

ACTIVITY 5

TEACHER'S TOPIC:

SCIENTIFIC RESEARCH FOR STUDENT

STUDENT'S RESEARCH:

“A STUDY ON CANAL WATER TREATMENT USING AQUATIC PLANTS: WATER LETTUCE AND BACOPA”

I. INTRODUCTION:

- Student's science research is as new activity of focus interest from the education of Vietnam since 2009, originated from American Intel ISEF contest. Intel ISEF stands for International Science and Engineering Fair of the United States, founded by the Association of Community and Science, first held in 1950 in Philadelphia. This contest is an opportunity for future young scientists from all over the world to get connected with Nobel Prize scientists. The students have got chances of exchanging, learning and sharing the best thematic practice with the global peer at an insight toward the future.
- Encouraged by the global education and the comprehensive innovation spirit of national education, I have guided my students to participate in the Student competition for Scientific research held by Ho Chi Minh City Department of Education and Training during the 2013 – 2014 school year.
- During scientific research scheme, students are able to develop some crucial 21st century soft skills such as creative, innovative; and independent thinking skills plus problem solving; collaboration and communication skills, next to life skills and vocational skills likely flexibility and adaptability, active self-direction, leadership and accountability... This will benefit them greatly in the future.

II. OBJECTIVE:

- Facilitate Vietnam education towards globalized trend.
- Scientific research motivates the teaching of science in schools, combines theory with practice and helps students see the relevant between different subjects to solve practical situations.
- Help student to develop interest in learning, create the ability to apply knowledge and skills and improve communication skill through the process of interpretation and defense for the research topic.
- Building self-confidence and inspired students to get involved in scientific research activities.
- Contribute to driving educational reformation and refreshing organizational approach, renewing the process of student assessment; improving student's capability and advancing the teaching quality at school.

III. IMPLEMENTATION PLAN:

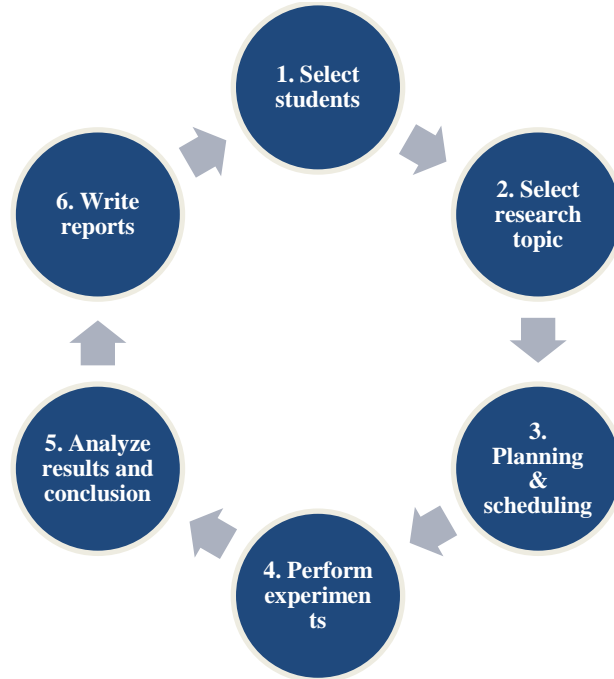
Time	Work content
August 2013	<ul style="list-style-type: none">- Select students to participate in the scientific research activity.- Students choose the research topic.- Students learned about the selected topic.
September 2013	<ul style="list-style-type: none">- Teacher helps students to classify and organize relevant information about the chosen topic.- Teacher and students arrange a working schedule to manage time effectively and to determine the duration of the experiments.- Planning: consider about the design of experiments and develop a research plan.- Students discuss the research plan with teacher.- Conduct experiments.
October 2013	<ul style="list-style-type: none">- Students conduct experiments.- Analyze result- Write literature reviews
November 2013	<ul style="list-style-type: none">- Analyze results- Make conclusions.- Write reports.
December 2013	<ul style="list-style-type: none">- Edit reports

IV. RESEARCH METHOD

- Collaborative method.
- Experimental method
- Data processing method

V. IMPLEMENTATION:

1. Implementation process



2. **Time:** from August 2013 to December 2013.

VI. RESULT – APPLICATION:

- During the 2013 – 2014 school year, teacher had guided a group of 2 student from Class 9A3 with the research “*A study on canal water treatment using aquatic plants: water lettuce and Bacopa*”
- Content summary:
 1. *Participants (group of 2 students):*
 - Nguyen Ngoc Nhu - Class 9A3
 - Tong Huynh Gia Phuc - Class 9A3
 2. *Aims and objectives of the research*
 - **Aims:**
 - + Evaluate the filter ability of Tau Hu – Ben Nghe canal water by the two studied species: water lettuce and Bacopa
 - + Demonstrate the treatment ability of polluted canal water by Bacopa.
 - + Design a system using aquatic plants to purify canal surface water
 - **Objectives:**
 - + Using water lettuce, Bacopa and a combination of these two plants for canal surface water treatment. The obtained result was used to determine the optimum plant for treatment.
 - + Propose practical application.
 3. **Basic content of topic:**

Collect information: from book, internet and actual observed for detailed outline paper.

