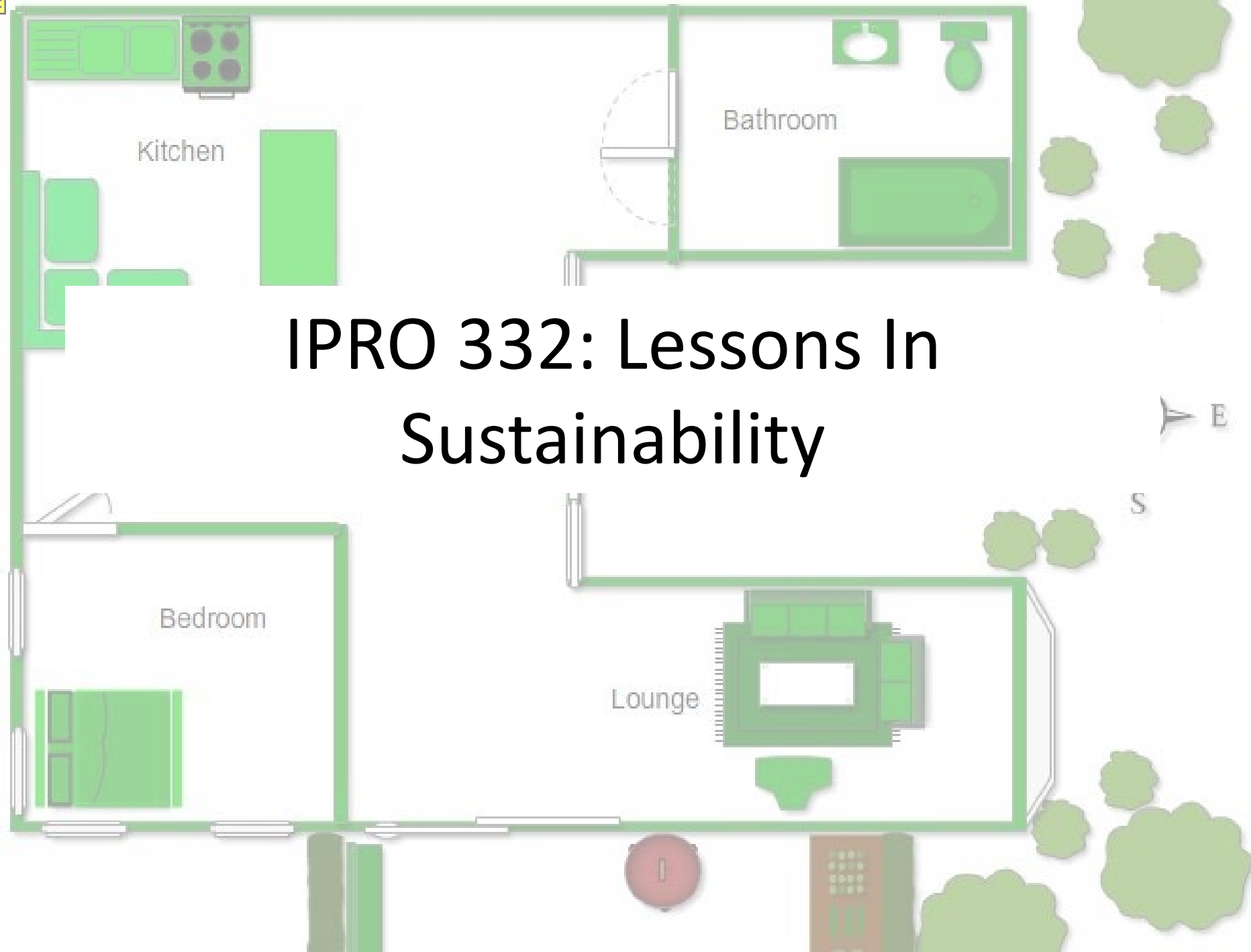# IPRO 332: Lessons In Sustainability

Problem

- Lack of awareness of the energy and environmental issues facing our world

- In order to face these issues people must be educated starting with children

- Teachers do not have time to create teaching modules on the subject

History of IPRO 332

- IPRO 332 is in its 6th and final semester
- 6 Teaching kits passed down from prior semesters
  - Energy Policy in America
  - Cradle to Cradle
  - Ecological Foot Print
  - 3 Tree Farming Kits
- Potential contact list for multiple schools
- Documentation of previous work
- Some funds turned over

Example of Old Teaching Modules

Elementary Module Lesson 2

Making Paper
Usage

Introduction

This lesson focuses on the materials required and the process used for making paper. Paper is a valuable resource in our society. It is used to make many products; from newspapers to refrigerator boxes. The goal of this lesson is to give students an understanding of the materials and energy used to create paper. By understanding the work needed to make paper, one can appreciate it, and ultimately be encouraged to recycle. The lesson starts with a discussion of the history of paper, followed by an explanation of the current production processes accompanied by slides which can be projected or drawn on the board. Finally there is an activity of actually making paper which reinforces the information learned in the lesson.

