

Measuring Impact of Pollinator Conservation Teaching

To measure the impact of the pollinator conservation module, our team of high school teachers, Purdue entomologists and curriculum specialists developed the following survey examination deliverable by Qualtrics but flexible to fit any other method a teacher chooses.

Thirty multiple choice questions were used to measure general knowledge about current environmental challenges. In addition, we sought a way to measure how this teaching module impacted students' attitudes and motivation towards pollinator conservation. We adapted an existing "Children's Environmental Attitudes & Social Knowledge Scale" (CHEAKS) with a "Reduced Instructional Motivation Survey" (RIMMS) that includes the 4 constructs; attention, relevance, confidence and satisfaction, with a goal to measure motivation (impact). Following the traditional CHEAKS construct, ours consists of three sections; verbal commitment, behavior, and an affect section.

When completed, the survey was tested to ensure that the content and wording was consistent and aligned favorably with a traditional survey. Validation was performed by reviewers (45 students of a similar age group) to confirm that the questions were; easy to understand, followed the goals of the project, were at the desired difficulty level (mid high school – early college age) and could be completed in the appropriate time period (~20 min).

We began with demographic questions that include ethnicity, sex, grade, agricultural background, and general residence (whether they live in a rural, suburban, or urban setting), in order to make our results more meaningful followed by 3 general sections containing 12 questions each. Students are asked to select a number 1 through 5 [1= Strongly Agree] [2= Agree] [3= Neither] [4= Disagree] [5=Strongly Disagree] as they agree or disagree with the statements presented.

Pre-Test. The questions are as follows.

Unique Identification number- known only to designated Teacher

Teacher's Name- _____

Grade- _____

Sex- Male/ Female

Ethnicity: Caucasian, African American, Asian, Hispanic, Other

Residence: City, Suburb, Rural,

I have an agricultural background: Strongly agree, Agree, Neither agree nor disagree,
Disagree, Strongly disagree

PRE-TEST QUESTIONS

(Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree)

Verbal Commitment:

- I am willing to reconsider purchasing products if it means saving animal lives.
- I would purchase organically grown vegetables and fruits if it protected the environment.
- I am willing to build homes for native bees.
- I would support making butterfly counts to help understand their decline.
- I am willing to alter my daily routine to reduce environmental contamination.
- I would not be willing to stop someone from crushing a bee nest.
- I would donate a portion of my own money to help protect wild animals.
- I would plant flowers for pollinators at my home or a nearby area.
- I would be willing to tolerate a few insect pests if it meant conserving monarch butterflies.
- I would go from house to house to pass out environmental information.
- I would write letters asking people to help reduce pollution.
- To save pollinators, I would be willing to advise others to use less pesticides.

Effect:

- I am frightened to think that people don't care about the environment.
- I am angry about the damage pollution does to the environment.
- I don't worry if farming practices are dangerous to pollinating insects.
- I get upset when I witness people going out of their way to kill insects.
- I get angry when I think about non-target effects of pesticides.
- I fear that forest fires and floods are linked to climate change.
- I do not worry much about habitat loss for wild animals.
- I am not frightened about the effects of pollution on future generations.
- I worry when I think about pollinators/bees going extinct.
- It makes me sad to see houses being built where animals used to live.
- It frightens me when I see or hear about people misusing pesticides.
- It upsets me that plastic accumulation is damaging our ocean ecosystem.

Actual Commitment:

- I have discussed climate change outside of school.
- I have told others of the importance of pollinators in food production.
- I have talked with my parents about how to help with environmental problems.
- I try to conserve water where possible.
- I have asked my parents to buy organically produced fruits.
- I have asked others what I can do to help reduce pollution.
- I often read stories about protecting our environment.
- I often consider ways I can live better with nature.
- I kill stinging wasps and bees when I encounter them out of doors.
- I have researched how to help I can protect bees.

- I have installed a bird or a bee house near my home.
- I have informed others about the negative effect of pesticides on pollinators.

Knowledge: The knowledge section of this survey is in multiple choice format and designed to measure comprehension. Students are asked to choose the 'most correct' answer.

Burning coal for energy is a problem because it:

- A) releases carbon dioxide and other pollutants into the air.
- B) decreases needed acid rain.
- C) reduces the amount of ozone in the stratosphere.
- D) is too expensive.
- E) depletes coal reserves.

Ecology assumes that people are what part of nature?

- A) exempt.
- B) related to all other parts.
- C) not important.
- D) the most important.
- E) unrelated.

Extinction is:

- A) inevitable.
- B) permanent.
- C) necessary.
- D) beneficial.
- E) a myth.

Phosphates are harmful in sea water because they:

- A) cause cancer in fish.
- B) stop reproduction in fish.
- C) make fish nervous.
- D) make the water cloudy.
- E) suffocate fish by increasing algae.

