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Effects of Biophilia on Secondary Science Classrooms

Annie Dietz
Wartburg College

Keli Potter
Wartburg College

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01

Biophilia

What is Biophilia?

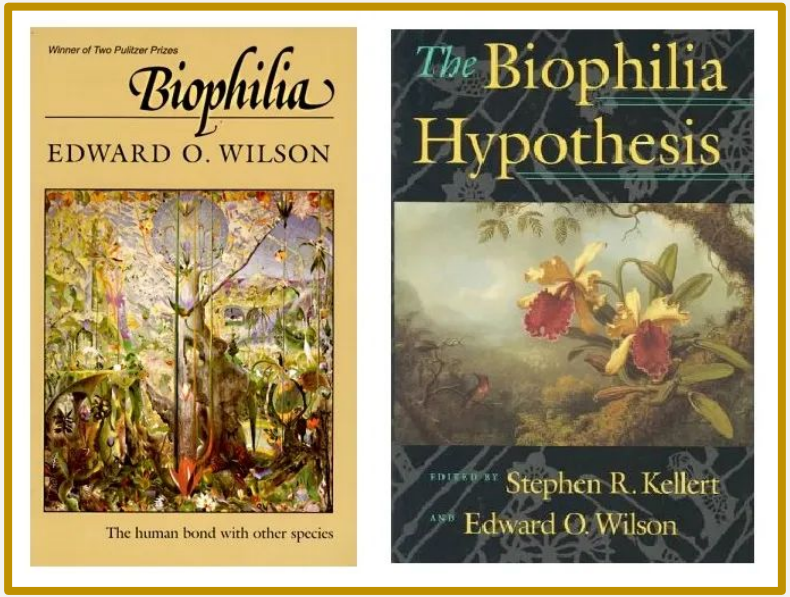
E.O. Wilson

- The father of “biodiversity”
- **Biophilia Hypothesis**
  - Humans genetically want to be surrounded with living things.

https://www.nationalgeographic.com/culture/article/eo-wilson-darwins-natural-heir-dies-at-age-92

Biophilia Hypothesis

- Idea that humans seek connections with other forms of life.



Biophilia in the Classroom

- Direct contact with natural components allows students to gain a deeper understanding of the content

- Live animal and film treatment groups scored significantly higher in achievement

- Motivation variables such as interest and competence has a positive correlation with achievement

Hummel, E., and Randler, C., 2011. Stannard, S., 2021.

Biophilia vs. Biophobia

Biophilia

- Positive attitudes towards nature and living things
- Correlated to productivity, happiness, and longevity
- Derived from learned experiences

Biophobia

- Repulsion, fear, and other negative attitudes
- Urge to interact with technology and man-made objects

Lin, B., et al. 2018. Simaika and Samway, 2010.

Dissections

- 86% of students disagreed with the removal of dissection in anatomy courses
- Face-to-face instruction had significantly higher lecture exam scores compared to online anatomy courses

Brown, P., and Peterson, J., 2021. Kalthur, S., et al. 2021.

02 Hypothesis and Predictions

Hypothesis & Predictions

Hypothesis:

Students exposed to natural components during a dissection will positively affect their achievement, retention, and motivation over the topic.

Predictions:

Students performing dissections with natural components will have greater achievement, retention and motivation.

Students performing online dissections will have decreased in achievement, retention and student motivation.

