

Design of a Maritime-Themed Toy for Preschool Children

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Abstract

This paper focuses on early childhood education aimed at promoting maritime military culture and science education. It proposes the design of an educational board game based on a maritime military theme, intended to provide children with foundational learning. Through the introduction and popularisation of knowledge regarding ships and maritime navigation, children can develop an understanding of China's naval affairs from an early age. At the same time, parents remain keenly interested in experiential, interactive education for their children. Many parents face challenges in selecting early learning toys and are increasingly prioritising the importance of subconscious education and companion-based parent-child interaction during their children's development. This project is aimed at pre-school children aged 3–6. Based on the fundamental principles of convenience, safety and ease of use in children's toys, it integrates learning through play into daily life. During play, it cultivates children's spatial awareness of shapes and expands their logical thinking. By gradually increasing the game's difficulty, it encourages brainstorming and stimulates visual senses, thereby sparking creativity, achieving cognitive balance and enhancing cognitive abilities.

Keywords: naval affairs, science education, board games, experiential activities, preschool children

1. Origin and Background of the Study

1.1 Background and Significance of the Research Topic

1.1.1 Background to the Topic

Against the backdrop of modern society, a wide variety of toys continue to emerge, and the choice of toys for pre-school children has become a matter of consideration for many parents. These toys must not only provide children with enjoyment whilst they play, but also fulfil educational requirements, enabling children to acquire knowledge as they grow and to continually develop and be nurtured within the ocean of knowledge. For children aged 3–6, it is crucial to provide them with a basic understanding and foundational education regarding China's current naval forces. Moreover, in today's context, the cultivation of military culture among children is increasingly important, as it lays a solid foundation for them to develop a sound worldview in the future. Popular science outreach on national defence education is gradually appearing in various aspects of daily life, fostering a sense of family harmony and creating a bridge of mutual trust between parents and children.

1.1.2 Significance of the Topic

Taking the theme of maritime military affairs as its starting point, this project focuses on the design of toys for pre-school children, with the aim of using toys as a medium to convey to children the prosperity and strength of China's maritime military power. The core of the Chinese national spirit is patriotism, which has inspired generation after generation of the Chinese people to strive tirelessly for the prosperity and development of the motherland. Childhood represents the most crucial formative period in a person's life, and is also the optimal time for military cultural education. How to fully capitalise on this golden period of education and enhance the

impact of maritime military education on children is a pressing issue; innovative educational tools for popular science are the solution. Through clever design, children's intellectual abilities are honed, their agile thinking and problem-solving skills are developed, whilst hands-on activities satisfy their natural curiosity about the world. Parents can further shape their children's understanding of maritime military culture, foster a positive family ethos, establish their authority by participating in their children's developmental stages, and build a harmonious and close parent-child relationship.

1.1.3 Objectives of the Topic

This paper aims to provide children with an introduction to maritime military culture, thereby stimulating their interest in and awareness of the nation's maritime military affairs. It utilises children's toys as a medium for disseminating and promoting China's maritime military culture, and designs a toy for pre-school children that enhances their manual dexterity and cognitive development.

1.2 Topic Research

Firstly, we conducted research into existing children's educational board games and their rules currently available on the market. The product primarily features naval vessel models, incorporating designs inspired by several representative vessels from China's naval forces into our research and analysis.

This is an educational board game for children from the United States designed to enhance spatial awareness through play. It features animal tiles of various shapes and game levels. Not only does this benefit early childhood education and scientific literacy, but the process of matching the tiles to their corresponding positions on the game board also captures children's interest and improves their concentration. Children successfully complete the challenge by placing the game pieces in the correct positions according to the pictures. During this process, they also gain an understanding and familiarity with the animals.

This is a Chinese-designed board game for young children. The game primarily involves matching blocks to corresponding cards; players must arrange the physical models in the correct positions according to the two-dimensional layout to complete each level. Not only does this help develop children's logical thinking skills, but the process of arranging three-dimensional shapes also stimulates their curiosity and desire to explore. At the same time, it enhances their ability to observe and identify key information whilst playing. The toy features straight edges and rounded corners to ensure safety.

This is an award-winning children's board game designed by Benlai Design, which ingeniously combines a traditional Chinese chessboard with a tangram puzzle. The pieces are categorised into different levels based on their shape and size, and players can also assemble the tangram pieces whilst playing. This not only helps children develop their ability to perceive and coordinate the division of shapes, but also allows them to experience the spark of imagination through play.

