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MyOcean (Organize, Clean, Eco, and Nurture): Implementation of a Strategy Based Mobile App as a Media for Building Microplastic Caring Characters

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Keywords

Microplastic; Mobile app; MyOcean; Microplastic Caring Character

Abstract

Microplastics are dispersed and mixed together in water, especially in coastal areas. Public awareness and understanding of microplastics remain limited. This certainly requires steps to minimize microplastic pollution in the community, one of which is through education using the MyOcean (Organize, Clean, Eco, and Nurture) media, which applies IoT in the form of a mobile app to increase understanding of microplastics. This media is a digital platform that is easily accessible to various groups. This study uses a qualitative descriptive method with a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The interactive and reflective application design includes literacy, audio-visual elements, games, and evaluations for users. MyOcean helps provide an understanding of microplastics, making the delivery of microplastic education more effective and communicative.

INTRODUCTION

Microplastics originate from plastic waste in the form of small particles generated by human activities and the fulfillment of daily needs. Improper plastic recycling practices may, paradoxically, increase the level of microplastic contamination (Candra, 2023). In relation to the growing demands of human consumption, global plastic production continues to rise significantly. More than 400 million tons of plastic are produced annually worldwide, with approximately 60% ending up as poorly managed waste (Geyer et al., 2017). Plastics are characterized by their resistance to natural degradation, often requiring hundreds of years to decompose in the environment. The accumulation of plastic across various ecosystems ultimately undergoes fragmentation into particles smaller than 5 millimeters. Consequently, the presence of microplastics has emerged as a global environmental concern.

This global issue is also evident in Indonesia, which is recognized as one of the largest contributors to marine plastic waste after China (Harpah et al., 2020). One such affected area is the coastal region of East Java, particularly Gresik Regency, which is highly vulnerable to microplastic pollution. Microplastics can reach coastal zones through various pathways, including waste generated by restaurants that dominate coastal tourism areas, contributing to the dispersion of microplastic particles that ultimately accumulate along the shoreline (Yani, 2024). In addition, microplastic contamina-tion in Gresik Regency is closely associated with intensive industrial activities, domestic waste, and aquaculture practices in the region. Gresik is well known as a center for freshwater and brackish water aquaculture, producing commodities such as tilapia, carp, milkfish, and vannamei shrimp. While these activities provide significant economic benefits to local communities,

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they are also accompanied by environmental challenges, particularly microplastic pollution. Recent studies have indicated that aquaculture ponds in Duduksampeyan District, Gresik, have been contaminated with microplastics at concentrations reaching 41 particles per 250 mL of water, with fiber-type microplastics dominating at 92.20%. These fibers predominantly originate from domestic waste and aquaculture nets made of synthetic materials (Wicaksana & Farmani, 2025).

In aquatic organisms, microplastic particles can enter the body through feeding mechanisms. This may lead to functional alterations in the digestive system, resulting in nutritional deficiencies and impaired growth in fish, as well as a reduction in the energy available for growth (Huang et al., 2022). Microplastics, which are easily ingested by marine biota, can cause physiological disturbances that may ultimately lead to mortality or even population decline (Amanu et al., 2024). Microplastics can also be classified based on their color, which may indicate their source and environmental exposure. Blue and transparent microplastics are often associated with more significant negative impacts on aquatic organisms, as these colors may suggest prolonged exposure to ultraviolet (UV) radiation (Pradiptaadi & Fallahian, 2022). Microplastics originate from various sources, including single-use plastic waste, industrial effluents, synthetic textiles, and fishing gear (Osman et al., 2023). Furthermore, most microplastics are land-based in origin and subsequently accumulate in marine and aquatic environments (Bigalke et al., 2022). n a pond area in Gresik, it has been reported that tilapia and carp were contaminated with fiber-type microplastics derived from household waste and damaged aquaculture nets (Wicaksana & Firmani, 2025). This contamination has been associated with a decline in the physiological quality of the fish and an increased risk of mortality under prolonged exposure. In addition to fish, microplastics have also been detected in other marine organisms such as shellfish, shrimp, crabs, and other seafood commonly consumed by humans. Global studies indicate that microplastics can accumulate in the soft tissues of these organisms, disrupt physiological functions, and affect meat quality, which is ultimately consumed by humans. Therefore, the presence of microplastics in aquatic environments is not only an environmental concern but also has direct implications for food safety.