03

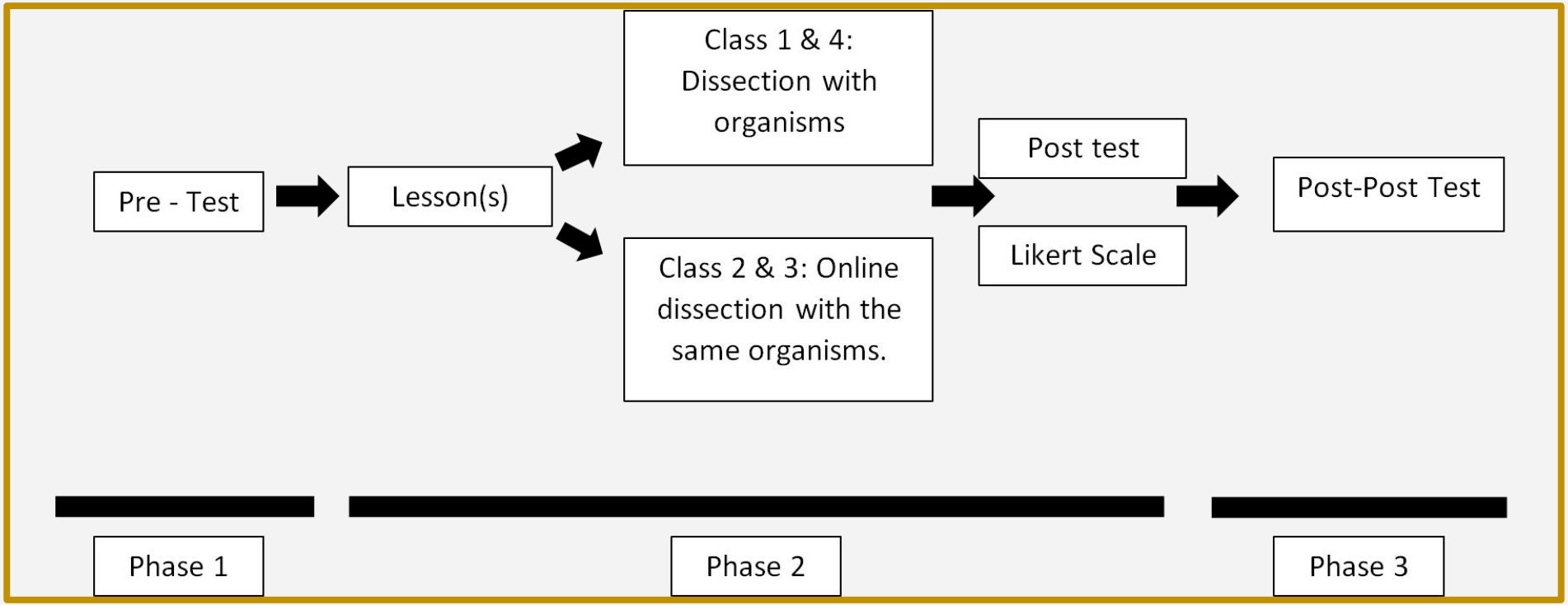
Materials and Methods

Lesson

Lessons will take place during Winter Break of 2023

Day 1 School (X,Y,Z)
First class: Natural Plant Dissection (LP1)
Second class: Digital Plant Dissection (LP2)
Day 2 School (X,Y,Z)
First class: Digital Worm Dissection (LP4)
Second class: Natural Worm Dissection (LP3)

Method Diagram



Lesson Plans

4 lesson plans
Lesson 1 - Real Plant
Lesson 2 - Digital Plant
Lesson 3 - Real Worm
Lesson 4 - Digital Worm

Different modes but lesson plan objectives and processes are the same.

Classes will have the same methods, management, and script for every lesson.

Plant Lesson Plans

EXPERIMENTAL Animal DAY 1

Teacher: Annie Dietz & Keli Potter

Date: February 24, 2023 (Tentative schedule date)

Subject/grade level: 9th – 12th

Materials: (per class) Plant Leaves (Succulent, and a bigger leaf (whatever BEC has)), plate (to put leaf on), clear nail polish, tape. (TO LOOK AT STOMATA) Maybe.

Dissection kit, gloves, flower

STANDARDS

NGSS

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

Lesson objective(s):

Objective: 9th – 12th grade students will be able to correctly identify all parts of the plant within 75%

(cognitive): Identify the importance of each part of the leaf to the pants system.

(affective): Appreciate all the functions of leaves and demonstrate how the cycles function.

(psychomotor): Perform leave dissections, looking at stomata, and breaking down the leaves.

ENGAGEMENT (5 min)

- Introduce the researchers
- Explain Student ID #'s
- Pre-test (administered by cooperating teacher before lesson date)
- Introduce the organisms. (Both Plants)

EXPLORATION (10 min)

- Students get in groups of 4
- Send one student from each group to collect materials
- Students perform their Stomata experiment and then leave dissection

EXPLANATION (5 min)

- The class will come back together to discuss what they learned
- Researches will discuss anything they missed if needed.