Materials

For Discussion:
- 1 pre-test (included) per student
- 1 post-test (included) per student
- Slides (included)

For Activity:
- Blender
- Water
- Corn Starch
- Mesh in frame
- Old news papers or other used paper
- Rolling Pin

Optional:
- Iron
- Food coloring
- Glitter

Preparation

Copy enough tests for all students. Prepare to project included slides, print them out for students, or draw them on the board. Purchase activity supplies and prepare for distribution. One or two days before this activity is to take place assign the students to bring used newspapers or other used paper products (worksheets, newspapers, cereal boxes etc.), but nothing too dense or that cannot be torn easily.

Lesson

Pre-test

Administer pre-test, then collect. To reduce the use of paper, have students use two different color writing utensils for the pre-test and post-test. Color Number 1 for pre-test and color Number 2 for the post-test.

Discussion: History

Teacher: Ask the class the questions listed below. Gather multiple answers, then show the corresponding slide and read the answer listed.

Ask the class "Where do you think the word 'paper' comes from?"

Paper History

[Show slide 1] Actually the word paper comes from the Greek word for papyrus. Papyrus is a reed plant that grew in ancient Egypt. People cut it into thin strips and wove it to create a paper-like surface that they wrote on, they called this papyrus too! There is a difference between papyrus and paper. Papyrus is woven pieces of plant, paper is made of plant fibers that were suspended in water and wove together themselves.

English word 'Paper' comes from Latin word 'Papyrus'

Ask the class "when do you think paper was invented?"

Paper History

[Show slide 2] Actually paper was first made in China in the year 200 A.D.! A man named Ts'ai (Cai) Lun used old fishing nets and rags to make paper. Paper may have been made before him, and like all scientists he built off of previous discoveries but he was the first to record his invention. It took a while but paper spread all over the world but they were still making it out of old rags which were hard to come by.

Year 200 A.D. paper is made.

