

4-Senses compact exhibit: novel tool to promote biodiversity

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Abstract. Natural history exhibits serve as a valuable means of raising public awareness and disseminating information about biodiversity. It is one of the ways to attract all generations to mainstream biodiversity by exploring those components in more depth and detail. This research focuses on developing a 4-senses compact exhibit as an innovative tool to promote biodiversity, engaging the senses of sight, hearing, smell, and touch. The study involves students from primary and secondary schools, as the exhibit is intended for various locations such as education and research centers, shopping centers, and schools. The research employs pre- and post-treatment questionnaires to assess the effectiveness of the 4-sense compact exhibit in promoting biodiversity. The results suggest this exhibit is a potent and novel tool for enhancing biodiversity awareness among school students, fostering a deeper understanding and appreciation for nature. Its potential as an educational resource for both primary and secondary schools make it a promising tool to instill a sense of care and appreciation for biodiversity from a young age, contributing to a more environmentally conscious future.

1 Introduction

The activities of humans have caused an abrupt change in the ecosystem and a serious loss of biodiversity throughout time [1]. Over consumption of natural resources has become a serious threat to the biodiversity system due to the high reliance on biodiversity and expanding of the human population. A significant conservation effort must be put in place to counteract these risks and maintain the sustainability of biodiversity consumption. In particular, biodiversity conservation is the practice of conserving and safeguarding the riches and diversity of species, habitats, ecosystems, and genetic diversity found worldwide, all of which are vital to our health, wealth, supply of food, fuel, and other necessary services. Since natural history exhibitions are appropriate for all age groups, visiting them is one of the most well-liked leisure activities in the public eye [2]. It is known as a tool for raising awareness and providing fundamental knowledge about biodiversity [3]. By exploring those elements further rather than merely seeing them in the media, it could be possible to draw in all generations and age groups, especially school students, to the mainstreaming of biodiversity. The audience can learn scientific facts, explore every aspect of the show, get their questions

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answered by the descriptions of the exhibits, and share their experiences with others through natural history exhibitions [4]. Therefore, the best approach to presenting natural history exhibits is through education [5]. This mechanism is able to share knowledge among students in any field, whether formally or informally. Hence, primary and secondary school students are suitable targets for this effort because mainstreaming biodiversity should start at an early age [6].

However, in order to ensure that students are focused and interested in the exhibition, good qualities of the exhibit need to be implemented during its development, including excitement and cognitive qualities. Thus, individual interest thereby highlights people's enduring preferences for particular information types [5]. The stupendousness that encourages the public's curiosity and encourages them to discover and learn more about the specimens is the most vital component to emphasize. As previously mentioned, attractive factors might contribute to piquing a person's interest in certain subjects.

The development of the 4-senses compact exhibit produced in this research project is an innovative instrument or novel tool in promoting biodiversity among school students that will stimulate the senses of sight, sound, smell, and touch. The ability to see with the eyes, hear with the ears, smell with the nose, and touch with the skin are all connected to sensing organs that transmit information to the brain and help humans understand the conditions around them [7]. Hence, this tool will enhance the understanding and awareness of biodiversity throughout the exhibition program. This compact exhibit will develop into a flexible, adaptable, and portable natural history exhibit that can be installed in any location and is compact with many elements of component biodiversity. Consequently, it can be deduced that an exhibit densely packed with elements that engage all four human senses is referred to as a "4-Senses Compact Exhibit. Four preservation techniques relating to the stimulation of the four human senses must be used to preserve the specimen collections to create an innovative tool [8]. On top of that, the compact exhibit facilitates exhibitors to manage the exhibition program efficiently by just bringing one compact portable bag without being burdened to carry other tools. Usually, there are a lot of problems because of the challenges the exhibitor must confront, especially before presenting the exhibition. The problem is that the exhibitor must prepare several things and transport them all to the display locations. Subsequently, upon arriving at the exhibition venue, the exhibitor is required to arrange each display in a well-organized, appealing, and orderly fashion to attract guests to explore it.

