Teaching Material for Environmental Literacy: Exhibiting Fish and Arthropods with Epoxy Resin Method, Introducing them with DataMatrix

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ABSTRACT

The protection of biodiversity is important for our future and the increase in environmental problems shows the importance of raising environmental awareness. Within the scope of the rich biodiversity of our country, the importance of active learning of arthropods and fish in biology lessons is increasing. In addition, the distance of students from arthropods for various reasons poses a problem in raising an environmentally conscious individual.

Keywords : *: Biodiversity, Epoxy Resin, Teaching Material, Fish, Arthropod*

1. Main Abstract

The protection of biodiversity is important for our future and the increase in environmental problems shows the importance of raising environmental awareness. Within the scope of the rich biodiversity of our country, the importance of active learning of arthropods and fish in biology lessons is increasing. In addition, the distance of students from arthropods for various reasons poses a problem in raising an environmentally conscious individual. The lack of importance given to laboratory activities in schools and the difficulties in preparing the materials related to the classification of 9th grade living things make it difficult to teach the concepts. When the textbooks are examined, it is seen that the examples related to the animal kingdom are insufficient and make it difficult to learn the concepts. Exhibiting fish and arthropod specimens in epoxy resin in biology laboratories instead of storing them in ethanol or formalin provides more usage areas. In this method, the color loss in stuffed animals is less than those stored in liquid. Our aim of the project is to prepare permanent and useful teaching materials by embedding arthropods from Giresun region and fish samples from our region, obtained from fishermen's stalls, in epoxy resin. Preferred fish species for epoxy resin application for our project, Carassius gibelio (Israeli Carp), Salmo trutta (Stream trout), Leuciscus cephalus (Pulleyfish), Diplodus annularis (Sparring), Chelidonichthys lucernus (Swallow), Hippocampus guttulatus (Sea squid) fish) was. In addition, the arthropod specimens treated with epoxy resin were Carcinus spp. (Freshwater crab), Pachygrapsus spp. (Saltwater crab), Scorpiones spp. (scorpion), Araneae spp. (spider), Lepidoptera spp. (Scaly-winged), Mantodea spp. (Mantis), Odonata spp. (Daughter beetle), and Coleoptera spp. A website called https://bio.giresunfenlisesi.com/ containing information on epoxy samples was prepared and mobile phones were directed to the relevant section of the website with the QR code application.

2. Introduction

Conservation of biodiversity is important for our future and it shows the importance of environmental experiences in raising people's environmental awareness [1].

It will be very useful to provide active learning in biology lessons about the fish diversity of our country surrounded by seas on all four sides and to raise awareness about their importance in the ecosystem. In the same context, students' distance from invertebrates to arthropods causes negative attitudes. The teaching material to be prepared will be used in the biology laboratory environment of our school and will contribute positively to the active learning process. In addition, the prepared materials will give the opportunity to get to know and examine the fish diversity and arthropods of our country.

The lack of importance given to laboratory activities in schools and the difficulties in preparing the materials related to the classification of 9th grade living things make it difficult to teach the concepts. When the textbooks are examined, it is seen that the examples related to the animal kingdom are insufficient and make it difficult to learn the concepts.

The tools used in biology laboratories in secondary education provide permanent learning and active learning [2]. For this purpose, it is important to prepare and exhibit auxiliary materials for biology lesson laboratory applications by using fish belonging to our region, which are sold at the fishermen's stall by Giresun fishermen, and arthropods living in our region caught by us.

Our aim of the project is to prepare permanent and useful teaching materials by embedding arthropods of Giresun region and fish samples obtained from fishermen's stalls in epoxy resin medium. In addition, it is to prepare a website containing information on arthropod-fish samples with epoxy application and to direct mobile phones to the relevant website section with data matrix application.

Our project differs from the studies mentioned in the literature on the following issues.

1. Epoxy resin application for Fish and Arthropods
2. Exhibition of epoxy resin samples in the biology laboratory
3. Establishment of a website where epoxy resin samples are promoted
4. Creating and routing data matrix for each sample

Students' distance from insects causes negative attitudes.

Conservation of biodiversity is important for our future. It is important to raise awareness for arthropods from invertebrates and to prevent their destruction.Providing active learning about the fish diversity of our country

surrounded by seas on all four sides and raising awareness about their importance in the ecosystem will be very useful for the biology course. In our project, permanent and useful teaching materials were prepared by embedding the arthropods of the Giresun region and the fish samples obtained from the fishermen's stalls in the epoxy environment.