Plants are also affected by microplastic pollution. Recent studies in Indonesia indicate that microplastic particles can enter plant root systems through contaminated irrigation water (Xiang et al., 2023). Once inside the roots, microplastics may inhibit the uptake of water and nutrients, leading to reduced crop yields.Global studies further reveal that microplastic particles can induce oxidative stress in plant cells, potentially disrupting photosynthetic processes and causing alterations in root morphology (Riaz et al., 2025). These findings demonstrate that microplastics are not only a threat to aquatic ecosystems but also pose significant risks to agriculture as a primary source of human food.

In humans, the threat of microplastics is increasingly evident, as exposure can occur through both direct and indirect pathways. Microplastics may enter the human body via three primary routes: oral ingestion, inhalation, and dermal contact (Prata et al., 2020). Once inside the body, microplastics have the potential to cause various health issues, including respiratory irritation, digestive disorders, oxidative stress, chronic inflammation, and an increased risk of carcinogenic effects (Dzierżyński et al., 2024). These findings indicate that the accumulation of microplastics poses a significant health concern. Despite these risks, public understanding of microplastics remains relatively low. Aziz et al. (2024) highlight that one of the main challenges in waste management is the lack of public awareness. Many

Many individuals still perceive waste as material that can simply be collected and burned, without recognizing the risks associated with its fragmentation into microplastics. Furthermore, public attitudes toward microplastics tend to be insufficiently cautious (Siahaan et al., 2024).Therefore, it is essential to enhance public awareness of the dangers posed by microplastics to both the environment and human health. Such awareness must be fostered through accessible and effective educational efforts. However, this issue is further exacerbated by the limited availability of information sources that are both easily accessible and communicative. Consequently, there is a need for innovative educational media that not only convey theoretical knowledge but also provide interactive learning experiences.Kalau kamu mau, aku bisa bantu menyambungkan paragraf ini dengan bagian MyOcean (sebagai solusi) supaya transisinya lebih kuat dan "argum

One innovative solution that can be developed is the use of information technology–based educational media. The utilization of the Internet of Things (IoT) has emerged as a growing trend in delivering environmental literacy, as it enables rapid, cost-effective, and wide-reaching dissemination of information. The integration of IoT in software development also offers significant benefits, particularly in the education sector (Marlina et al., 2024). One innovative solution that can be developed is the use of information technology –based educational media. The utilization of the Internet of Things (IoT) has emerged as a growing trend in delivering environmental literacy, as it enables rapid, cost-effective, and wide-reaching dissemination of information. The integration of IoT in software development also offers significant benefits, particularly in the education sector (Marlina et al., 2024).

RESEARCH METHODS

This study was conducted at SMAN 1 Sidayu over the period from August 27 to September 26, 2025. The research employed a qualitative descriptive method, which provides an in-depth and systematic explanation of the research focus, the resulting product, and its effectiveness (Rukin, 2022). Furthermore, this study adopted a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). Data collection was carried out through questionnaires and literature review. The data sources in this study primarily consisted of primary data obtained through questionnaire distribution, aimed at identifying respondents' level of knowledge regarding microplastics, their preferences for educational media, and the effectiveness of the MyOcean application. Two types of questionnaires were utilized: Questionnaire 1 was administered prior to the application testing, while Questionnaire 2 was distributed after the application testing. The data collection process was conducted in several stages. In the first stage, questionnaires were distributed to members of the KIR (Scientific Writing Club) extracurricular group at SMAN 1 Sidayu. To reach a broader sample, the second stage involved distributing questionnaires to students of the same school. The questionnaires were designed using Google Forms and distributed digitally to respondents. Subsequently, based on the research development and target scope, the third stage involved distributing questionnaires to students of MI Tarbiyatul Athfal Sumurber, including Grade 4 (29 students), Grade 5 (29 students), and Grade 6 (24 students), with a total of 82 respondents. In this stage, the questionnaires were prepared in paper format and distributed directly to respondents. Questionnaire 1 aimed to measure respondents' level of understanding of microplastics, while Questionnaire 2 was intended to evaluate the effectiveness of MyOcean as an educational application on microplastics.

