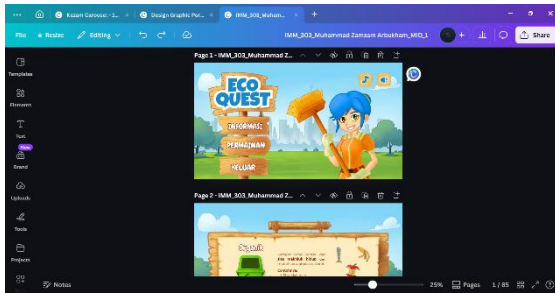


Figure 15 – Interface Layout In Canva
Source : Authors 2026

Subsequently, the visual assets underwent technical optimization using Adobe Photoshop. Adjustments were made to canvas dimensions, image resolution, and file formats to ensure compatibility with the interactive multimedia application. These refinements facilitated the seamless integration of the illustrations into the application while maintaining visual quality and performance across the digital environment, ensuring consistent display across different interface layouts and supporting efficient asset management during application development.

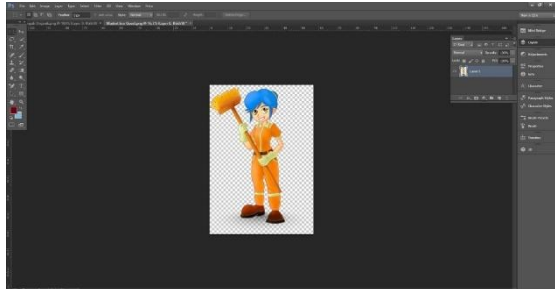


Figure 16 – Asset Format Adjustment in Photoshop
Source : Authors 2026

The Role of Illustrations in Interactive Multimedia

Illustrations play a significant role in facilitating the delivery of educational content within the Eco Quest application. Beyond serving as decorative visual elements, illustrations function as engaging communication tools that enhance information comprehension and increase user engagement. Through the presentation of visual representations, users can more easily understand and interpret educational content in an accessible and appealing manner.

1. The Role of Illustrations on the Home Page



Figure 17 – Home Page Display
Source : Authors 2026

On the home page, illustrations play a strategic role in establishing the visual identity of the Eco Quest application through the integration of the logo, navigation boards, mascot character, and environmental background. The adoption of a cartoon illustration style with vibrant colors creates a visually appealing and approachable interface for the target audience.

The mascot, represented as a sanitation worker, functions as a visual symbol of environmental awareness and cleanliness. Beyond its decorative role, the mascot serves as a communicative element that reinforces the educational theme while supporting the presentation of learning content. Its consistent appearance throughout the interface also contributes to a recognizable visual identity.

Moreover, the navigation board illustrations were designed to resemble directional signage, enabling users to interpret navigation functions more intuitively. The environmental background, featuring a clean and green urban park setting, visually reinforces the environmental values promoted within the educational content. Collectively, these illustrative elements contribute to a cohesive visual experience, establish a strong thematic identity, and encourage user engagement from the first interaction with the application, while maintaining visual consistency across learning materials, gameplay interfaces, and

navigational components throughout the application.

2. The Role of Illustrations on Learning Pages



Figure 18 – Organic Waste Learning Page Display
Source : Authors 2026



Figure 19 – Inorganic Waste Learning Page Display
Source : Authors 2026



Figure 20 – Hazardous Waste Learning Page Display
Source : Authors 2026



Figure 21 – Paper Waste Learning Page Display
Source : Authors 2026



Figure 22 – Residual Waste Learning Page Display
Source : Authors 2026

On the learning page, illustrations serve as visual communication tools that facilitate the presentation of educational content and support users in recognizing different waste categories. Each category is represented through a distinct waste bin color, enabling users to understand the waste sorting system through intuitive visual associations, while reinforcing the relationship between visual symbols and their corresponding waste classifications.

The color coding scheme follows widely adopted waste classification practices, with green representing organic waste, yellow representing inorganic waste, red representing hazardous waste (B3), blue representing paper waste, and gray representing residual waste. The implementation of these visual codes enhances users' ability to rapidly identify and differentiate waste categories, thereby supporting the learning process.

Additionally to the waste bin illustrations, various waste objects, including plastic bottles, dried leaves, batteries, cardboard, and used face masks are visually represented to provide concrete examples of the waste categories discussed in the educational materials. These illustrations translate abstract classifications into recognizable visual forms, making the content more accessible and meaningful for users, while supporting consistent visual communication and strengthening the connection between textual explanations and illustrated waste examples.

By incorporating relevant, simplified, and easily identifiable visual representations,

the application supports users in understanding waste types commonly encountered in everyday life, particularly among children and adolescents. Thus, illustrations function not only as supporting visual elements but also as engaging educational communication media that enhance comprehension and facilitate the delivery of waste sorting concepts.