The prepared teaching material will be used in the biology laboratory environment of our school and will contribute positively to the active learning process. In addition, the prepared materials will give an opportunity to recognize and examine for students who have fear of arthropods such as insects and scorpions.

The collections of invertebrates and fish from vertebrates are an important source for studies on biodiversity for the purpose of course material in secondary education biology laboratories. There are many methods for preservation in the preparation, preparation, archiving, display and educational use of materials in school laboratories. Among the methods used for the preservation of these materials; drying method by drawing the tissue fluid of the animal, the method of storing the tissue in ethanol or form aldehyde solution, and the method of freezing the whole body in the refrigerator [3].

If there is too much material, it will be technically difficult to store whole samples in ethanol or formaldehyde solution or to freeze them. Therefore, the most appropriate storage method for future genetic activities is to store skin and skull samples [4]. In fish, a similar structure can be prepared from gills and fins and covered with skin [5]. It also provides DNA analysis thanks to the tissue samples obtained from the materials [6].

Taksidermi has been translated into Turkish as embalming. The foundations of the embalming method are based on mummification in ancient Egypt. In the 19th century, some taxidermists began to remove the bones completely and add them to separate collections [7]. In addition, specimens are preferred more in museums for systematic and paleontological studies because they are preserved with their spines [8].

2.1. Material Development and Model Teaching Method

With the developing and changing conditions, educators and those who need other presentation technologies can easily find the teaching tools and materials they need in the market. In these cases, teachers can prepare some of the tools and materials they need themselves, or they can have students prepare by guiding them [9]. What makes the use of materials in education so valuable is the linear relationship between learning and sense organs. Students learn 83% of their learning by sight, 11% by hearing, 3.5% by smell, 1.5% by touch and 1% by taste. In addition, people remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say and 90% of what they do and say [10]. The effect of seeing and hearing on learning at this rate makes the design of visual materials extremely important.

Model Teaching Method; It is a teaching method applied with the help of examples of real objects made of the same or other material, and objects brought to the classroom from their natural environment. Models may be larger or smaller than the original object, or may be exactly the same size and structure as the actual object it replaces [11].

In the field of science, it is important for students to acquire concepts that are difficult to reach, dangerous, inaccessible even though they are abstract or concrete, both visually, audibly and descriptively by using models in the classroom environment and by making use of today's technology [12].

2.2. EPOXY Method and Material Development

Epoxy is any of the main components or cured end products of 'epoxy resins' and also the name of the epoxide functional group [13]. Epoxy has a wide range of applications for structural and other purposes, including use in metal coatings, electronic/electrical components/LEDs, high voltage electrical insulators, paint brush fabrication, fiber-reinforced plastic materials and adhesive. Epoxy is an adhesive chemical resin from the thermosets group. Its resistance to water, acid and alkali is very good, it does not lose its resistance feature over time. The epoxy adhesive filled in the crack transforms the discontinuity environment created by the crack into a continuous state, continuously bonds both sides of the crack along the crack and prevents stress accumulations. Generally, two-component epoxies, like other thermoset plastics, go from liquid to solid after a certain period of time and reach their final hardness by maturing within a week or two. The word epoxy is derived from two Greek prefixes: “epi” meaning “over” and “oxy” meaning “sharp/acidic”. Epoxy resin mixed with pigment can be poured in layers to create a painting medium. It is also used in the form of dome resin for jewelry, embellishments and labels, and in decoupage applications for art, countertops and tables [14]. Epoxy resin was first synthesized in 1930 and used for many industrial applications. These application areas are; building materials, coatings, composite materials, aerospace, laminates, adhesives [15].

3. Method and Experimental Details

3.1. Tools Used

Materials used for epoxy treatment for arthropods and fish:

- 4 units ARC brand Ultra Transparent Cast Type Glossy Epoxy Resin Transparent Set
- 1 unit of ARC brand Hardener
- Plastic Silicone Gun
- Silicone Sealant 500 ml for the production of 2 molds
- Container and wooden stick for mixing Epoxy Resin and Hardener
- Pin for fastening
- Electronic balance
- A 5 lt basin provided for use in making silicone molds
- Liquid soap

3.2. Epoxy Application Stages

I. Silicone Mold Design: 4 liters of tap water and liquid soap were put into the basin provided to be used in mold making and mixed.