Questionnaire 1 was designed to

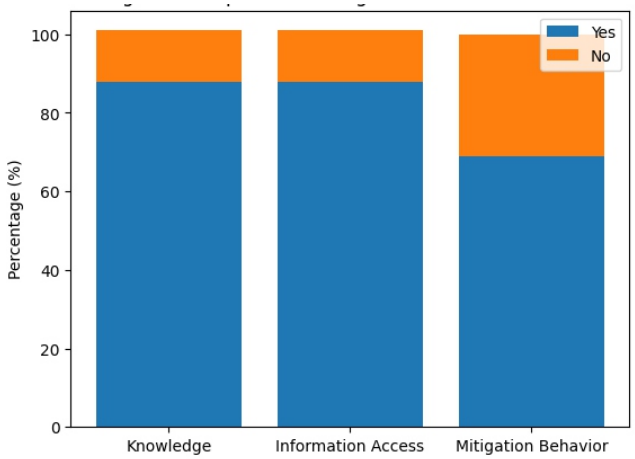
collect data on respondents' levels of understanding and awareness regarding microplastics. The form gathered respondents' identity data, including name and date of birth, in order to determine their age. It included several questions assessing respondents' knowledge of microplastics. This section consisted of a series of closed-ended questions (multiple-choice and multiple-response items) aimed at measuring respondents' understanding of the definition, sources, and causes of microplastics. Additionally, the questionnaire contained items to identify respondents' sources of information about microplastics and their efforts to mitigate microplastic pollution. An open-ended question (short response) was also included to explore respondents' perspectives on strategies to minimize microplastic contamination. Questionnaire 2, on the other hand, was designed to evaluate several aspects, including application usability and interface design, user interest and engagement, knowledge improvement, and increased awareness. Overall, this questionnaire aimed to obtain respondents' feedback after using the MyOcean application.

Data Analysis

Data analysis in this study was conducted to determine the effectiveness of the MyOcean application in increasing awareness and fostering pro-environmental attitudes toward microplastics. The data collected through questionnaires administered both before and after the application testing were processed and analyzed using a qualitative descriptive approach to provide a comprehensive overview of respondents' perceptions, understanding, and the effectiveness of MyOcean as an educational tool on microplastics. The data analysis procedure consisted of several stages: initial data collection (distribution of questionnaires prior to the use of the MyOcean application), final data collection (distribution of questionnaires after the use of the application), data reduction (selecting and focusing on relevant information), comparative analysis (comparing the results of pre- and post-application questionnaires), data interpretation (interpreting changes in respondents' perceptions and awareness of microplastics after using MyOcean), and conclusion.

RESULTS AND DISCUSSION

Based on Figure 1, it can be observed that although members of the KIR extracurricular group at SMAN 1 Sidayu are already familiar with microplastics, the majority of them have not implemented measures to mitigate microplastic pollution in their daily lives. Therefore, an effective educational medium is needed to address this issue. Furthermore, data



Source: Processed Primary Data, (2025)

Figure 1

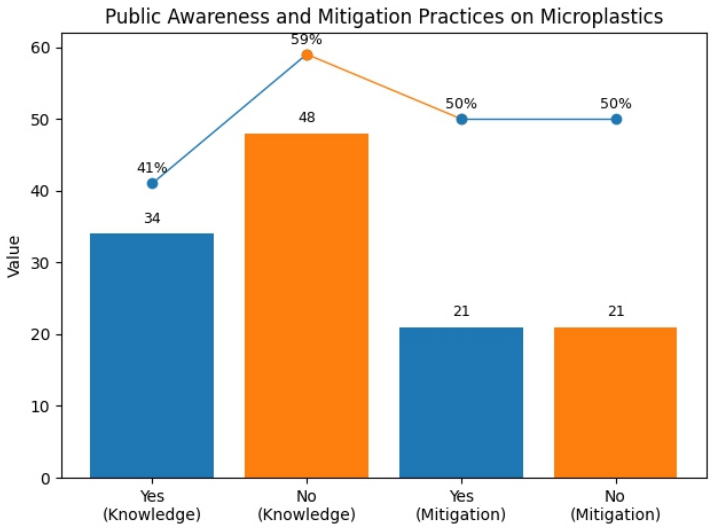
Level of Knowledge of Microplastics among KIR Students of SMAN 1 Sidayu