3. The Role of Illustrations on Play Pages

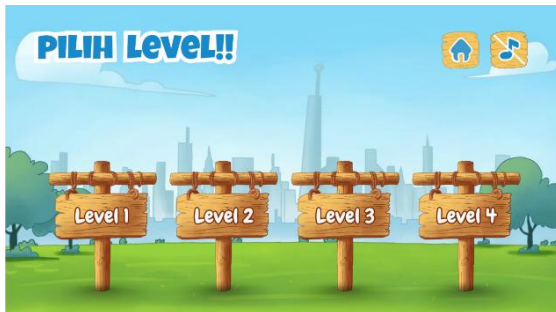


Figure 23 – Level Board Display
Source : Authors 2026



Figure 24 – Level 1 Display
Source : Authors 2026



Figure 25 – Level 2 Display
Source : Authors 2026



Figure 26 – Level 3 Display
Source : Authors 2026



Figure 27 – Level 4 Display
Source : Authors 2026

On the game page, illustrations function as core interactive elements that facilitate user engagement with the waste sorting activities. Users are required to classify waste objects by matching illustrated items with the appropriate waste bins according to their respective categories, allowing them to actively apply the knowledge acquired during the learning phase.

The consistent application of illustrative assets across both the learning and gameplay sections was intended to maintain visual continuity and strengthen the connection between educational content and interactive practice. This consistency helps users transfer previously acquired knowledge into gameplay activities, thereby reinforcing the learning process.

In addition to waste object illustrations, the interface incorporates level boards, timer indicators, and navigation buttons that help users understand the game structure and interaction flow. The level boards were designed to resemble directional signage, contributing to a sense of exploration and enhancing user experience.

Through this interactive design approach, users do not merely receive information about waste sorting but actively participate in the classification process through gameplay. Consequently, illustrations function not only as visual representations but also as learning media that encourage participation, reinforce knowledge retention, and create a more engaging educational experiences.

Discussion

The findings of this study indicate that the digital illustration design process plays a substantial role in supporting information delivery within interactive multimedia environments. In the Eco Quest application, illustrations function not merely as supplementary visual elements but as integral components of the learning experience. The consistent application of illustrative assets across different interface sections contributes to clearer visual communication, enabling users to comprehend waste sorting concepts.

The outcomes further suggest that illustrations contribute significantly to the visual attractiveness of the application. Engaging visual presentations help sustain users' attention throughout the learning process, thereby supporting continued interaction with the educational content. The adoption of a cartoon style illustration approach characterized by simplified forms and vibrant colors was considered appropriate for the target audience, particularly children and adolescents. This design strategy helped establish a more enjoyable, approachable, and motivating learning environment.

Beyond their aesthetic function, illustrations also enhanced the clarity of educational communication. The use of color coded waste bin illustrations with distinct visual characteristics enabled users to identify and differentiate waste categories more rapidly. These findings support the view that visual representations can simplify the communication of

environmental concepts and reduce users' dependence on extensive textual explanations.

Visual consistency emerged as a critical factor in the effectiveness of the illustration design. The consistent use of characters, color schemes, and illustration styles strengthened the visual identity of the application while improving users' ability to navigate and interpret interface elements. This consistency contributed to a more coherent learning experience and reinforced the communication of educational content.

On the gameplay page, illustrations functioned as key interactive components that connected users with the learning material. Rather than passively receiving information, users actively engaged in waste sorting activities through game based interactions. This interactive approach promoted experiential learning by allowing users to apply acquired knowledge directly within a simulated environment.

The observations also indicate that the integration of game based learning elements contributed positively to user motivation. Visual components such as waste object illustrations, timer indicators, and level boards created a more engaging learning environment that encouraged users to complete educational challenges. Thus, the learning process extended beyond information acquisition and incorporated meaningful and enjoyable learning experiences.

Furthermore, the implementation of digital illustrations in Eco Quest spotlights their value as visual communication tools for environmental education. By transforming abstract waste sorting concepts into recognizable visual representations, illustrations help users identify waste categories commonly encountered in everyday life and facilitate a deeper understanding of the educational content. The role of illustrations observed in this application supports the view that visual

elements contribute to better comprehension and knowledge retention within digital learning environments.

The results also highlight the importance of a structured illustration design process. The systematic stages, ranging from brief development and conceptualization to digital production and asset finalization, contributed to the creation of visual assets that were visually consistent, communicative, and aligned with the objectives of the interactive multimedia application.

To sum up, the research shows that the implementation of digital illustrations in the *Eco Quest* interactive multimedia application contributes not only to the visual quality of the interface but also to the effectiveness of waste sorting education. These results reinforce the strategic role of illustrations as visual communication media in the development of interactive learning applications for environmental education, supporting the findings.

Conclusions

This study investigated the design process of illustrative visual assets for *Eco Quest*, an interactive multimedia application developed to support waste sorting education. The findings demonstrate that a structured illustration design process, encompassing brief development, conceptualization, sketching, digital production, and asset finalization, contributes to the creation of visual assets that are both communicative and suitable for interactive learning environments.

Within the *Eco Quest* application, illustrations play a strategic role in improving the delivery of educational content. Beyond their aesthetic function, illustrations support visual communication by strengthening visual identity, facilitating interface navigation, and improving users' ability to recognize and differentiate waste categories. The consistent application of illustrative elements throughout the application also

reinforces the relationship between learning materials and interactive activities, thereby supporting a more coherent learning experience.

Altogether, digital illustrations have become an essential part of the *Eco Quest* application, supporting not only the visual appearance of the interface but also the communication of waste sorting concepts. Their integration throughout the application helps create a more engaging learning experience while demonstrating the value of visual communication in environmental education.

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