Ask the class "how do you think people got the idea for using wood to make paper?"
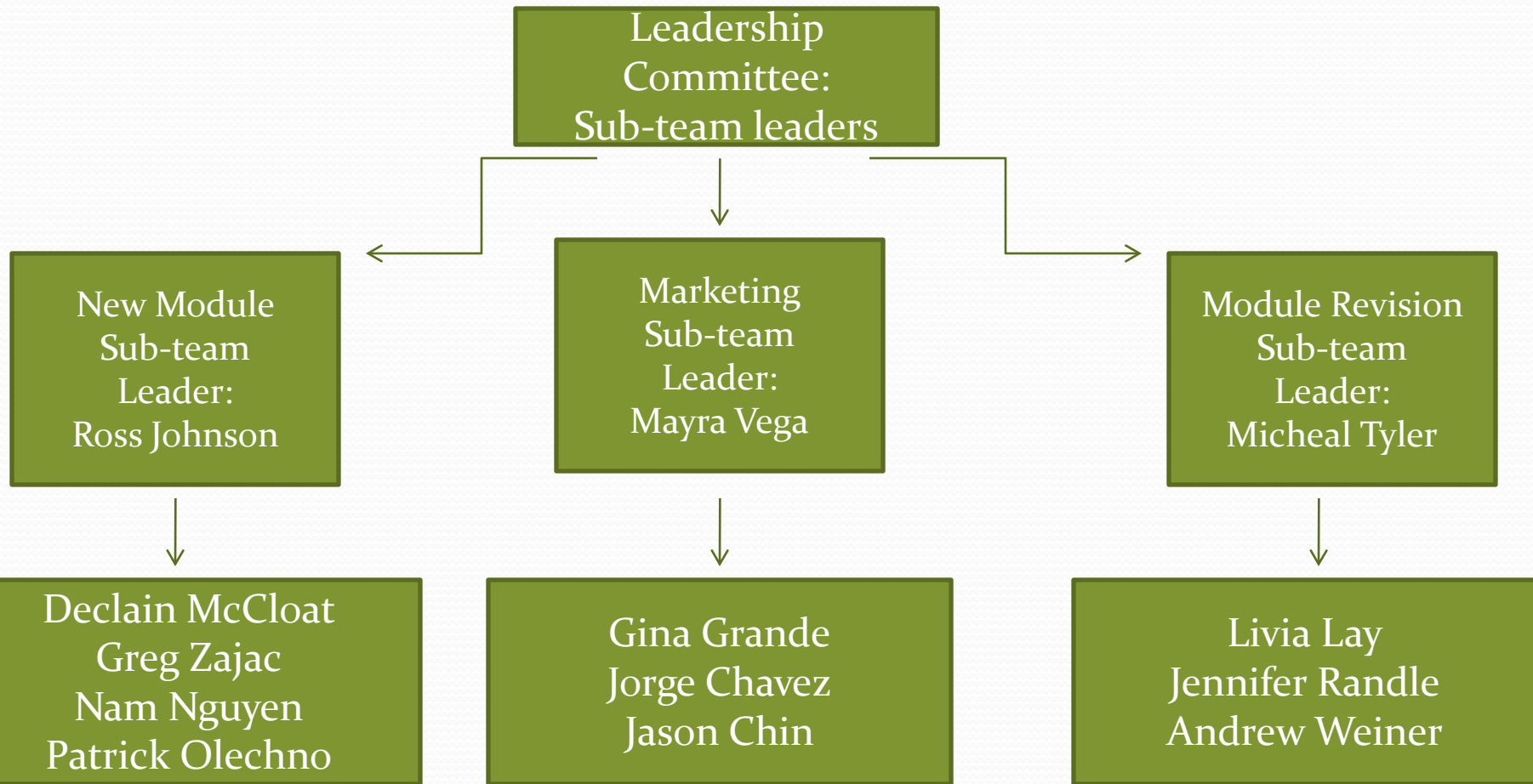
Paper History

[Show slide 3] Actually the idea came from bugs! In the 1700's a man by the name of Rene de Réaumur, was thinking of new materials to make paper out of, when he saw some wasps. They were chewing up wood and spitting it out to make nests. They were making paper.

Goals

- Generating a teaching module which covers the science and technology used in a zero energy home
- Revising existing teaching modules
- Raising awareness of sustainability issues at local events
- Make teaching modules available through Teacher Knowledge Share website