1.3 Summary of Topic Research

With regard to the existing range of board games for pre-school children on the market, although there has been a constant stream of new products in the fields of science education and construction toys in recent years, and whilst there are many different assembly methods in terms of spatial graphic cognition and module combination, there remains a lack of innovation in design philosophy, with gameplay often limited to modules and traditional assembly methods. Furthermore, current board games tend to be overly two-dimensional, frequently relying on the richness of flat designs to enhance visual impact and increase entertainment value, whilst there is relatively little focus on the design of physical model products.

There is a relative scarcity of educational toys centred on maritime military themes, and their educational value is, to some extent, lacking. This project aims to design a toy for pre-school children with a maritime military theme at its core. Drawing on China's modern naval fleet — which features a variety of distinctive and representative vessels — the design focuses on four primary types: aircraft carriers, destroyers, frigates and supply ships. Each vessel possesses distinct functionalities and designs. This serves as the design starting point and rationale. During children's play, graphic modules, vessel combination methods and track designs are integrated to facilitate interaction with the user. Through the toy's design and accompanying cards, parents can engage in educational activities with their children, with experiential learning serving to strengthen parent-child bonds.

This project is a toy designed for pre-school children, based on the premise of nurturing and cultivating an appreciation for maritime military affairs, with the aim of promoting China's maritime military heritage. Based on an analysis of the physiological and psychological characteristics of pre-school children, this toy must satisfy their natural curiosity and foster emotional engagement during interaction. The naval military theme provides children with a rich and novel hands-on experience, thereby widely disseminating naval military culture through play-based learning.

Research Process Planning:

- (1) A detailed market analysis of educational children's toys and educational board games was conducted. Designs of naval vessels were collected and refined to produce a preliminary design for a naval-themed board game aimed at pre-school children.
- (2) Using the naval military theme as a backdrop, four representative vessel types were selected to further develop suitable designs for the board game's aesthetics and interactive mechanisms, and to complete the design of the naval military-themed children's toys based on this proposal.
- (3) Applying knowledge of product design, a prototype of the naval military-themed children's toy was designed and produced.

2. Design Principles and Methods

2.1 Analysis of Design Positioning

This project focuses on the design of children's toys with a naval military theme. The design features a refined, unified aesthetic and employs a modular structure, allowing users to assemble the toys themselves and making them easy to store. Whilst prioritising aesthetic appeal, the design also emphasises practicality, ensuring a clear logic, a neat and minimalist appearance, and compatibility with existing toy manufacturing processes, thereby embodying the aesthetic of order found in design theory. The exterior features rounded chamfered edges, incorporating geometric shapes such as triangles, ovals and squares. This not only stimulates children's visual and spatial thinking but also significantly enhances safety during use.

2.2 Analysis of Functional Positioning

This is a children's toy designed around a maritime military theme, with a focus on experiential interaction. It uses illustrated cards to educate children about China's maritime military equipment and vessels. As children grow, they need constant practice and external stimulation to master basic life skills and develop an understanding of the world around them. By offering a variety of formats rather than relying on a single didactic approach, the toy stimulates children's interest in independent learning. Children are free to plan their boat's route according to the design scenario; successfully completing a level involves positioning the boat in a fixed spot that matches the illustration on the card. This fully harnesses children's autonomy to enhance their independent thinking skills, whilst the assembly process also strengthens parent-child interaction and fosters a closer bond.

2.3 Analysis of Colour Positioning

This research project focuses on a maritime military theme and is aimed at pre-school children aged 3–6. Drawing on the principles of the three primary colours, two colour schemes have been developed: one featuring yellow and blue, and the other blue and pink as the primary colours. Taking into account the target audience's colour perception abilities, colours that are both soft and vivid — and which help develop children's visual skills — have been selected as secondary colours. These are integrated with the design's functional attributes and stylistic features. distinctive colours are selected to highlight the characteristics of naval vessels.

When selecting colour schemes, the focus is on soft tones that enhance colour contrast. From a child's psychological perspective, warm colours evoke feelings of enthusiasm and joy, helping to foster a closer bond with children during play, relieve stress, and create a more harmonious and welcoming environment. From a physiological perspective, the visual sensory systems of pre-school children are still developing; they are particularly drawn to toys with vivid colours and high saturation, which in turn stimulates their interest in and desire to explore these toys. The inspirational nature of colour schemes can enhance experiential, science-based teaching, allowing children to become fully immersed in the educational process whilst playing happily.