presented in Figure 1 indicate that most respondents obtained information about microplastics from the internet (88%). This finding suggests that respondents are highly receptive to educational content delivered through digital media.

Based on Figure 2, it is evident that the majority of respondents at MI Tarbiyatul Athfal Sumurber are not familiar with the concept of microplastics. This indicates that respondents' knowledge regarding microplastics remains very limited. In addition, the figure shows that many respondents have not implemented actions to mitigate microplastic pollution in their daily lives. Therefore, there is a need for an effective educational medium to address this issue. One potential solution is the development of a dedicated platform that specifically educates the public about microplastics. MyOcean was developed as an application that leverages digital media, enabling it to reach a wide audience quickly, cost-effectively, and with easy accessibility.

MyOcean was designed to enable users to actively participate in the learning process. The application features two main components: learning and playing (game-based features). The learning feature consists of two elements, namely literacy-based content and video, which are tailored to accommodate different user learning styles. The alignment of learning styles is essential in supporting the learning process, as it enhances users' confidence and satisfaction with their learning outcomes (Budi et al., 2021). Therefore, both features were developed to maximize effective learning achievement. The literacy component is presented in the form of reading materials accompanied by illustrative images related to micro-plastics. Meanwhile, the video feature delivers the same content in an audio-visual format. In this way, the information provided in the literacy feature can also be accessed through video, offering a more interactive and engaging learning experience for users.

Furthermore, in the playing (game) feature, several challenges are provided to evaluate users' learning outcomes. Before starting the challenges, users are introduced to a prologue in the form of an illustration that tells the story of a young man named Sean who aims to save the ocean from microplastic pollution. In order to help Sean achieve this goal, users must complete three challenges. In the first challenge, users are guided to match types of microplastics with the corresponding images. In the second challenge, users are required to arrange puzzle pieces in the



Source: Processed Primary Data, (2025)

Figure 2
A Comparison of Students' Knowledge of Microplastics and Their Mitigation Practices

Source: Processed Primary Data, (2025)

