Activity 6

LE SAUT quantique
CENTRE D'INNOVATION PÉDAGOGIQUE EN SCIENCES AU COLLÉGIAL

Mission: Integrating a Living Organism into the Montreal Biodôme

Activity developed at Collège Lionel-Groulx
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Award-winning activity in the *Getting Off the Beaten Path 2005-2006* contest, organized by the Saut quantique in collaboration with Merck Frosst Canada.

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Date Last Tested

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Scientific Discipline

Biology

Average Age of Students

17-18 years old

Course Title and Number

Evolution and Diversity of Life (101-NYA-05)

Duration of Activity

4 weeks (20 fifty-minute periods)

NOTE

In this document, the masculine is used without discrimination and solely to make the text easier to read.

Appendices are available in PDF and Word format on the CD provided with this document.

In addition, an instructional analysis of the activity is available in the pedagogical treasures section (*Trésors pédagogiques*) on the Saut Quantique Web site at: **http://www.apsq.org/sautquantique**.

SAUT QUANTIQUE
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Mission: Integrating a Living Organism into the Montreal Biodôme

Description of Activity

OVERVIEW

Students are invited to respond to a fictitious request for proposals from the Montreal Biodôme, asking them to analyze the potential of integrating a new living organism into one of the ecosystems in the current exhibition.

Students divide into teams of three or four to create a company that will determine the potential of integration of a new species into the Biodôme. They will respond to the request for proposals by submitting an analytical grid (list of requirements).

The Biodôme selects a company (it actually selects them all!), and assigns it a specific living organism. Each company will study the possibility of introducing that organism into one of the ecosystems in the exhibition.

To this end, each team must formulate a hypothesis about the possible introduction of the species, and find out about the natural niche environment of the living organism. Afterwards, they verify the potential of integrating it into an artificial ecosystem by visiting the Biodôme and meeting with on-site specialists.

Results of this assignment are submitted as part of a mini-conference, via oral presentations using PowerPoint slides, as well as in a research file.

Students are evaluated by the teacher and their peers.

RELEVANCE AND ORIGINALITY OF ACTIVITY

While field trips are difficult, the Biodôme is a very interesting option to provide a hands-on learning experience in ecology. The activity brings students to understand the main concepts specific to ecology in an active and concrete setting, discover the Biodôme, and recognize it as a natural heritage conservation site.

The originality of the activity lies in the students' self-directed approach, where they are required to organize their work and schedule for four weeks. Regular tutoring sessions with the teacher help verify the teams' approach and keep track of their progress.

Objectives and Relation to the Program

PEDAGOGICAL OBJECTIVES OR TARGETED COMPETENCIES

The contents aim at covering the key concepts of the ecology module.

Competency statements to be addressed: To analyze the organization, functioning and diversity of living beings, and to analyze the integration of living beings with their environment.

This activity also helps to develop the following abilities in students: critical sense, ability to speak in front of a group, resourcefulness and organization skills.

LINK BETWEEN THE ACTIVITY AND THE PROGRAM

General Program Goals Targeted

This activity targets the following general goals of the *Science* program:

- To apply the experimental method;
- To use the appropriate data processing technologies;

- To reason logically;
- To communicate effectively;
- To learn autonomously;
- To work as members of a team;
- To make connections between science, technology and social progress;
- To adopt attitudes that are useful for scientific work.

Link with Course

This pedagogical activity helps students understand the concept of ecological niche of a species. This gives rise to the notions of using abiotic and biotic resources in the environment, as well as the notions of ecosystem, habitat, food web, biogeochemical cycles, balance and imbalance in ecosystems, sustainable development, environmental protection, and evolution and biodiversity of life.

Link with Other Courses

This activity has links with biology (*Biodiversity and Evolution*), chemistry, physics, and English.

Number of Students and Educational Support

APPROXIMATE NUMBER OF STUDENTS IN CLASS

About 25 students

NUMBER OF STUDENTS PER TEAM

3 or 4 people

EDUCATIONAL SUPPORT

The teacher gives a few theoretical lessons on the basic concepts in ecology, but his main role is that of a tutor. In this capacity, he monitors the students throughout the activity, and requests regular progress reports in tutoring sessions. He also evaluates the various stages of the project.

Biodôme guides also play a key role. They are the main contacts who can validate the information gathered on the assigned species. Guides are informed in advance of the species proposed to the various teams, and read up on the specific subject to prepare for the students' visit to the Biodôme.

Conducting the Activity

CONDUCTING THE ACTIVITY AND TIME REQUIRED TO COMPLETE EACH STEP

Before

The teacher presents the project to the students, makes them familiar with the concepts in ecology, and introduces them to certain methodological skills. These activities may be scheduled differently, depending on the course schedule for the first four weeks.

The activities proposed as an introduction to the ecology module may vary. For example, students could be asked to delve on the concept of sustainable development, by reading an article at home on the problems of deforestation or by writing a summary on the subject, and subsequently discussing it in class.

(The article by Vincent Tardieu (Québec Science, June 2002), "La terre malade de l'homme – Forêts : silence on coupe!" was used for three semesters, and sparked a lot of interest among students (see the Media Directory).)