Organization

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                    ┌─────────────────┐
                    │   Leadership    │
                    │   Committee:    │
                    │ Sub-team leaders│
                    └─────────────────┘
```

| New Module Sub-team Leader: Ross Johnson	Marketing Sub-team Leader: Mayra Vega	Module Revision Sub-team Leader: Micheal Tyler
Declain McCloat Greg Zajac Nam Nguyen Patrick Olechno	Gina Grande Jorge Chavez Jason Chin	Livia Lay Jennifer Randle Andrew Weiner

Marketing - Objectives

- To increase the visibility of IPRO 332 and issues on sustainability
- To provide educational materials for after school program
- To obtain endorsement from IIT for IPRO 332 and the Teacher Knowledge Share website

Marketing - Obstacles

- Locating schools and sustainability related events
- Choosing an activity for students
- Teacher Knowledge Share website

Paper Making

These are all made up of plant fibers

Teacher Knowledge Share
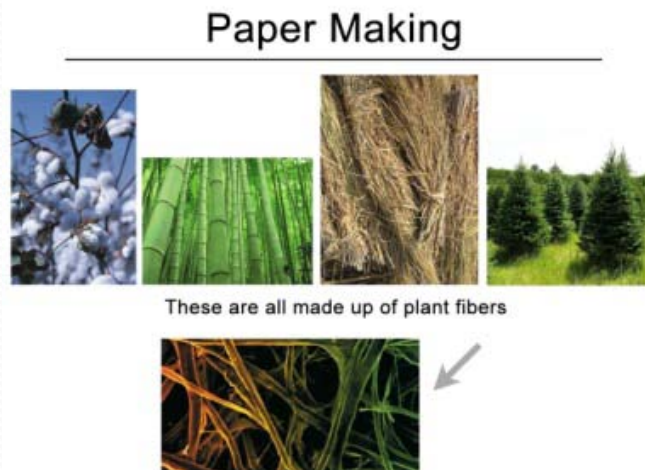
Marketing - Results

- Teacher Knowledge Share website

- Met with Joseph Clair of Office of Campus Energy and Sustainability

- Attended IIT Sustainability Forum

- Presented materials at Pershing West Elementary
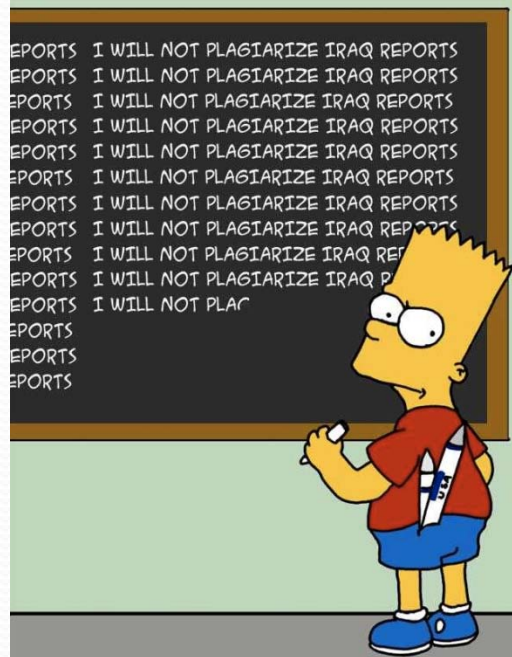
New Module - Objectives

- Create a new module about zero energy home.

- Develop the teacher script and presentation based on new module and present to the high school students.

New Module- Obstacles

- Adjusting and editing the material more understandable for high school students

So what? who cares?

- Locating classroom and presenting to the students
- Avoiding legal issues

New Module- Results

- Successfully presented at De La Salle all girl high school.

- Completed the teacher script for the new module

- Created the Jeopardy Game for more interactions between the students

- Field trip to the Chicago Center for Green Technology
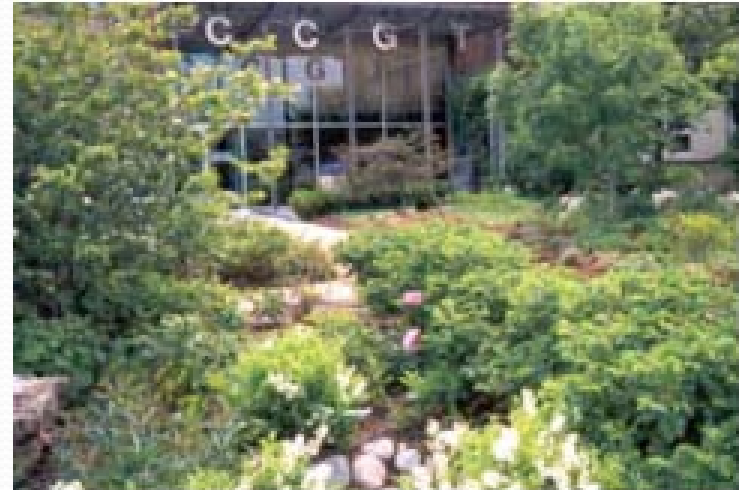
New Module- Results

Teacher Script

Alternative Energy Solutions

Presentation

High School Module Lesson 1

Zero Energy House

Curriculum

This module fits with the Illinois state curriculum under both the early and late high school education. For early high school education it fits under items 13.B.4b, 13.B.4c, and 13.B.4d. 13.B.4b states that the curriculum should analyze a particular occupation to identify decisions that may be influenced by a knowledge or science. 13.B.4c states that the curriculum should analyze ways that resource management and technology can be used to accommodate population trends. 13.B.4d states that the curriculum should analyze local examples of resource use, technology use, or conservation programs; document findings, and make recommendations for improvement. For later high school education the module fits under items 13.B.5b and 13.B.5c. 13.B.5b states that the provided curriculum should analyze and describe the processes and effects of scientific and technological breakthroughs. 13.B.5c states that the curriculum should design and conduct an environmental impact study, analyze findings, and justify recommendations.

Objectives

1. Students will learn about topics addressed by engineers and architects in their respective fields involving implementation of the science and technology of sustainable energy solutions (13.B.4b).