When products interact with users, the visual appeal of the product's colour and design instantly captures a child's attention during use. This greatly satisfies children's natural curiosity about the world, leading to faster emotional development compared to their peers.

2.4 Analysis of Target Audience Positioning

China's Compulsory Education Law stipulates that children who have reached the age of six must enrol in school to receive an education. Drawing on developments in child psychology, the renowned early childhood education expert Mr. Chen Guomei, in his work *Preschool Psychology*, divides the childhood stage into six periods. Toy design will target pre-school children aged 3–6; for children whose intellectual development is still in its formative stages, a toy that exercises fine motor skills and enhances cognitive thinking is an essential item. Children in this age group are brimming with curiosity about the world. Building upon age-appropriate principles, the play structure has been upgraded and optimised, with meticulous attention paid to the disassembly, stacking, arrangement and combination of components. This ensures that parts can be effectively

interchanged during assembly, significantly enhancing children's grasp of the toy's details and overall structure, as well as their interest and understanding.

This cognitive development is also reflected in the children's ability to complete the assembly of different ship hulls, and this children's toy specifically employs a challenge-based approach to satisfy their need for a sense of achievement.

3. Analysis of Design Content and Effects

3.1 Conceptual Sketches for a Science Education Board Game

Concept Sketch 1: This is a jigsaw-style board game. Set against the backdrop of the Maritime Silk Road, it features simplified designs of naval vessels, with different sailing routes mapped out from start to finish. As children play, they learn about the locations along the journey, and the game includes a storage box at the bottom for easy tidying away.

Drawbacks: Compared to other children's toys on the market, this design offers a relatively limited range of gameplay, and there is room for improvement in terms of fostering children's logical thinking.

Concept Sketch 2: This is a board game. The simplified naval vessels are used as game pieces. Players roll dice to move a set number of spaces, navigating through mazes and obstacles encountered during the voyage. Children must plan their routes to avoid these hazards. The game can be played solo or in two-player mode; in the latter, the first player to reach the finish line wins.

Disadvantages: The educational value is limited, and the lack of storage features makes it easy for pieces to get lost.

Sketch Proposal 3: This is a graphic classification board game. Using cards to introduce the characteristics and attributes of the selected naval vessels, and based on the different level layouts provided on the cards, players must navigate small boats featuring spatial graphics along a route to specific positions to complete the task.

Advantages: Innovative gameplay that develops children's hand-eye coordination and logical thinking, with built-in storage functionality.

Following a comprehensive analysis and discussion of the above design proposals (as shown in Figure 1), Sketch 3 was ultimately selected for further development.

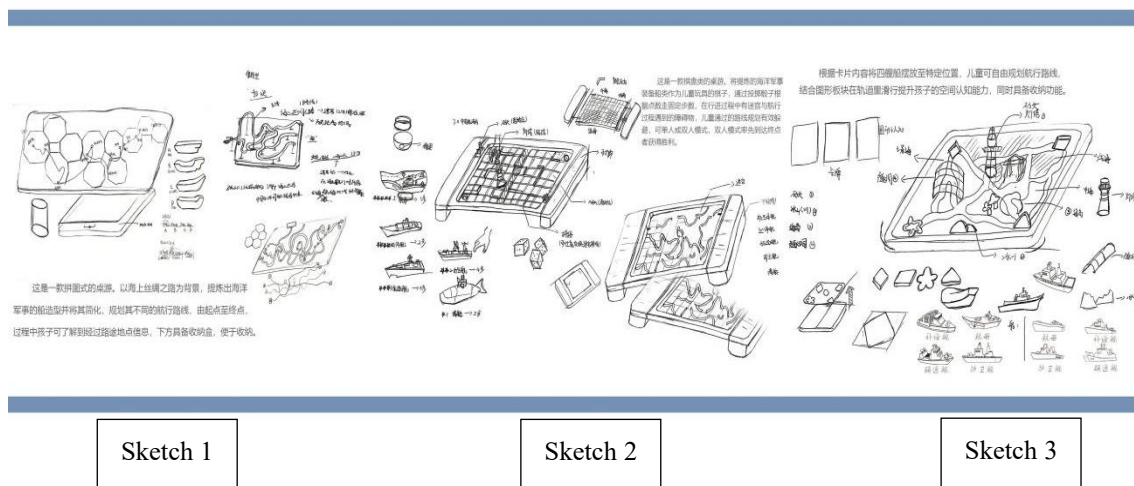


Figure 1. Design sketches for children's toys with a naval theme

3.2 Design Proposal for the Science Education Board Game

The design of this children's toy with a naval theme features ships representing China's naval equipment, navigation route scenarios and corresponding spatial recognition exercises. Children move the ship's projection onto a three-dimensional space based on the content of two-dimensional cards; if the shapes align correctly, they successfully complete the level. The toy's design incorporates a margin for error, allowing children to change direction promptly to resolve any issues they encounter whilst planning their route to complete the task.