2 Materials and Methods

2.1 Developing and conducting questionnaire

The questionnaires were developed using previously validated and published questionnaires to conserve time [9]. The questionnaire set encompassed four sections: demographic profile, comprehension of terminology, understanding of biodiversity concepts, and assessment of the portable exhibit. Each respondent was required to complete two sets of questionnaires during pre- and post-treatment that were given in the form of a Likert scale. Prior to the exhibition, students were required to complete a pre-and post-treatment questionnaire that allowed the researcher to assess the student's level of understanding before and after the exposure to the exhibit.

2.2 Development of portable exhibit

A concise overview, encompassing the scientific name, common name, order, and specimen names, is presented on a compact flash card. Additionally, careful consideration must be given to the selection of species featured in the exhibit, as well as the preservation methods employed for both flora and fauna collections. The materials and specimens for the exhibitions were sourced from the repository laboratory of Universiti Tun Hussien Onn Malaysia, located in Pagoh, Johor. The overarching theme of this exhibition revolves around the use of innovative, portable, flexible, and adaptable tools to promote biodiversity awareness among the public.

2.3 Data analysis

Descriptive analysis used a bar graph and pie chart from Microsoft Excel was examined to assess the effectiveness of 4-senses compact exhibits as a tool to promote biodiversity. Data collection used for the analysis process comes from a comparison between the level of understanding about biodiversity among the public before and after the exhibit's display.

3 Results and Discussion

Based on Table 1, the samples consisted of 47 respondents of primary and secondary school students from different places according to the university's program joined by researchers such as Nature School Program: Junior Park Ranger, Pameran Karnival STEM Kebangsaan 2022 and Let's Start with UTHM Programme.

Table 1. Number of respondents

Name of program	Location	Number of sampled students
Nature School Program: Junior Park Ranger	Nature Education & Research Centre (NERC), Endau-Rompin	18
Pameran Karnival STEM Kebangsaan 2022	Mydin Mall Mutiara Rini, Johor Bahru	21
Let's Start with UTHM Programme	SMK Sultan Alauddin Riayat Shah 1, Pagoh	8
Total sample		47



Figure 1. Overview of 4-Senses Compact Exhibit (4SCE)

Based on Figure 1, all exhibit elements, flashcards, and posters were combined in the portable bag and ready to be displayed. The first sensory element is an insect jar with a magnifying lid. The second element for the sense of smell is fragrance oil in a glass bottle with a wooden lid, while the third element for the sense of hearing is an audio speaker. The last element for a sense of touching is bark, leaf, and insect's exoskeleton.

Table 2. The results on understanding about concept of biodiversity

Questions	Correct answer	Answer by students	Pre-treatment %	Post-treatment %
Ginger is one of the plants that has a strong smell.	Yes	Yes	85.1	100
		Not sure	12.8	0
		No	2.1	0
Tree bark has an uneven surface.	Yes	Yes	91.5	100
		Not sure	8.5	0
		No	0	0
The sound of the waterfall can be heard even from a great distance.	Yes	Yes	76.5	95.7
		Not sure	19.2	4.3
		No	4.3	0
Insects have three pairs of legs and two pairs of tentacles.	No	Yes	44.7	23.4
		Not sure	29.8	10.6
		No	25.5	66
Lemongrass is often used in cooking because of its fragrant aroma.	Yes	Yes	97.9	97.9
		Not sure	2.1	0
		No	0	2.1
Horned beetles have a rough and shiny body surface.	No	Yes	57.4	42.6
		Not sure	29.8	4.3
		No	12.8	53.1
Cicadas makes a very loud noise especially at night.	No	Yes	74.4	31.9
		Not sure	21.3	2.1
		No	4.3	66
The giant forest ant is one of the largest ants in the world.	Yes	Yes	53.2	95.7
		Not sure	46.8	4.3
		No	0	0
Papaya has a fragrant and sweet smell.	Yes	Yes	74.4	95.7
		Not sure	21.3	4.3
		No	4.3	0
The wings of cicadas are transparent.	Yes	Yes	51.1	95.7
		Not sure	48.9	2.1
		No	0	2.1
Each species of bird produces a different sound rhythm.	Yes	Yes	85.1	87.2
		Not sure	12.8	10.6
		No	2.1	2.1
Insects have two body parts, the head and abdomen.	No	Yes	48.9	19.1
		Not sure	19.2	10.6
		No	31.9	70.2

