

HSCI2007

Proceedings of the
4th International Conference on

Hands-on Science

Development, Diversity and Inclusion in Science Education

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The Hands-on Science Network

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During these stage the contacts were constant and in some cases three or four days a week.

After every activity or in end of activities was necessary evaluating the repercussion of them and identifying problems and things to be changed in future actions. These also reveal complicated for the majority of the students (about 70%).

4.3. Write the work

The roles to write the work was establish in manual of seminar (general for all themes, in this paper only referred theme of biology).

The students contact to ask the items referred in contents, and they always had problems in writing everything in the 20 pages. Annex can be apart but it only allow put there photos and a copy of questionnaires done.

During the writing, normally, contact to ask the role and with doubt about how to introduce bibliography references in the middle of the text and how to do final references. To the last group orientated was send to all a text with all these explain and with examples. But when the final work was evaluated verified that a few number did not understand everything and done mistakes in it.

In this stage the contacts of students was by email and two times per week (average). A very few try to use Moodle platform at this stage.

4.4. Presentation of work

To present the written work orally, they have 10 minutes, the doubt is what tool to use. The students of continent went to university in Lisbon to done this presentation and students of islands done it by videoconference. The tool chose after our explanation was computer program PowerPoint.

5. Conclusions

This distance teaching is ideal for this kind of work because allow a permanent contact between teacher and students. The doubt that the student had can be explain in a few time. For the teacher was only necessary to have a computer with access to internet. Is equal a very good tool when our students came for all parts of country. In relation to the evaluation done by our students of the impacts the work had in communities the results were very good. In a lot of communities the mentalities of persons who contact with children (family, friends, neighbours, etc.) in fact stay more alert to several problems.

6. Acknowledgements

To my students and their student's parents that allow the used of the photos.

7. References

- [1] Pereira, A., Miranda, B. Problemas e Projectos Educacionais. Universidade Aberta, 2003.

Aquarium as a Tool for Teaching Sciences at All Grades Levels

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Abstract. The aquarium are an excellent hands on teaching tool in the classroom, it offers students the opportunity to learn directly through experience. The first step is to choose the environmental and animals specifically for the objectives of teaching. Its possible creates environments of different places: seashore, corals reef, lakes, different rivers, etc. The most common tool for classrooms is an aquarium of freshwater. The material necessary depends on the environment chosen. The second step is set up the aquarium with all material necessary. Then is necessary select the gravel and decoration roots or stones. If is recommend for the environment chosen the species of plants to introduce. Finally the fishes and invertebrates must be introduced. The phase of set up allows the classroom understands the requirements of animals and plants, come from different environments. A several examples of different environments aquariums will be referred. After the aquarium is established the water parameters must be control, such as water temperature, pH, ammonia, nitrite and nitrate levels. Graph the information and looks to trends is an excellent way in such levels to explain a lot of concepts. The animals must be fed with appropriate food, this introduce the concept of food chain. The reproduction and behaviour of animals are also very important to understand zoology concepts. The reproduction and grow up of plants are also very important to understand botany. Is given some examples of done this in classroom.

Keywords. Aquarium, Teaching Tools.

1. Introduction

Teaching sciences is not easy in classroom and students need to contact with real situations to understand the theoretical concepts. Is also not easy arranging an activity that involves and allows practical activities for disciplines such as biology, physics, chemistry and mathematics. One toll that can be used is aquarium in classroom. Normally the aquarium stimulates a lot of interested in the students, and is a moment of learning and relaxing.

2. What kind of environment and fishes in it

The first step is to choose what kind of environment. If the objective of set-up an aquarium is to study a determine environment, is easy. Otherwise if objective is using the aquarium as a tool to teach sciences in general, our advice is to choose a warm freshwater environment, because is easy to maintain and have a lot of potentialities as you can understand below.

Our advice is chosen environments with warm water. Is easy to put a thermostat and maintain the temperature than put a chiller to maintain low temperature and the last equipment is very expensive. The other reason to choose warm water is because fishes that lives in that conditions are colorful and have more attractive, in general.