The toy model is divided into three layers: a storage box, a game panel and the ship components. It also includes 14 game cards: four cards detailing the functional attributes of the ships and ten level cards. Whilst providing

children with educational insights into China's naval military themes, the toy also helps develop their hand-eye coordination and cognitive skills.

3.3 Module Design for the Science Education Board Game

This project involves the design of a children's toy set with a naval theme, comprising a ship module and corresponding graphic modules, as well as lighthouse, tunnel and glacier modules (as shown in Figure 2). The set is stored in a toy storage box, and players move the modules to specific positions by selecting task cards. This naval-themed children's toy set features educational modules and puzzle elements, allowing for interaction with children during play to explain naval culture.

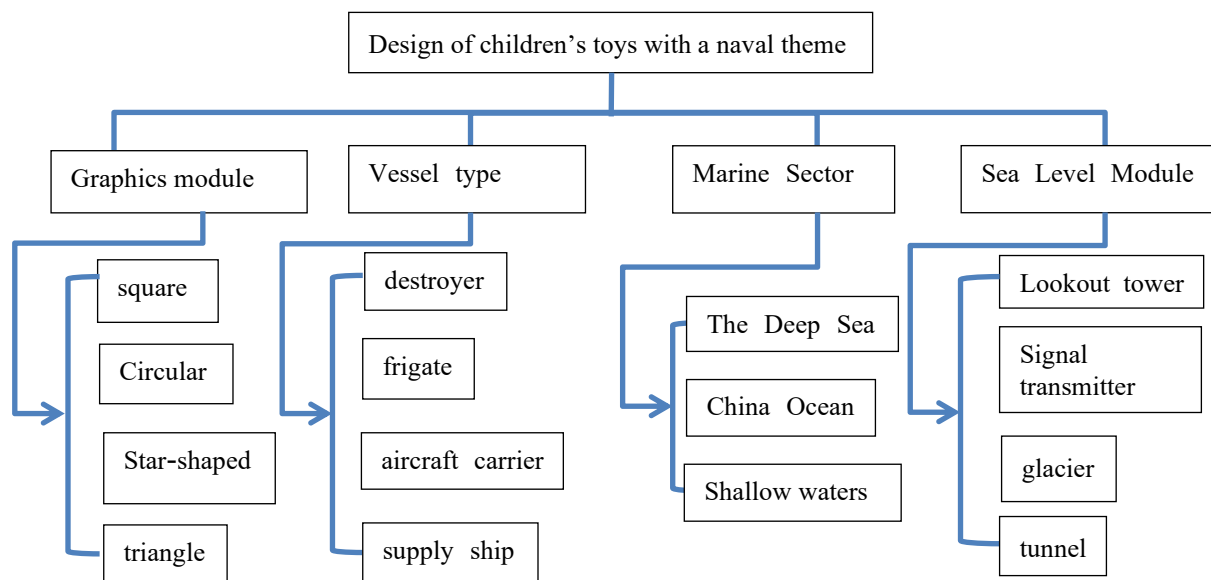


Figure 2. Diagram showing the layout of the toy modules

3.4 Vessel Modelling and Graphic Design for the Science Education Board Game

The naval vessels featured in this design primarily comprise four representative types, including an aircraft carrier, a frigate, a destroyer and a replenishment ship. The designs are minimalist, with each hull featuring distinctive, iconic elements.

Aircraft carriers are pivotal to naval operations; their large deck areas, particularly the vast flight decks, enable aircraft to operate, facilitating their docking, landing and take-off; The primary missions of a destroyer include air defence, land attack and anti-submarine warfare, endowing it with diverse combat capabilities. It is likewise one of the key combat vessels in modern Chinese naval forces. Its most distinctive features are its slender hull and the advanced radar equipment mounted above the hull, designed to accommodate a variety of naval tasks such as missile defence, air defence and anti-submarine warfare; Frigates are primarily responsible for escort duties, safeguarding the safe passage of ships and ensuring they can carry out their missions smoothly. Emphasising flexibility and safety, their defining characteristic is that of a protective vessel, with the upper hull designed in the shape of a protective wing; Replenishment ships possess ample space to store large quantities of fuel, food, ammunition and other supplies, providing both vertical and horizontal resupply to other vessels; consequently, the storage containers are selected as their representative feature. During the design refinement process, by observing the characteristic outlines of these ship types, elements are appropriately simplified, retained and exaggerated to enhance the vessels' visual appeal and recognisability.