2. Students will become familiar with green technological trends and resource management practices that are compatible with our current society and environmental circumstances (13.B.4c).
3. Students will analyze current and local examples of resource use and technology use as applied within a zero energy house (13.B.4d).
4. Students will be capable of analyzing and describing processes and effects of current technology in the field of energy conservation (13.B.5b).
5. Students will understand some impacts that current house systems have on our environment and develop a more clear conception of what is currently being done and what can possibly be done in the future (13.B.5c).

Introduction to IPPRO 332

IPRO 332 is a research development program involved with educating various members of our community, specifically elementary and high school level
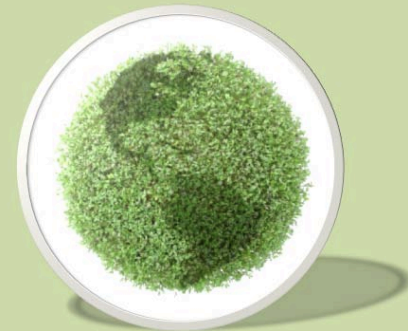
Module Revision - Objectives

- Improve Tree Farming Module
- Establish a common theme for past and future efforts
- Demonstrate effectiveness of existing teaching modules
- Identify and eliminate any weaknesses in existing modules
- Create similar modules at multiple age levels to ensure material is taught

Module Revision - Obstacles

- Being allowed into Math and Science Education Department (MSED)classroom to speak with teachers

- Final unifying theme dependent on others work

- Amount of time required to publish modules so they will be used by teachers

Module Revision - Results

- Tree Farming Module revised to suit multiple age levels
- Tree Farming Module revised to better suit elementary school students
- Tree Farming Modules revised to suit needs of teachers at suggestion of Dr. Norman Lederman
  - Curriculum codes now included
  - Necessary for teachers to accept modules
- Current facts inserted into presentations
- Slides to describe unifying theme created

High School Tree Farming Module

IPRO 332 SUSTAINABILITY

PAPER AND THE ENVIRONMENT

OBJECTIVES

- Raise awareness of sustainability issues
- Pass the knowledge of sustainability to students
- Teach young generation about sustainable solutions to the problem
- Encourage them to participate in future sustainability efforts and nurture their commitment to environmental stewardship
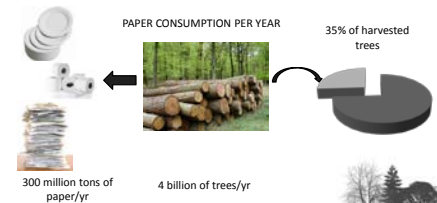
PAPER AND THE ENVIRONMENT

ABSTRACT

Paper is an expression of everyday living. It is hard to imagine what life would be like without paper. Most of the paper that we use today is made from virgin wood pulp.

PAPER CONSUMPTION PER YEAR

35% of harvested trees

300 million tons of paper/yr

4 billion of trees/yr

PAPER AND THE ENVIRONMENT

PROBLEM

- Planetary deforestation

Growing a tree: 10 years

Deforestation rate over 70 years

Cutting a tree: 1 hour

- Pulp and paper account for approximately 40% of deforestation worldwide.
- World consumption of paper has grown 400% in the last 40 years

PAPER AND THE ENVIRONMENT

PROBLEM

- Planetary deforestation (diagram)

PAPER AND THE ENVIRONMENT

PROBLEM

- Pollution released from paper mills

The processing of virgin wood paper uses harsh chemicals. It also wastes more energy and generates greenhouse gas emissions. Solid waste material is usually dumped on the land, liquid waste is generally flushed into streams or the sea and gases are left in open air contributing to global warming.
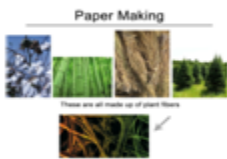
PAPER AND THE ENVIRONMENT