The marine aquarium can be done in classroom, but the price of the equipment is higher, time necessary to the stabilization of the aquarium is longer and his maintenance is more complicated.

Choose a freshwater environment aquarium allow the classroom study in advance what kind of river or lake they like to set-up.

In first levels the teacher can explain that the current, temperature and water chemistry is different. This can be done showing photos of rivers and lakes and chemistry is easy if different kinds of bottled mineral and natural water are given to taste to the students.

In high levels can be explain the different conditions of environments and put students to study what the differences in water chemistry, current, etc, between the different environments. Can also study what species are in endangerment in each habitat. Our advice is to study a river environment with current, one of lakes of rift (Malawi or Tanganyika), Amazonian environment and Asian environment. The students can also study the needs of the fishes of each environment and compatibility between them. Composition of decoration must be study and the possibility of introduce it in each

environment. Is also necessary study the behavior of fishes if is better to maintain a couple or maintain a shoal. If were considering: a rift lake of Africa, which has high pH, calcareous stone and gravel, must be chosen, Amazonian river that have low pH, natural roots are the appropriate. The necessary current also be study and students calculated the power of the pump need for an aquarium and to a determine environment.

Temperature is very important and in warm water are a lot of fishes with different requires. For example Amazonian environment the temperature is 28°C and in Rift Lake is 25°C.

Fishes live in different water layers. There are fish species mostly swim near the surface, in the middle or near the bottom of the aquarium. In order to have fish in all water layers is necessary considerer this when selecting the fish.

3. Plants

The aquarium must have plants. A beautiful planted aquarium is a relaxing and decorative. Apart of decorating plants also help the maintenance of a healthy aquarium and offer the fish hideaways and reduce the stress. Plants are also, good places to young fish hide from the adults.

Plants are an excellent oxygen provider and remove nitrate that is an algae grow promoter.

The plants to introduce in aquarium must be of different types and with optimum of living appropriate to environment chosen. Is interesting choose a plant that gives flowers. In classroom can be discuss the different types of plants and their requirements. The quantity of light, radiation necessary and temperature are essential to a good grown and to maintain healthy plants.

Another aspect to take in account is avoiding plants that the fish chosen to eat.

When was considerer the height of plants there are three types. Foreground Plants that must be smaller to not obstruct the view into the aquarium. Middle ground plants that can be solitary or planted in groups and backgrounds plants that decorating the back of aquarium and help to hide the material necessary for the correct functioned of it.

Depend of the environment chosen can also be introduce floating plants.

Plants must be "fed", they must be had a good substrate (like home plants) and in some cases must be added to water a fertilizer.

4. Set-up the aquarium

To set-up the aquarium is need the glass aquarium. The aquarium of 80 cm length is

enough, if there is space limitation it can also be an aquarium of 60 cm length.

The localization of aquarium in classroom must be appropriate. Choose a quiet place away from direct sunlight, because sunlight can promote algae growth. The power supply should be above the aquarium, if possible, to prevent water spills going into the outlets during maintenance. After put the tank in final localization, must prepare the other equipment necessary: filtration system, heater and lighting.

To have a good water quality is necessary have mechanical filtration and biological water cleaning. In the last one microorganism, such as bacteria, make that pollutants such as fish excrements and dead plants are broken down biologically. Both of these process can be done by modern extern filters, is only necessary put inside the filter sponge to made mechanical filtration and a substrate that provides ideal condition for bacteria (these must have large and rough surface).