II. With the help of 500 ml Plastic Silicone Gun, Silicone Sealant is poured into the basin and shaped with the help of hand, silicone molds are obtained (Fig.1).

Fig. 1: Silicone Mold Making

III. 4 parts of Transparent Epoxy Resin and 1 part

part of Hardener were mixed with the help of an electronic balance in a suitable container with the help of a wooden stick for 10 minutes (Fig. 2).

Fig.2: Mixing Epoxy Resin and Hardener

IV. After pouring some of the Epoxy Resin and Hardener mixture into the molds, arthropod and fish samples were placed in epoxy. The remaining part of the epoxy mixture is poured on the sample (Fig. 3& Fig. 4).

Fig. 3: Placing invertebrate specimens in epoxy

Fig.4: Placing fish samples in epoxy

3.3. Arthropod and Fish Samples Treated with Epoxy

The arthropod specimens caught by us and the local names of the fish species offered for sale by the fishermen are the species names.

- Carassius gibelio (Israeli Carp)
- Salmo trutta (Stream trout)
- Carcinus aestuarii (Freshwater crab)
- Pachygrapsus marmoratus (Saltwater crab - Marmara hermit crab)
- Leuciscus cephalus (Freshwater mullet, Pulley fish)
- Diplodus annularis (Sparse fish)
- Chelidonichthys lucernus (Swallow)
- Hippocampus guttulatus (Sea Horse Fish)
- Arthropod collection in bulk: Arachnida (scorpion-spider), Lepidoptera (Scaly-winged), Mantodea (Mantis), Odonata (Girl beetles) and Coleoptera (Beetle-wings)

3.4. Website Preparation

A website containing information on arthropod and fish species on which epoxy application is made has been prepared on the website whose link is given below, with the facilities of our school.

For each arthropod or fish species in each epoxy application, a section containing information has been prepared on the website (Fig.5).

- Website address: https://bio.giresunfenlisesi.com/

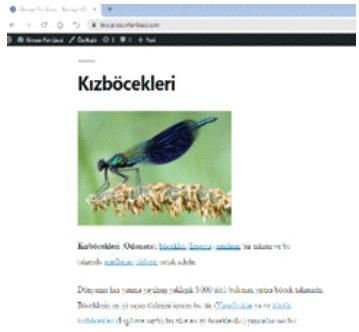


Fig.5: Snapshot of our website

3.5. QR Code Application

With the help of the new free add-on of the Google chrome application used for browser purposes, a QR code has been created for each epoxy. The student, who examines the epoxy material in the laboratory environment, will be directed to the website:
https://bio.giresunfenlisesi.com/
with the help of the data matrix application on the epoxy with the help of a mobile phone and have information about the related species. As seen in Figure 2.6, it is directed to the website with the data matrix created for the seahorse placed in epoxy.

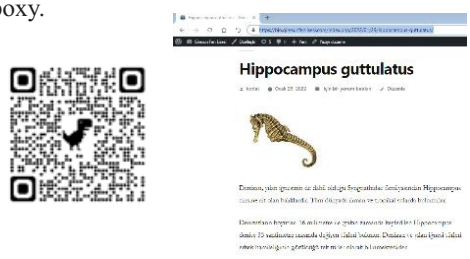


Fig.6. : The relevant section on the website directed by QR code

4. Result

Epoxy samples made by us for Carcinus aestuarii (Freshwater crab) samples for course material in the laboratory environment are shown in Figure(7) and Pachygrapsus marmoratus in Figure(8).

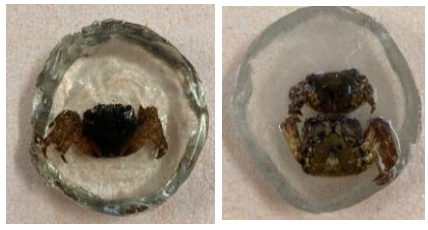
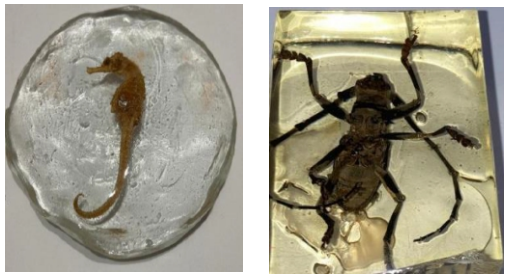