Honey bees can communicate with each other via:

- A) a waggle dance.
- B) a square dance.
- C) wing flickering.
- D) nuzzling.
- E) buzz pollination.

River water pollution is primarily caused by:

- A) dams.
- B) chemical runoff from agricultural operations.
- C) methane gas.

- D) sewer leakages.
- E) human and animal wastes.

Ecology is the study of the relationship between:

- A) different species of animals.
- B) plants and the atmosphere.
- C) organisms and their environments.
- D) humans and other animals.
- E) humans and the environment.

Polar bear population decline is mostly attributable to:

- A) old age.
- B) trophy hunting.
- C) climate change.
- D) predation.
- E) commercial fishing.

The most common poisons found in water are:

- A) arsenic, silver nitrates.
- B) hydrocarbons.
- C) carbon monoxide.
- D) sulfur, calcium.
- E) nitrates, phosphates.

Most urban garbage is:

- A) incinerated.
- B) dumped into the ocean.
- C) recycled to make plastic.
- D) buried in a land fill.
- E) sent to farmers for use as fertilizer.

Which is most responsible for creating acid rain?

- A) sulfur dioxide.
- B) carbon dioxide.
- C) ozone.
- D) nitrogen.
- E) ultraviolet radiation.

Catching tuna in the ocean:

- A) eliminates a main food source for whales.
- B) protects baby sea turtles.
- C) also kills many dolphins.
- D) is now against the law.
- E) is necessary to keep their population size down.

Flowers use all the following cues to attract pollinators except:

- A) color.
- B) smell.

- C) sound.
- D) shape.
- E) ultra-violet patterns.

Which of the following is the most dangerous to the earth's environment?

- A) damming rivers.
- B) global warming.
- C) tornadoes.
- D) livestock production.
- E) nuclear power plants.

Most current atmospheric pollution is caused by:

- A) automobiles and airplanes.
- B) burning of all fossil fuels.
- C) pollen.
- D) wild fires.
- E) cigarettes.

Which of the following does not pose a threat to bees?

- A) agricultural pesticides.
- B) climate change.
- C) mowing lawns.
- D) native habitat restoration.
- E) parasitic mites.

Animals are most likely to become extinct because:

- A) natural selection kills weaker animals.
- B) of global warming.
- C) of environmental pollution.
- D) of habitat loss.
- E) their food supply is destroyed by acid rain.

Environmental problems are a threat to:

- A) people in small countries only.
- B) people who live in cities only.
- C) just wild animals and endangered species.
- D) tropical plants and animals only.
- E) all living things in the world.

A deep-reddish flower that smells like rotting meat would most likely be pollinated by a:

- A) honey bee.
- B) bumble bee.
- C) fly.
- D) monarch butterfly.
- E) hawk moth.

Which of the following is least helpful in reducing pollution caused by automobiles?

- A) using larger engines.

- B) high octane gas.
- C) low lead gas.
- D) smog control devices.
- E) using propane engines.

The main problem with landfills is that they:

- A) take up too much space.
- B) are an eye-sore and smell bad.
- C) attract rats and other pests.
- D) prevent farming of nearby land.
- E) do not contain toxins, leachates and harmful gasses.

Building a dam on a river can be harmful because it:

- A) makes the river muddy.
- B) the river can no longer be used to make electricity.
- C) increases level of pollution on the water.
- D) causes the river to flood.
- E) damages the river's natural ecosystem.

Most ground water is found in:

- A) landfills.
- B) ponds.
- C) low pressure areas.
- D) aquifers.
- E) rivers.

An example of a nonrenewable resource is:

- A) petroleum.
- B) trees.
- C) ocean water.
- D) sunlight.
- E) animals raised for food.

Most air pollution in big cities comes from:

- A) factories.
- B) jet planes.
- C) cars.
- D) big trucks.
- E) landfills.

Understanding how and why insect sting may allow us to:

- A) better live with them.
- B) more easily poison them.
- C) find antivenoms.
- D) keep others from trespassing.
- E) exterminate them.

The main concern about relying on aquifers for water is that:

- A) they recharge too quickly.
- B) they are becoming used up.
- C) they contain too much fresh water.
- D) they contain too much salt water.
- E) extracting the water is too difficult.

Which of the following are capable of buzz pollination?

- A) honey bees.
- B) bumble bees.
- C) butterflies.
- D) blow flies.
- E) yellow jackets.

A species that no longer exists is considered:

- A) protected.
- B) endangered.
- C) abundant.
- D) extinct.
- E) threatened.

Which resource would an insect NOT find in a flower?

- A) nectar.
- B) pollen.
- C) resin.
- D) honey.
- E) warmth.