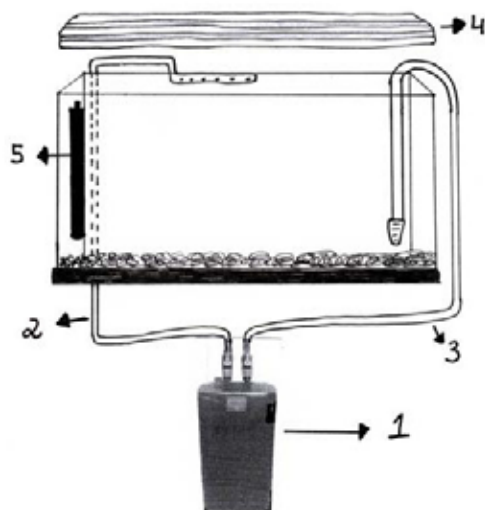


Figure 1. Scheme of an aquarium with equipment.
1 – External filter, 2 – Water from filter to aquarium, 3 – Water from aquarium to filter, 4 – Lighting, 5 – Heater

The bottom must have a substrate that contains essential nutrients, valuable humic acids, as well as trace elements, that provide the plants with everything they need. After that a layer of gravel were added (Figure 1).

The gravel and decorative pieces must be natural, such as roots, bog wood, stones (granite, limestone, lava, etc.), these as referred above must respect the environment chosen.

Before start put decoration and plants inside the aquarium must be planning the decoration design, technical equipment in the aquarium

(filter, heater, etc.) can be hidden in such a way that they become invisible when you look to the aquarium.

After decorating the aquarium and put the plants you can fill it with water and turn on the equipment. Tap water needs to be conditioned according to the requirements of the fishes. The tap water quite often has disinfecting chemicals such as chlorine to kill dangerous bacteria and pathogens. But the chemicals also provoke damages in fish and kill bacteria of the biological filter. The products to conditioner the tap water are easily found in commerce. When fill the aquarium put a plate in bottom to avoid the flux of water remove the gravel.

Fish are only added a few days later, with this allows the bacteria to grow in our filtration system and all small particles that stay in suspension after filled the aquarium will be in the bottom of the aquarium or in the filtration system.

5. Maintaining the aquarium

After the aquarium is functional, with all animals and plants in it (Figure 2), another step is begun - the maintenance period.



Figure 2. Aquarium with 60 cm length after set-up with Amazonian environment

Students collect data, with a periodicity estimate before, from an aquarium by measuring and recording water temperature, pH, GH, KH, nitrate, nitrite and ammonia levels. The data can be plot in a graph, and the information studied. Observe the trends can be correlating the differences with events in aquarium. For example if water is changed and the new water is from home canalization can be seen pH variances. After setup and before the aquarium is stable the levels of nitrate, nitrite and ammonia are an excellent period to explain in high levels the nitrogen cycle. If pH must be correct, adding products, the quantity of product necessary can

be done as an exercise of chemistry in classroom.

In biology classes the student can observe the growth rates of the different animals and plants and register these.



Figure 3. Cichlid Fishes with fry

The type of food added to fish can be also a good example to study different types of alimentation. Introduce a leaf of spinach in aquarium lead to some herbivorous fishes going to eat it and some carnivorous will try it and then throw out the spinach. Is interesting observe some herbivorous graze on algae that grow in glasses and decorative things.



Figure 4. Cichlid Fish protecting the nest

The observation of coloration of fishes (when they have sexual dimorphism) is a good away of understanding the differences and also observed that before spawning period the colors are intensifying. The courtship period, if the students were lucky to be observed the aquarium in this period, is also very interested to observe a particular behavior.

The different types of reproduction can also be observed, if you choose a fish that easily reproduces and in aquarium you have fishes that the parents take care of the fry, like the fishes belongs to cichlid family (Figure 3) the students

can observed a very interested behavior (Figure 4).

If the aquarium have livebearers can be easily observe the behavior of viviparous and students can compare the differences.

There are some cares that is necessary for a healthy aquarium. One is water changed, 20 % per week is good. Cleaning the external filter is also necessary. The sponge can be wash normally but biological part no, because is necessary prevent the dead of the bacteria. Algae can be removed from the tank glass with an algae magnet or scraper. Regularly remove any dead leaves from live plants as was done to home plants. If plants need some substrate it must added to water.

The alimentation required by fishes lived in an aquarium can be different and is necessary given different kinds of food in a way of given to everyone their appropriate food. Take care to do not overfeed the fishes as this will cause excess waste in the water which will settle at the bottom of the tank and need to be removed (Figure 5).