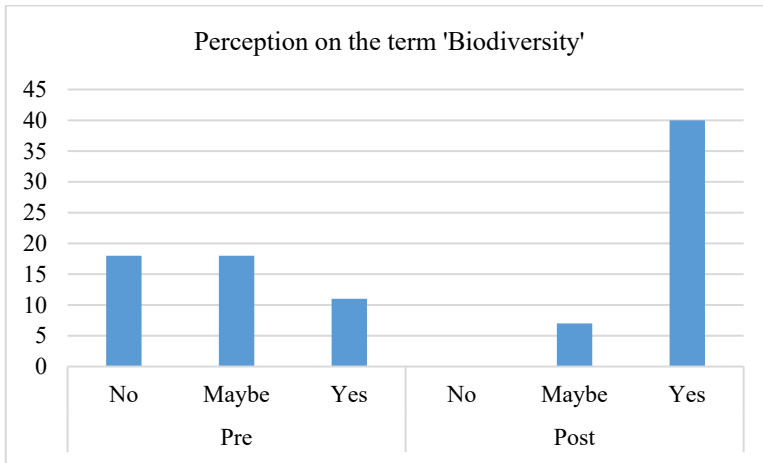


Figure 2. Graph of respondents' answers for questions pre- and post-treatment: "Have you ever heard of the term of biodiversity?"

Figure 2 shows the percentage of respondents who answered, "Have you ever heard of the term biodiversity?" before and after treatment. both questions require students to choose whether they have ever heard of the term "biodiversity" before and after the treatment. The most frequent answers ticked by the respondents during pre-treatment were the first and second choices, which both received 38.3 % of respondents (18 students each), followed by the third choice with 23.40% of respondents (11 students). However, the most frequent answer ticked by the respondents during post-treatment was the third choice, which was selected by 85.11% of respondents (40 students), followed by the second choice with 14.89% of respondents (7 students), and there was no respondent tick for the first choice. Hence, we can see that most of the respondents have heard about the definition of biodiversity and know it clearly after the exhibition compared to before.

Table 2 shows the comparison between the percentage of respondents answering questions on their understanding of the concept of biodiversity during pre-and post-treatment. Overall, respondents indicated that their ability to answer the correct question after treatment was higher than before treatment, as highlighted in the table. From all nineteen questions that have been asked, only one question was answered correctly during the pre-treatment test. All the questions given were answered during the treatment. This method can assist respondents in providing the correct answer, and the researcher can predict whether respondents are focused and understand the exhibit based on the answer. Thus, we can conclude from the result that students were focused and understood each detail explained during the exhibition, as well as that their level of understanding of the concept of biodiversity was increased.

Table 3 shows the comparison between the percentage of respondents answering questions on understanding the portable exhibit of the 4-Senses Compact Exhibit during pre-and post-treatment. Overall, students from both primary and secondary schools gave a positive answer during the post-treatment. All respondents are able to relate natural history to biodiversity. Furthermore, they concur that the 4-Senses Compact Exhibit is both engaging and enjoyable. This shows that the 4-Senses Compact Exhibit has become an educational tool that attracts their interest and helps them focus on understanding biodiversity. This finding was consistent with research conducted by [10], who found that children who participated in outdoor activities as part of a therapy intervention knew much more about the environment than they did previously.