Fig.7: Carcinus aestuarii

Fig. 8: Pachygrapsus marmoratus

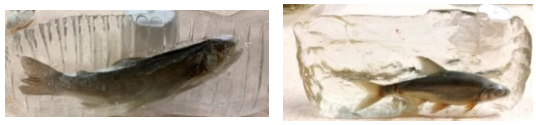
Other samples are in Figures (9-15).



a b

Fig. 9: a) Hippocampus guttulatus; b) Hylotrupes spp. (Coleoptera)

Fig. 10: Examples of Arthropoda (Arachnida, Lepidoptera (Scaly-winged), Mantodea (Mantis), Odonata (Dragon beetle) and Coleoptera (Beetle)

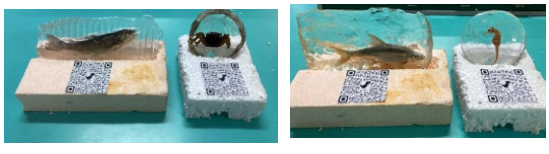


a b

Fig. 11: a) Salmo trutta (Stream trout); b) Carassius gibelio (Israeli Carp)

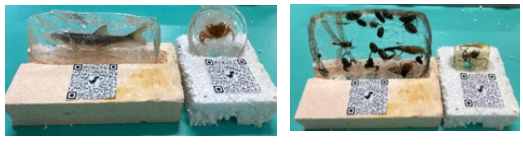
a b

Fig. 12: a) Leuciscus cephalus (Pulleyfish); b) Diplodus annularis (Sparrow) and Chelidonichthys lucernus (Swallow)



a b

Fig. 13: a) Biology laboratory exhibition material-1; material 2



a b

Fig. 14: a) Biology laboratory exhibition material-3; material 4

5. Conclusion

It will be very useful to provide active learning in biology lessons about the fish diversity of our country surrounded by seas on all four sides and to raise awareness about their importance in the ecosystem. In the same context, students' distance from invertebrates to arthropods causes negative attitudes. The teaching material to be prepared will be used in the biology laboratory environment of our school and will contribute positively to the active learning process. In addition, the prepared materials will give the opportunity to get to know and examine the fish diversity and arthropods of our country.

The lack of importance given to laboratory activities in schools and the difficulties in preparing the materials related to the classification of 9th grade living things make it difficult to teach the concepts. When the textbooks are examined, it is seen that the examples related to the animal kingdom are insufficient and make it difficult to learn the concepts. For this purpose, it is important to prepare and exhibit auxiliary materials for biology lesson laboratory applications by using the fish belonging to our region, which are sold at the fishermen's stall by Giresun fishermen, and the arthropods living in our region caught by us.

Permanent and useful teaching materials were prepared by embedding the arthropods of the Giresun region and the fish samples obtained from the fishermen's stalls in the epoxy environment. In addition, a website named containing information about the Arthropod-Fish samples, on which epoxy was applied, was prepared. With the QR code application, mobile phones were directed to the relevant website section. In school laboratories and field studies, difficulties are faced in terms of fluid transport protocols. Therefore, materials in alcohol or formalin solution limit studies. Color loss in animals stuffed with this method is less than those stored in liquid. Since the samples are prevented from getting air, it will protect against the effect of moth in school laboratories. Thus, the maintenance cost of the samples has been reduced compared to the formaldehyde-alcohol mixture that needs to be renewed. It provides convenience for the storage of samples.

This method minimizes possible risks and side effects and makes it possible for people with odor sensitivity and chemical respiration problems to be less affected if they work in this field. With this method, while working with materials prepared for educational purposes, it is possible to perform a healthier laboratory work by being exposed to the least chemical vapor and active substance. In particular, the preparation of course materials with this method will be more useful in terms of health and visuality. In biology teaching, both educational situations and the abstract and complex nature of biology concepts cause students to have difficulty in understanding some subjects and to learn by memorizing without understanding. In order to solve this problem, well-prepared three-dimensional models in biology lessons provide easier comprehension of information [17]. In studies on new curricula in Turkey, it is frequently encountered that there are teachers' opinions that "significant disruptions are experienced in the implementation of the curricula due to the lack of structures, tools, materials and materials" [18]. Model teaching method; It is a teaching method applied with the help of examples of real objects made of the same or other material, and objects brought to the classroom from their natural environment [11].

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