

CONSTRUCTION AND SETTING-UP OF AN AQUARIUM: A TEACHING AID FOR BIOLOGICAL SCIENCES

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ABSTRACT

Background of Study: An aquarium is an artificial pool keeping living aquatic organisms. This system simulates the natural aquatic system in Biological science. Biological science is a field of science that helps us to inquire about living and non-living things. However, one of the problems mostly encountered in the teaching of Biological Science are topics that involve practical activities where the students need to connect with real situations to understand the theoretical concepts, thus the need for teaching aids.

Methodology: The tank was constructed with 10mm and 4mm glass, tested for leakages and all materials needed for its set-up were introduced accordingly. The living organisms (plants and fishes) were introduced after the water quality had been tested. The objectives of this study were to construct an aquarium box and set up an aquarium of life plants and animals as a teaching aid for Biological science.

Results: The completed aquarium measured 2.11ft in length, 1.3ft in width and 1.4ft in height, providing a total volume of 120 litres. The aquarium test strip was used to determine the water quality and read against the standard.

Conclusion: The result revealed that the pH was 6.4 while nitrate, nitrite, carbonate, chlorine, total alkalinity and hardness were the same as the standard colour code for safe usage.

Keywords: aquarium, teaching aid, biological science, aquatic organisms.

Introduction

An aquarium is an artificial compartment for maintaining and displaying living aquatic plants and animals for various purposes such as breeding, decoration and research. Aquarists use aquaria to keep fish, invertebrates, amphibians, aquatic reptiles such as turtles and aquatic plants. Science is an intellectual activity designed to discover information about the natural world in which humans live and to discover how this information can be organized into meaningful patterns (Taylor, 2008). Biological science helps

us to inquire about living and non-living things and also preserve life (Yildirim, 2008). Experience is the source of all knowledge and the importance of practical activities in science lessons has been emphasized at all levels of education, hence, the need for teaching aids / instructional materials. A large amount of what science deals with cannot be seen, thus the need for instructional materials. Instructional materials and teaching aids are potent tools in the science classroom as it help to represent, describe, elucidate and add more explanation about the living world.

Instructional materials are educational resources used to improve students' knowledge, abilities and skills to monitor their assimilation of information and to contribute to their overall development and upbringing (Afolabi, 2003). It gives learners hands-on experience. Ibe and Abamu (2019) established that the application of hands-on activity that is the use of hands-on instructional material will help improve and make learning more effective as students can manage their learning and apply it in their independent study. These aids allow teachers to consider and conduct research faster and aid in facilitating students' learning through instruction. According to Atadoga and Onalapo (2018), teaching aids encourage self-reliance, and creativity and establish a mental bridge that takes students from mental indigestion or abstraction to a nodding acquaintance with reality. Calascibetta *et al.* (2000) carried out a study on aquariums as a means for interdisciplinary teaching of Chemistry. The results they obtained during the period of experimentation led to them confirming and emphasizing the potential of using aquariums for teaching in technical schools. They further stated it will help in the analysis of physicochemical parameters required in monitoring an aquarium as a more stimulating way of introducing the principles and procedures related to classical and instrumental analytical techniques. They concluded that the use of an aquarium for teaching proved extremely helpful in arousing the learners' interest and giving a more concrete image of science. Usendu *et al.* (2023) reported that the use of an improvised aquarium facilitated students' academic achievement in Biology teaching and learning. One of the problems mostly encountered in the teaching of Biological Science is teaching a topic that involves practical activities in which the students need to connect with real situations to understand the theoretical concepts. One effective tool that can be utilized in the Biology classroom and laboratory is the aquarium. It can be useful in teaching topics like ecology, the water cycle, the food chain/web and conservation.. This tool can stimulate students' interest in the course of teaching and learning as it makes abstract scientific ideas that cannot always be seen and understood. This study was carried out to achieve the following objectives; i) to construct an aquarium box; ii) to set up an aquarium of life plants and animals as a teaching aid/instructional material for Biology teaching and laboratory activities which is a prerequisite for students.