The teacher provides an overview of the ecology concepts and chapters being studied in Campbell (see the Media Directory), using a conceptual flowchart. He introduces the concepts of trophic levels, food webs and food chains, biogeochemical cycles, biomass pyramids, etc. (three fifty-minute periods, not necessarily consecutive!)

The teacher introduces students to problem-based learning (PBL[1]) , bibliographical research and Internet research (variable duration, depending on student abilities, approximately two fifty-minute periods).

If necessary, the teacher facilitates a workshop on the use of PowerPoint.

The teacher leads students to discover the Biodôme, and gets them to recognize it as a natural heritage conservation site and as a source of information and knowledge on ecology. Activities could include:

- Viewing the Biodôme's Web site (http://www2.ville.montreal.qc.ca/Biodome/index.htm)
- Watching the film The *Glass Ark*, which depicts the design and construction of the Biodôme. Note that shipping fees will probably be required if you loan the film from the Biodôme or NFB. A copy of this film may be available at your institution's library.
- Renting the Biodôme exhibition *The Earth, 12 Years after the Rio Summit*, and presenting it at your college (there is a rental fee for the exhibition).

The teacher provides students with practical guidelines for the visit to the Biodôme.

For further details, please consult the teacher's support guide (Appendix T.1) and project schedule in the participant's notebook (Appendix S.3).

During

The teacher submits the first situation scenario to the students (Appendix S.1), i.e. the fictitious request for proposals from the Biodôme, seeking companies that are capable of studying the potential of integrating new species into the Biodôme's ecosystems. Teams must create an analytical grid (list of requirements), which will serve to verify the potential of integrating species. They submit their grids to the teacher at the end of this session for evaluation purposes. These grids are their responses to the Biodôme's request for proposals (one fifty-minute period).

During the next period, students review the first situation scenario. They engage in a discussion on the grids presented and make corrections as required, first in teams and then as a plenary session. The teacher provides a corrected grid (Appendices T.2 and S.3) (30 to 40 minutes).

Students receive the second situation scenario (Appendix S.2), i.e. the Biodôme's response. The head of the Scientific Research Division assigns a specific species to each team. Students must formulate an assumption (without any detailed knowledge of the species) on the Biodôme's ecosystem that could support this species, and submit it to the teacher.

Afterwards, students independently complete an in-depth research on the natural ecosystem, habitat and ecological niche of the species. This research is done partly during class time (library and computer classroom) and partly at home, with team meetings (variable duration out of the classroom, and two fifty-minute periods in class).

Students subsequently go to the Biodôme on their own, in order to validate their data and verify their assumption (transportation and visit: about three fifty-minute periods).

After

Students summarize the information they gathered and confirm or reject their initial assumption (individual work and team meeting in and out of the classroom).

The teacher meets with each team for about fifteen minutes, twice during the project, to evaluate progress and answer questions (three fifty-minute periods).

Each team also prepares its research paper, stating the various steps required to complete the project, documentation found, sources used,

[1] To learn more about this pedagogical approach, please refer to the section Apprentissage par problèmes (problem-based learning) on the Saut quantique Website at www.apsq.org/sautquantique/doss/d-app.html.

schedule and review of teamwork (individual work and team meeting out of the classroom).

Each team makes an oral presentation (PowerPoint) of its results in front of the class. These presentations are followed by a question period and peer evaluation. (20 minutes per team: three fifty-minute periods in total).

Each team submits its research paper.

For further information, see Appendices T.1 and S.3.

Evaluation and Required Material

SUGGESTED EVALUATIONS

The following items are evaluated:
(I) individual evaluation, (T) team evaluation

Summary and text discussion (trigger component) (I):	6 points
Analytical grid (T):	2 points
Work plan and schedule (T):	2 points
Oral presentation (T):	20 points
Research paper (T):	5 points
Final mini-test (I):	5 points
Total score:	**40 points**

This total score counts for 25% of the semester.

For further information, see Appendices T.1 and S.3.

REQUIRED MATERIAL

Computer classroom, library.

Optional: photo camera, binoculars, video camera, etc.

APPENDICES

Teacher

Appendix T.1: Teacher's Support Guide
Appendix T.2: Sample Corrected Data Sheet

Students

Appendix S.1: Request for Proposals
Appendix S.2: Biodôme's Response
Appendix S.3: Participant's Notebook

Note:

Appendices are available in PDF and Word format on the CD provided with this document.

Other Ideas to Explore

Vegetable organisms, fungi and bacteria could be the subject of the same study.

MEDIA DIRECTORY

CAMPBELL, Neil A. and Jane B. REECE (2004). *Biologie*, 2nd Edition, Montreal, ERPI, 1364 p.

TARDIEU, Vincent (juin 2002). « La terre malade de l'homme – Forêts : silence on coupe ! » *Québec Science*, vol. 40, no. 9, p.46-53.

DIONNE, *Bernard et al.* (1998). *Pour réussir, Guide méthodologique pour les études et la recherche*, 3rd Edition, Laval, Études vivantes, 272 p.

Biodôme de Montréal, Nature Under Glass. [Online] URL Address: http://www2.ville.montreal.qc.ca/biodome/mvc/integrationen/content.html

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