ELABORATION (10 min)

- Have students go through some literature over photosynthesis in the same groups
- Apply the literature to their activities
- Make connections between literature and activities

EVALUATION (15 min)

- Informal Check for understanding
- Post-test and Likert test

EXPERIMENTAL Online DAY 2

Teacher: Annie Dietz & Keli Potter

Date: February 25, 2023 (Tentative schedule date)

Subject/grade level: 9th – 12th

Materials: Computers and online dissection (Pentas Lanceolata dissection)
Link: https://www.cuhk.edu.hk/lifesciences/IVFDL/virtual_p301_whole.html

STANDARDS

NGSS

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

Lesson objective(s):

Objective: 9th – 12th grade students will be able to correctly identify all parts of the plant within 75%

(cognitive): Identify the importance of each part of the leaf to the pants system.

(affective): Appreciate all the functions of leaves and demonstrate how the cycles function.

(psychomotor): Perform leave dissections, looking at stomata, and breaking down the leaves.

ENGAGEMENT (5 min)

- Introduce the researchers
- Explain Student ID #'s
- Pre-test (administered by cooperating teacher before lesson date)
- Introduce the organisms. (Both Plants)

EXPLORATION (10 min)

- Students get in groups of 4
- Students work through the online dissection of plants

EXPLANATION (5 min)

- The class will come back together to discuss what they learned
- Researches will discuss anything they missed if needed.

ELABORATION (10 min)

- Have students go through some literature over photosynthesis in the same groups
- Apply the literature to online lab
- Make connections between literature and online lab

EVALUATION (15 min)

- Informal Check for understanding
- Post-test and Likert test

Worm Lesson Plans

EXPERIMENTAL Animal DAY 3

Teacher: Annie Dietz & Keli Potter

Date: February 26, 2023 (Tentative schedule date)

Subject/grade level: 9th – 12th

Materials: Dissection kit, gloves, earth worms
Dissection video: https://www.youtube.com/watch?v=aCnwF6vtE2g

STANDARDS
NGSS
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Lesson objective(s):

Objective: 9th – 12th grade students will be able to correctly identify all parts of the earth worm within 75%
(cognitive): Identify the importance of each part of the worm to the organism's system.
(affective): Appreciate all the functions of worm and demonstrate how the cycles function.
(psychomotor): Perform dissection

ENGAGEMENT (5 min)

- Introduce the researchers
- Explain Student ID #'s
- Pre-test (administered by cooperating teacher before lesson date)
- Introduce the organisms. (Worm)

EXPLORATION (10 min)

- Students get in groups of 4
- Send one student from each group to collect materials
- Students perform their worm dissection.

EXPLANATION (5 min)

- The class will come back together to discuss what they learned
- Researches will discuss anything they missed if needed.

ELABORATION (10 min)

- Have students go through some literature over worms' life cycle in the same groups
- Apply the literature to their activities
- Make connections between literature and dissection

EVALUATION (15 min)

- Informal Check for understanding
- Post-test and Likert test

EXPERIMENTAL Online DAY 4

Teacher: Annie Dietz & Keli Potter

Date: February 27, 2023 (Tentative schedule date)

Subject/grade level: 9th – 12th

Materials: Computer and online dissection
Link: https://www.emindweb.com/demo/invert/ (HAVE TO BUY)
https://digital.lib.buffalo.edu/items/show/4209 (Only pictures)
https://www.youtube.com/watch?v=1tVVVu5vY6w (Video)

STANDARDS
NGSS
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Lesson objective(s):

Objective: 9th – 12th grade students will be able to correctly identify all parts of the earth worm within 75%
(cognitive): Identify the importance of each part of the worm to the organism's system.
(affective): Appreciate all the functions of worm and demonstrate how the cycles function.
(psychomotor): Perform online dissection

ENGAGEMENT (5 min)

- Introduce the researchers
- Explain Student ID #'s
- Pre-test (administered by cooperating teacher before lesson date)
- Introduce online dissection.

EXPLORATION (10 min)

- Students get in groups of 4
- Students work through the online dissection of earth worm

EXPLANATION (5 min)

- The class will come back together to discuss what they learned
- Researches will discuss anything they missed if needed.

ELABORATION (10 min)

- Have students go through some literature over worms' life cycle in the same groups
- Apply the literature to their activities
- Make connections between literature and dissection

EVALUATION (15 min)

- Informal Check for understanding
- Post-test and Likert test

Evaluation

Pre-test and Post-test

- A 10 question quiz
- Evaluate student achievement of the student

Post Post-test

- Evaluate student retention

Likert scale

- A scale of 1 - 5 based on students feelings, attitude, and emotion over the different lessons.
- Used for the motivation of the students

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