3.5 Navigation Route Design for the Science Education Board Game

This children's toy, designed with a naval theme, features a game board set against the backdrop of the vast, boundless ocean. The game is divided into different routes, each colour-coded to represent the deep sea, mid-sea and shallow sea. The board is adorned with various objects representing scenarios encountered during navigation, and includes key checkpoints. Children select any one of the 10 scene cards and, following the instructions on the card, slide the ship along the track to the correct position. By planning different routes, the game helps develop children's independent thinking and decision-making skills. The various branching routes offer distinct visual experiences of the voyage, creating an immersive sensation. Operating the ships allows

children to understand their functional characteristics, whilst integrating knowledge of maritime culture and naval history, enabling them to learn and grow through play.

3.6 Game Booklet Design for the Science Education Board Game

This educational board game is designed around a naval theme. The game booklet contains instructions for using the toys, rules of play, illustrations of the toy models, 10 reference cards depicting various scenarios, descriptions of the characteristics of four types of naval vessels, and cards detailing their functional attributes.

3.7 User Interaction Workflow for the Science Education Board Game

This is a children's toy design centred on the theme of naval warfare. The design features four representative types of ships, with their hulls simplified through stylised design (as shown in Figure 3). By incorporating educational elements about naval culture, it lays a solid foundation for early intellectual development in pre-school children and helps foster a sense of patriotism. During play, children first select a card to identify the corresponding ship type. The shape of the ship's base can be recognised and identified, and the piece is then fitted onto the toy's chassis, stimulating the child's visual recognition skills. Next, after inserting the ship body with its graphic module, the child moves it along the navigation track to adjust its position to match the object depicted on the scene card. Finally, if the ship strays off course, it can be adjusted to the correct direction and route; the challenge is successfully completed when the ship is positioned correctly and aligns with the objects depicted on the scene card.