- Conduct field surveys: selected sampling locations
- Experimental study

4. Materials:

- Water sample from Tau Hu – Ben Nghe Canal.
- Water lettuce and Bacopa.
- Laboratory equipment: pH meter, other equipment and devices to analyze water quality indicators: TSS, COD, NH_4^+ .
- Samples containers (buckets).



Fig: Water lettuce



Fig: Bacopa

5. Method:

5.1. Methodology:

Base on the theories of plant biology, photosynthesis, the absorption of water and sediment of some aquatic plants, combined with the analytical method for water quality indicators, experiments were conducted to come up to a conclusion of the treatment ability of water lettuce and Bacopa.

a. Research method:

- Method of documenting and synthesizing information.
- Method of empirical research.
- Method of sample analysis and technical drawing.
- Method of data assessment and processing.

b. Empirical research

5.2. Research Models

- Consider the suitable location and other influence factors include light and temperature for placing models.
- Construct 5 experiments:
 - + Sample 1: untreated canal water
 - + Sample 2: canal water with water lettuce.
 - + Sample 3: canal water with Bacopa.
 - + Sample 4: canal water with water lettuce and Bacopa.
 - + Sample 5: tap water with water lettuce and Bacopa



Fig: Sample 2 – canal water with water lettuce



Fig: Sample 3 – canal water with Bacopa



Fig: Sample 4 - canal water with water lettuce and Bacopa

- Duration of experiments: 2 weeks.
- Compare the treatment ability among 3 samples using aquatic plants base on the surveyed indicators: pH, TSS, COD, NH_4^+
- Evaluate and determine the treatment ability of two aquatic plants: water lettuce, Bacopa and the combination between these two species.

5.2 Research process:

- Canal water samples were collected at 3 different locations on the one-kilometer survey route from the Letter Y Bridge to the National Hospital of Tropical Diseases. After that, samples were mixed and transferred into buckets (20 liters).
- Water lettuce and Bacopa were added to the buckets
- The study was conducted in 2 weeks, samples were collected and analyzed weekly to determine the water quality indicators: pH, TSS, COD and NH_4^+ . Sensory evaluate was performed at the same time to assess samples color and odor.
- Two set of experiments was conducted simultaneously to get the average result.



Fig.: Two set of experiments

6. Analytical method:

Table: Analytical method for surveyed parameters

No.	Parameter	Analytical method	Sampling frequency
1	pH	pH meter	Once a week
2	TSS	2540 D. Total Suspended Solids Dried at 103 – 109 ⁰ C	Once a week
3	COD	Dichromate method (arbitration method)	Once a week
4	NH_4^+	Indophenol method(667nm)	Once a week

- **Data processing method:** using Microsoft excel to calculate, process experimental data and build chart.

7. Conclusions:

- Water lettuce, Bacopa or the combination of these two aquatic plants can be used for Tau Hu – Ben Nghe canal surface water treatment.

- Water lettuce has good capability in filtering water pollutants. Treatment efficiency: TSS 86.6%; COD 30%; NH_4^+ 96%.
- Bacopa is commonly used in aquariums to create landscapes and release oxygen through photosynthesis. However, the result of this study prove that Bacopa also improve the water quality after 1 week of treatment. Bacopa help increase pH value of water samples (from 6.0 to 8.3), reduce TSS (from 62.4 mg/l to 3.8 mg/l); COD (56%) and NH_4^+ (94.5%).
- The optimum result was achieved when combined water lettuce and Bacopa together. The treatment efficiency for TSS is 93.9%, COD 60% and NH_4^+ 98.7%.
- Sensory evaluation shows that 3 samples with aquatic plants became of lighter color and odorless.
- Treatment duration should be of 1 week.

8. Recommendation:

- Throughout the survey of canal water sample, the study recommends using water lettuce to improve the quality of Tau Hu canal's surface along Vo Van Kiet Boulevard *from the Letter Y Bridge to the front gate of the National Hospital of Tropical disease.*
- **Purposes:**
 - + Reduce odors from canal water, which affect the student of Ham Tu primary school, Hospital of Tropical disease, other offices and residential area where the survey was conducted.
 - + Help create landscape and green areas that can be seen from pedestrian bridge above.
- **How to perform:** Setting up fishing net along both canal banks with buoys attached on to facilitate the net's responsive mobility with tidal regime movement. Water lettuce is planted to grow along both sides of the canal. Due to traffic activities on the canal, water lettuce is placed inside the net to avoid ships and boats, each size of the net is one meter. Net should not be placed at point where there are stairs.
 - + Buoy main-rope:
 - Floating the net.
 - Create decoration highlights
 - + Net:
 - Limit the water lettuce living space to avoid it spreading out and causing traffic accidents.
 - Easy to control
 - Made by durable material, can't be decomposed when put into water for a long time. .
 - Create home for small fishes, avoid being attacked by larger species (suitable pore size).
 - + Concrete Main-rope:
 - Avoid using metallic material to reduce loss
 - Keep the lower part of the net fixed net.
 - Create scaffold for benthos species.
 - + Net - stretching frame:
 - Using plastic materials (pipes).
 - Hold the upper part of the net in stable shape.

9. Further development of this study

- Carried out pilot study base on the researched model.
- Continue to research further on canal water treatment using common aquatic plants like water hyacinth and lotus combine with chemical and biological methods. The main disadvantages of using aquatic plants is the slow rate of treatment and the less effectiveness compare to other chemical methods.