Table 3. The results on understanding about the portable exhibit

Questions	Answer by students	Pre exhibition (%)	Post exhibition (%)
I have visited the natural history exhibition.	Yes	40.4	93.6
	Not sure	17	2.1
	No	42.6	4.3
Natural history exhibition is closely related to biodiversity.	Yes	63.8	100
	Not sure	34	0
	No	2.1	0
The portable natural history exhibit is a compact and easy-to-carry exhibit.	Yes	59.6	95.7
	Not sure	31.9	0
	No	8.5	4.3
This portable natural history exhibit is very interesting and fun.	Yes	72.3	100
	Not sure	27.7	0
	No	0	0
This exhibit is suitable for all age groups to learn about the components of biodiversity found in Malaysia.	Yes	74.5	97.9
	Not sure	21.3	0
	No	4.3	2.1
I was able to stimulate the senses of sight, smell, sound, and touch through this portable exhibit.	Yes	53.2	97.9
	Not sure	42.6	2.1
	No	4.3	0
Through this exhibit I was able to increase my knowledge and level of awareness of biodiversity.	Yes	57.5	95.7
	Not sure	40.4	0
	No	2.1	4.3
I was able to handle my curiosity through all the components in this portable exhibit.	Yes	57.5	95.7
	Not sure	40.4	4.3
	No	2.1	0
This exhibit is very helpful especially in the learning and education process.	Yes	61.7	89.4
	Not sure	38.3	8.5
	No	0	2.1
I am interested in learning more knowledge through this portable exhibit.	Yes	72.3	93.6
	Not sure	27.7	0
	No	0	4.3
I hope this natural history exhibition can be done more often in various places.	Yes	57.5	95.7
	Not sure	34	0
	No	8.5	4.3

Table 4 shows the perspective of students' preferences on product acceptance. Throughout all exhibitions, students are most drawn to exhibits that involve a sense of touch. This might be because the specimens used for this exhibit are rarely found, which triggered their curiosity to experience touch and learn more about them. The sense of hearing is the least attractive exhibit in the 4-Senses Compact Exhibit. A potential factor that could diminish the appeal lies in the respondents' daily familiarity with the sound, leading to disinterest or boredom upon encountering it.

Table 4. Perspective of student's preferences on product acceptance

Types of sense	Nature School Program, NERC, Endau-Rompin	Pameran Karnival STEM Kebangsaan 2022, Mydin Mall Mutiara Rini, Johor Bahru	Let's Stat Programme, SMK Sultan Alauddin Riayat Shah 1, Pagoh
Seeing – Magnifying plastic jar	/	/	
Hearing – Audio recorder			/
Smelling – Essential oils		/	/
Touching – Bark, insect skeleton and dries leaf	/	/	/

4 Conclusion

The results of the pre-treatment questionnaire, which was given before the students were exposed to the 4-Senses Compact Exhibit, showed that the student's level of awareness of biodiversity was still quite low. Fortunately, according to the outcomes of a post-treatment survey, students exhibited an increased awareness of biodiversity following their exposure to the 4-Senses Compact Exhibit, designed to stimulate the senses of sight, smell, hearing, and touch. Consequently, this study concludes that the prototype of the 4-Sense Compact Exhibit is an efficacious and innovative tool for fostering biodiversity awareness among school children. As was already mentioned, providing students with exposure to this exhibition motivates them to delve into further studies and allows them to engage with the exhibit actively. Additionally, the experience proves to be advantageous.

The 4 Senses-Compact Exhibit has great potential for motivating the younger generation, particularly pupils in primary and secondary schools, to mainstream biodiversity. Through observation of the kids' responses to the senses of sight, smell, sound, and touch, this study will assist in gathering data and information on how these pupils are aware of and knowledgeable about biodiversity. Due to their exposure, students are encouraged to explore and experiment with the exhibit. Additionally, it supports students' early comprehension and knowledge of biodiversity.

As a suggestion, marketing this product as an educational tool presents a significant opportunity for the researcher to contribute to the market, aiding students in understanding and promoting biodiversity in the country. Additionally, it would be advantageous for future research to broaden the sample scope to incorporate university students, considering universities as valuable settings for exploring additional research details.

This research was made possible by funding from research grant number tier 1 Q010, "Development of UTHM natural history gallery," provided by Universiti Tun Hussein Onn Malaysia. The authors would also like to thank the Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, for its support.

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