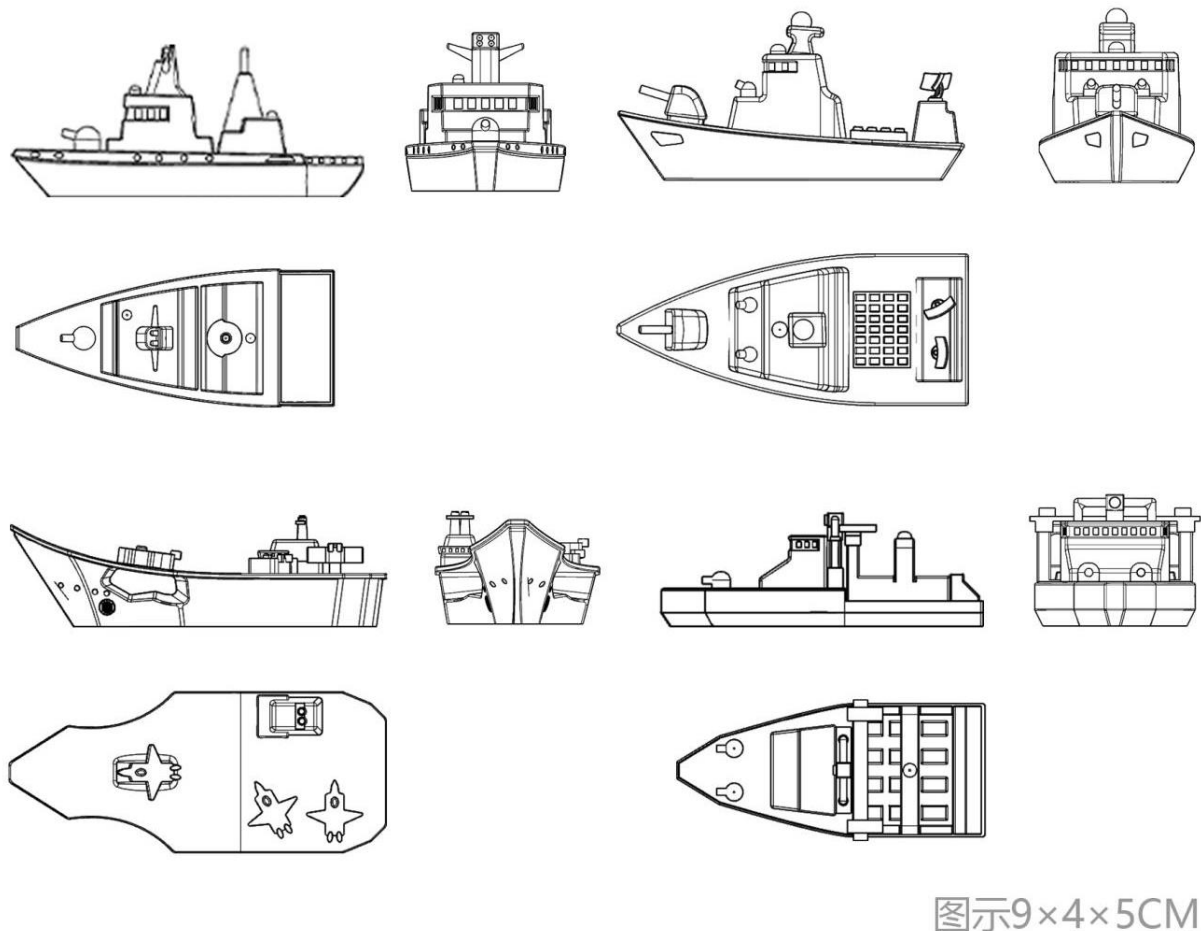


Figure 3. Structural diagram of a naval vessel

4. Practical Design of Children's Toys with a Naval Theme

4.1 Product CMF

In this design project, colour schemes have been developed for children's toys based on a naval military theme, resulting in two colour scheme proposals: yellow and blue, and blue and pink as the primary colour schemes. To highlight the toy design itself, we have taken the target user group into account: children aged 3–6 have a particularly strong perception of vivid colours. We have selected both soft and vivid colours as secondary tones,

linking them to the functional attributes and stylistic features of the toy design to mimic the colours of a ship. The design maintains harmony and unity with its surrounding environment.

In terms of materials, solid models are crafted primarily from wood. As wood is relatively soft, it is easy to carve into the complex structures of a ship, allowing for the clear presentation and accurate reproduction of intricate design details. During the manufacturing process, the models can be fully filled, including the minute and delicate internal structures. The smooth surface enhances the toy's texture, whilst the optimised tactile feel ensures children are comfortable whilst playing. This approach effectively reduces the workload in later stages, thereby improving the product's aesthetic appeal and overall quality. Compared to traditional toy materials, this is a relatively healthy option, offering superior environmental and safety performance whilst minimising potential pollution during production.

In terms of the manufacturing process for this product, the application of paint ensures rich, vibrant colours with a wide range of options available. The smooth, polished wooden surface provides a comfortable tactile experience for children, making the toy more lifelike and enhancing its visual appeal to the target audience. The painted finish also protects the toy from moisture and mould, thereby extending its lifespan.

5. Conclusion

Science education centred on maritime military themes is of paramount importance during the early years of a child's education, laying the groundwork for their future life planning. Using toys as a medium to convey and promote maritime military culture, as well as to disseminate knowledge about China's modern maritime military equipment and vessels, combined with spatial visualisation techniques to enhance children's visual cognitive abilities, and the arrangement of different scenarios to stimulate their curiosity. This paper employs methods such as user observation, case analysis, inductive summarisation and literature review to investigate the design approaches for children's toys with a maritime military theme. The research conclusions are as follows:

- (1) It is essential for educational board games to feature a maritime military backdrop. Through innovative conceptual design, these games effectively and ingeniously mitigate the risk of children losing interest due to overly simplistic or complex gameplay.
- (2) In line with the cognitive and physical-mental developmental characteristics of pre-school children, increasing interaction between family members or peers and the child helps create a harmonious and warm interactive atmosphere, thereby reducing social anxiety and fear.
- (3) The innovative aspect of the design lies in the integration of marine military-themed science education with user experience. Guided by design methodology principles, a suite of marine military-themed children's toys has been developed, comprising four representative ship models, a storage box, a game board, scene module assemblies, ten scene cards, and four informational cards detailing the ship models, alongside the production of physical prototypes. During the completion of the overall design proposal, numerous issues were identified and explored, relating to the compatibility and interoperability of methodologies; the scientific validity of these approaches requires further in-depth examination.

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Appendix

Final Project



Figure 4.

Image source: Author's own illustration.

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