Old Versus New Tree Farming

Old

Paper is Made of Fibers

Paper Making

[*Show slide 4*] Paper has always been made of natural plant fibers called cellulose. Paper has been made from the fibers from plants like cotton(rags), eucalyptus, straw, bamboo and trees. [Tell students to tear a piece of paper.] Look at the little hairs sticking out from the tear. These are cellulose or fibers. Today paper is made primarily from wood fibers and recycled fibers (from recycled paper products.) We'll start by talking about the processes used to make paper from wood.
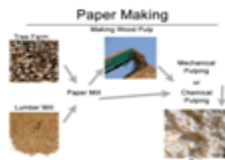
Making Wood Pulp

Paper Making

[*Show slide 5*] Wood fibers come from two places, from small trees harvested in tree farms or from scrap material produced when making lumber. When logs from small trees come to the paper mill they are put in the chipper. This is the first machine used. It chops and chips the logs into wood chips. Next those chips are turned into pulp. Pulp can be made in two ways: mechanically or chemically. In a mechanical pulper, the wood chips or logs and hot water are torn apart by rotating steel discs. The product is a mass of individual wood fibers.

In chemical pulping wood chips are put into chemical baths under pressure. This dissolves the chips and breaks them down into individual wood fibers.

So which is better, mechanical or chemical pulping? The answer is that both have their advantages and disadvantages.

Mechanical is cheaper, but uses more energy. There is almost no fiber lost (only 10-20%) in the process but the fibers are weaker and discolor over time.

Chemical is more expensive, but can create energy. More fibers are lost (about 40 to 50%), but the fibers keep their strength and do not discolor as much.
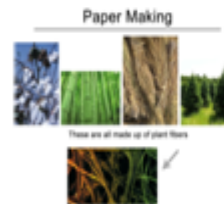
New

Paper is Made of Fibers

Paper Making

[*Show slide 4*] Paper has always been made of natural plant fibers called cellulose. Paper has been made from the fibers from plants like cotton(rags), eucalyptus, straw, bamboo and trees. [Tell students to tear a piece of paper.] Look at the little hairs sticking out from the tear. We'll start by talking about the processes used to make paper from wood.
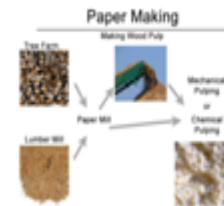
Making Wood Pulp

Paper Making

[*Show slide 5*] Wood fibers come from two places, from small trees harvested in tree farms or from scrap material produced when making lumber, which is wood for houses and building projects. When logs from small trees come to the paper mill they are put in the chipper. This is the first machine used. It chops and chips the logs into wood chips. Next those chips are turned into pulp, a gooey material which we turn into paper.

In chemical pulping wood chips are put into liquids to turn them into the fibers we need for making paper.

Tree Farming with Curriculum Codes

Elementary Module Lesson 1

Tree Farms
Creation

Curriculum

This module fits with the Illinois state curriculum under both the early and late elementary education. For early elementary education it fits under item 13.B.1e which states that students should demonstrate ways to reduce, reuse and recycle. For later elementary education it fits under item 13.B.2f which states students should analyze how specific personal and societal choices that humans make affect local, regional and global ecosystems. It also fits under item 13.B.2d which states that students should compare the relative effectiveness of reducing, reusing and recycling in actual situations.