Materials and Method

This research work was carried out in the Biology Department Laboratory of the School of Secondary Education (Sciences), Federal College of Education (Technical), Ekiadolor. The following materials were used to set up the aquarium; tampered glass of 10mm and 4mm thickness, substrate, lighting, air pump, filter, aquarium steel frame, fishes, sea shell, tree deco, air stones, wave maker and silicone sealant. The following steps were followed in installing the aquarium tank. Firstly, the bottom piece of the glass measuring 889mm x 410mm was placed down and then surrounded by the front and back glass panels measuring 889mm x 380mm. Glass edges were cleaned before silicone sealant was applied to hold them

together. This was allowed to be fixed before the side glass panels measuring 410mm x 380 mm were installed using the silicone sealant. Once the tank had been set up, it was tested for leakages after it was allowed to dry. After testing for leakages, the tank was wiped dry with a clean cloth and placed inside the steel frame for protection of the edges.

The next stage was the introduction of the substrates which were made of white sand, gravel, white pebbles and small rocks. The first substrate was a layer of fine white sand followed by medium size gravels after which white pebbles gravel was introduced and levelled. Then, a few rocks were added at the bottom. Clean water was introduced into the compartment by placing a small bowl on the substrate and the water was allowed to pour into the bowl. The water ran over the sides of the bowl, thus filling the tank without disturbing the substrates. When the desired water level was achieved, the tree deco, sea shells, filtration system, wave maker and air pump connected to an air stone were all introduced accordingly. The water quality parameters were checked using water test strips for pH, nitrate, nitrite, chlorine, alkalinity, carbonate and total hardness. Once the water parameters were checked and certified ok, the live plants were introduced. After that, the fish which were brought in oxygenated water bags from the vendor were slipped into the tank. The tank cover was put in place and the overhead light was installed over the cover (Ngueku, 2014).

Results:

The table below shows the water quality parameters measured using an aquarium test strip:

Parameter	Measured Value	Standard Colour Code
pH	6.4	Same as Standard
Nitrate	Safe	Same as Standard
Nitrite	Safe	Same as Standard
Carbonate	Safe	Same as Standard
Chlorine	Safe	Same as Standard
Total Alkalinity	Safe	Same as Standard
Hardness	Safe	Same as Standard

The completed aquarium measured 2.11ft in length, 1.3ft in width and 1.4ft in height, providing a total volume of 120 litres. The aquarium was equipped with a filtration system, wave maker and air pump. The filtration system helped to maintain the clarity and quality of the water while the wave maker facilitated current production in the aquarium just like the natural environment for the organisms in the system. The aquarium test strip used to determine the water quality was read against the standard and the result revealed that the pH was 6.4 while nitrate, nitrite, carbonate, chlorine, total alkalinity and hardness were the same as the standard colour code for safe usage.

Discussion

The constructed aquarium will be used as a valuable teaching aid in biological sciences, offering a unique opportunity for students to observe and study aquatic organisms in a controlled environment. The aquarium's design and layout support optimal viewing and accessibility, making it an ideal resource for teaching and learning. The variety of aquatic organisms kept in the system will provide a broad range of topics for study such as including ecology, water cycle, purification, animal behaviour, physiology and conservation studies. The white sand, gravel, white pebbles and rocks in the aquarium also provide an artificial favourable environment to aid the fishes and plants' survival as well as add to the attractive beauty of the aquarium environment.

Conclusion

The constructed aquarium as a teaching aid in biological sciences will help students understand better biological concepts as well as help them appreciate how dependent the biotic community is on the abiotic components of the environment. As a teaching aid, the aquarium has the possibility of enhancing students' understanding and appreciation of biological sciences, promoting a deeper understanding of the natural world.

It will assist students in becoming sensitive to the effects of destroying part of the ecosystem or removing a particular organism. They also put into consideration issues, such as endangered species and the impacts of human intervention in a habitat.

Recommendation:

Biological science deals with a large amount of what cannot be seen, thus the need for instructional materials cannot be over-emphasized. It is recommended that the aquarium is made use of when teaching Biological concepts such as the interactions between aquatic organisms and their environment, adaptations of aquatic organisms to their environment the role of aquatic plants in photosynthesis and the impact of respiration on water quality.

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CONFLICT OF INTEREST: We hereby declare zero conflict of interest in this study

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