Figure 5. Giving alimentation to the fishes

6. Final consideration

With an aquarium in classroom students understand the relationship between producers, consumers, scavengers, and decomposers.

The aquarium allows students to understand the biological concepts as competition for a territory, between animals and between plants. Furthermore, by studying its chemistry, students realize how quite dependent the biotic community is on the abiotic components of the system.

In relation to chemical of water students can learn the nitrogen cycle, pH, hardness of water and how these parameters changed.

Students become sensitive to the effects of destroying part of an ecosystem or removing a particular organism. They also consider more complex issues, such as endangered species

and the impacts of human intervention in a habitat.

7. Acknowledgements

To Delfim Machado to allowed the use the photo of Figure 3.

Virtual Instrumentation for Lessons of Mathematics and Sciences of Nature

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Abstract. The interest of members Fun Science Club for Virtual Instrumentation leads to organisation of a contest which first part has ended with an examination witch contained a practical test and a presentation of a project. We will show in this work some aspects of the first part of the class, difficulties and successes, exemplified with project sequences of those who passed the examination.

Keywords. LabVIEW, Fun Science Club, Virtual Instrumentation, Physics.

1. Introduction

The Fun Science Club was founded after the proposal of teachers and students of the „Tudor Vladimirescu” Theoretical High School (Bucharest, April 2005). The presence of the students on some important meetings, with well-known users of the Virtual Instrumentation was very important. These facts lead to an increase of the interest for using LabVIEW.

This is the cause for our proposal in organisation a contest „Virtual Instrumentation for lessons of mathematics and sciences of nature”. This activity as organised inside the Hands on Science Network Romania, by aegis the project „Education and Instruction in Science for a Society of Knowledge”.

These lessons are part of a strategy which lasts several years. Its first objective is the promotion of LabVIEW through the students and teachers. Then we'll pass to another sequence in which the Virtual Instrumentation will be used frequently in the mathematics and sciences of nature. This sequence also contains the developing of real experiments with signal acquisition. There are also premises for such a beginning: for the next year there were proposed optional classes which will be hold by our high-school.

The first level of the class, named „LabVIEW through examples”, it had as objective the initiation in the use of LabVIEW.

2. “LabVIEW through examples”

The first level of the „Virtual Instrumentation for mathematics and nature science” lessons had as a specific the explication of the programming elements starting from problems proposed to the members of the club for lessons of mathematics and physics, after learning the basic elements.

For most of these lessons, the items were formulated this way:

1. definition of problem;
2. writing the application algorithm;
3. the presentation of programming elements needed for the algorithm implementation;
4. creating the work file/ lab file which contains instructions about how the application works.

For exemplifying we will present some sequences from the „Rectilinear motions” application, which was proposed in one of the class lessons. For this subject we required from the students the identification of the main difficulties they had. This way we established which of the information would be offered by the application and how they will be presented. In fig. 1 a first sequence from this software is shown, sequence which was proposed because it reduces the difficulty of graphic interpretation of motion and velocity laws.

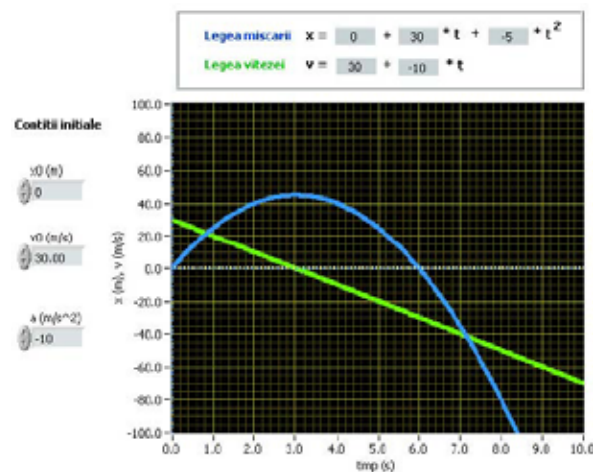


Figure 1. The Application “Rectilinear motions” - sequence 1

As the sequence presented previously was developed for allowing the association of the kinematical equations of motion with the graphic