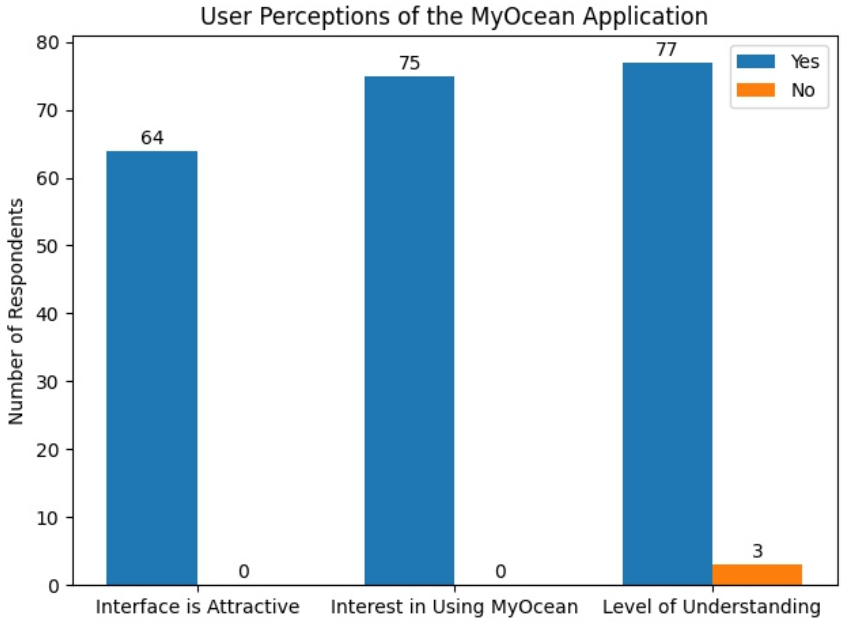
Figure 3
MyOcean Learning Feature

correct numerical order to form an illustration of a clean ocean free from microplastic pollution. The final challenge presents a set of questions related to microplastics that must be answered by the users. This stage assesses users' learning outcomes. Through the integration of learning and gameplay elements, MyOcean functions not merely as a conventional educational tool but as an interactive and engaging learning medium. This approach is expected to create a meaningful and lasting impression on users, thereby enhancing awareness and fostering environmentally responsible attitudes toward microplastics.

To assess respondents' understanding and awareness after using the MyOcean application, a second questionnaire was administered. This step aims to determine the extent to which the

Source: Processed Primary Data, (2025)

Figure 4
MyOcean Game Feature

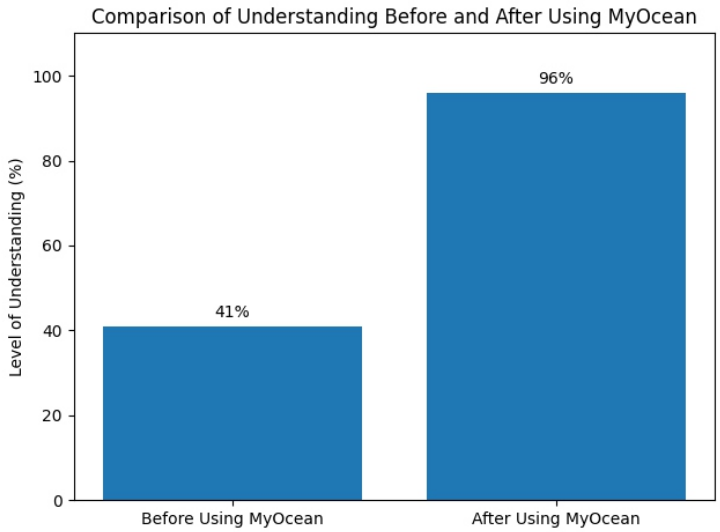


Source: Processed Primary Data, (2025)

Figure 5
MyOcean Effectiveness Survey Results

application is effective in educating the community. Based on the study design and research objectives, the analysis focuses on the second questionnaire at Stage 3, specifically to evaluate the effectiveness of MyOcean among children aged 8–13 years.

As shown in Figure 5, MyOcean serves as an engaging educational medium. Ardiansyah et al. (2025) state that the use of games as educational tools provides motivation and opportunities for students to learn independently, engage in healthy competition, and receive immediate feedback, thereby strengthening motivational elements. The inclusion of a game feature in the MyOcean application is intended to effectively and gradually encourage users to develop a pro-environmental character, particularly in relation to microplastic awareness. In addition, MyOcean offers various other features that facilitate the learning process, enabling educational content to be delivered more effectively.



Source: Processed Primary Data, (2025)

Figure 6
Pre- and Post-Use Comparison of Respondents' Understanding of MyOcean

Figure 6 indicates a 55% increase in respondents' understanding of microplastics after using MyOcean.. Therefore, the implementation of integrated features within MyOcean plays a significant role in helping users acquire knowledge, develop understanding, and build awareness of the impacts of microplastics. Furthermore, the questionnaire results indicate that users perceived clear educational benefits from the application. These findings demonstrate that MyOcean is effective as an educational medium in fostering pro-environmental attitudes, particularly in relation to microplastic awareness.

CONCLUSION

In response to the persistent global issue of microplastic pollution, this study introduces MyOcean as an innovative digital educational platform. MyOcean utilizes interactive and accessible learning media to foster pro-environmental character, particularly in raising awareness of microplastic issues. The application integrates various features tailored to users' needs, enabling educational content to be delivered in a more effective and engaging manner.The findings indicate that, after using MyOcean, respondents demonstrated improved knowledge, understanding, and awareness of microplastics. Therefore, it can be concluded that MyOcean is an interactive, communicative, and effective educational medium for enhancing awareness and fostering environmentally responsible behavior related to microplastics.

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