Objectives
1. Students will discover where paper comes from (13.B. 1e).
2. Students will describe what a tree farm is (13. B. 2f).
3. Students will analyze how tree farms help our environment (13. B. 2d.).

Introduction

During this lesson, students will discover tree farms—the source of much of our paper. Students will better understand where paper comes from and how they can positively participate in the life cycle of paper products.

Upon completion of this lesson, students will be able to describe trees as a renewable resource, analyze the consequences of large tree farms, and explain the origin of most paper. These topics will be reemphasized through an activity in which students will plant a seed in a cup, monitoring growth over several days.
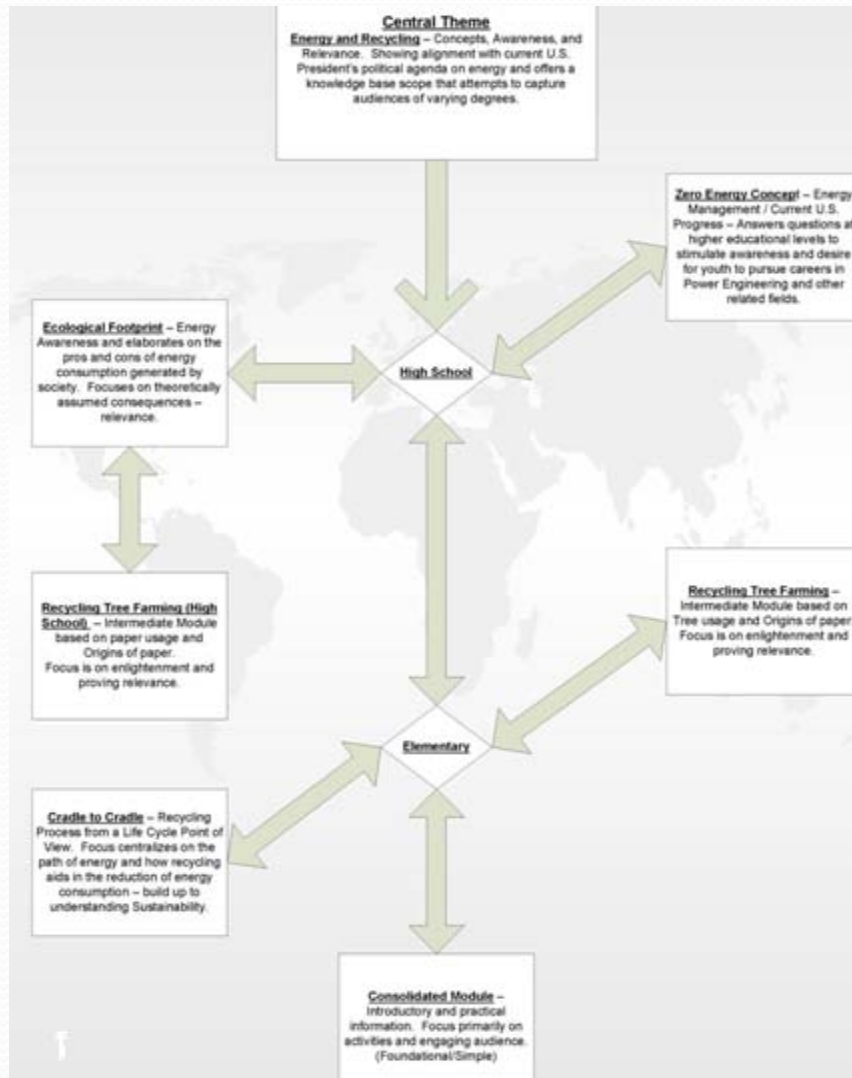
Materials per student

For Discussion:
- 1 pre/post-test (included)
- Slides (included)
- 2 Colored Pencils

For Activity:
- 1 clear plastic cup
- 1 cotton ball
- 1 seed (tree or other)

Central Unifying Theme

Central Theme
Energy and Recycling – Concepts, Awareness, and Relevance. Showing alignment with current U.S. President's political agenda on energy and offers a knowledge base scope that attempts to capture audiences of varying degrees.

Zero Energy Concept – Energy Management / Current U.S. Progress – Answers questions at higher educational levels to stimulate awareness and desire for youth to pursue careers in Power Engineering and other related fields.

Ecological Footprint – Energy Awareness and elaborates on the pros and cons of energy consumption generated by society. Focuses on theoretically assumed consequences – relevance.

High School

Recycling Tree Farming (High School) – Intermediate Module based on paper usage and Origins of paper. Focus is on enlightenment and proving relevance.

Recycling Tree Farming – Intermediate Module based on Tree usage and Origins of paper. Focus is on enlightenment and proving relevance.

Elementary

Cradle to Cradle – Recycling Process from a Life Cycle Point of View. Focus centralizes on the path of energy and how recycling aids in the reduction of energy consumption – build up to understanding Sustainability.

Consolidated Module – Introductory and practical information. Focus primarily on activities and engaging audience. (Foundational/Simple)

Energy and Recycling

Cradle/Tree Mod. III
[Elementary]
IPRO 332

Recyclable Versus Non-Recyclable

- **What are recyclable products?**
  - Aluminum
  - Paper
  - Glass
  - Plastic
  - Water

Conclusion

- Multiple teaching modules can potentially be used in classrooms
- New module well received in the classroom
- Modules connected through a single unifying theme
- Modules should be applicable at intended grade levels
- Project and materials are ready to be picked up by any group through IIT or an outside source

Acknowledgements

- Office of Campus Energy and Sustainability
  - Mr. Joseph Clair, Director
- Community Affairs and Outreach
  - Ms. Lisa Montgomery, Managing Director
- De La Salle Institute
  - Mr. Bob Chrupka, Science Instructor
- MSED Department
  - Dr. Norman Lederman, Chairman
  - Dr. Judith Lederman, Associate Chairman
  - Dr. Martina Nieswandt, Professor
- The Chicago Center for Green Technology

QUESTIONS?