香 港 大 學
THE UNIVERSITY OF HONG KONG

TIMSS 2019 Webinar: Enhancing learning and teaching of mathematics and science in Hong Kong – A reflection based on the TIMSS 2019 results

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Teacher Education and Learning Leadership

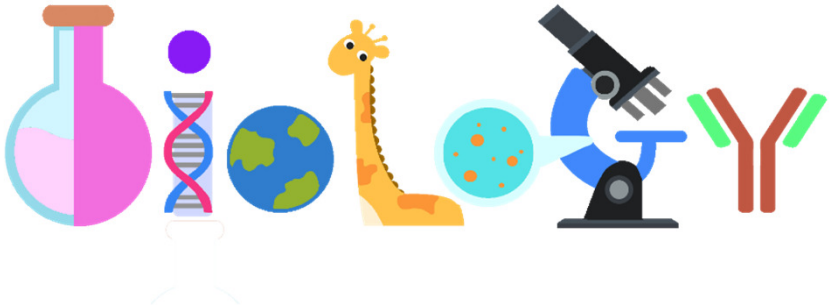
Faculty of Education

About Me

Background:

- Science education researcher
- Biology teacher educator

Research Interest:



- Teacher expertise
- Formative assessment
- Use of videos in teacher education
- Innovative biology teaching

Outline

❶ Examining 2019 Grade 4 TIMSS items (Life Science)

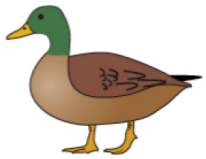
❷ Examining a video case of teaching and learning of *Organisms and Ecological Relationships*

❶ Examining 2019 TIMSS Items

❶

The pictures show a wind-up toy duck and a living duck.

toy duck



living duck

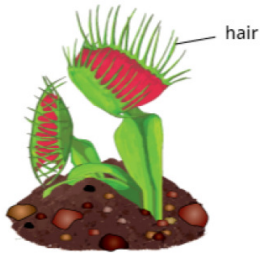
Do these characteristics describe **both** the toy duck and the living duck, or **only** the living duck?

Click one circle for each characteristic.

	Toy duck and living duck	Only living duck
needs water	A	B
needs air	A	B
can grow	A	B
can move	A	B
can reproduce	A	B

❷

This plant is a Venus flytrap.



When an insect touches the hairs on the Venus flytrap, the trap closes around the insect. Then the plant digests the insect.

In what way is the Venus flytrap different from most other plants?

A. The Venus flytrap attracts insects and other plants do not.

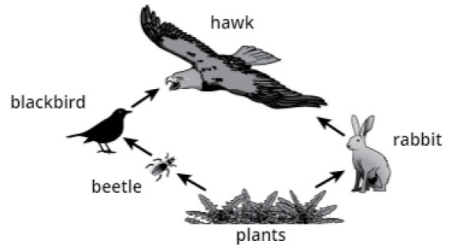
B. The Venus flytrap gets nutrients from insects and other plants do not.

C. The Venus flytrap helps insects reproduce and other plants do not.

D. The Venus flytrap gets its water from insects and other plants do not.

❸

The picture below shows a food web in a forest ecosystem.



A. Based on what you can see in the food web, what does the hawk eat?

A. only the blackbird

B. only the rabbit

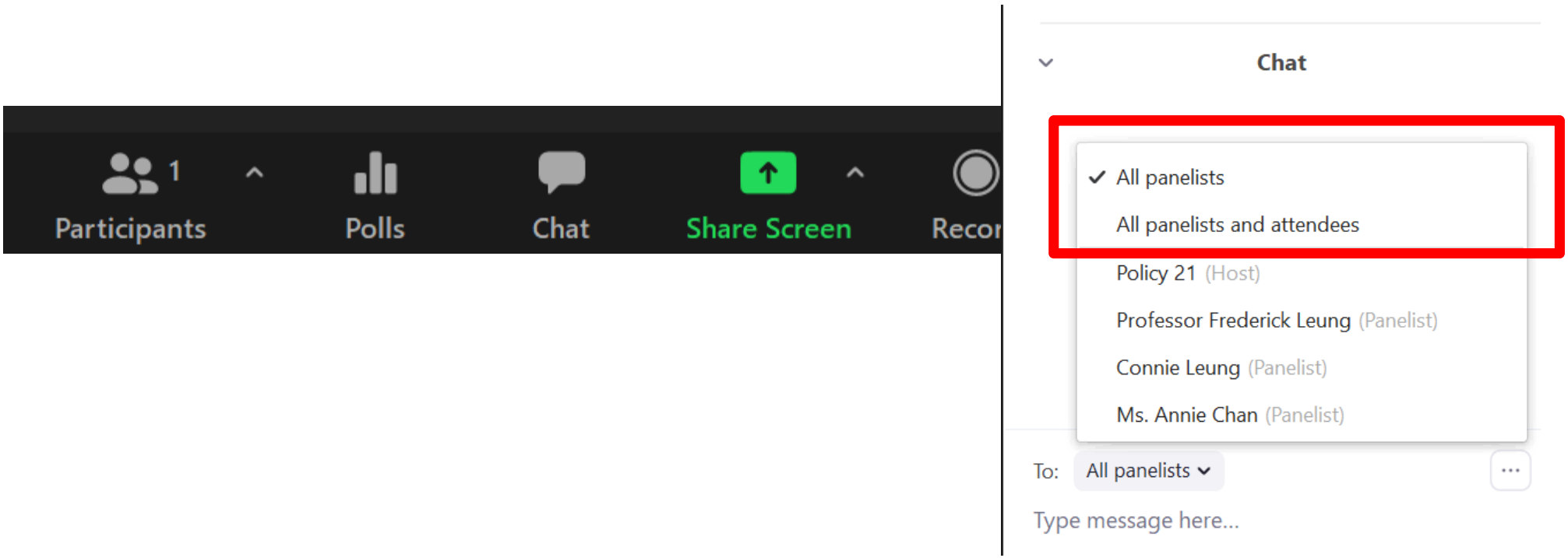
C. the blackbird and the rabbit

D. the beetle, the blackbird, and the rabbit

B. Based on what you see in the food web above, which two animals compete with each other for food?

1. _____

2. _____


1
Participants
Polls
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All panelists
All panelists and attendees
Policy 21 (Host)
Professor Frederick Leung (Panelist)
Connie Leung (Panelist)
Ms. Annie Chan (Panelist)
To:
All panelists
Type message here...

Curriculum and Assessment Guide p.25-p.26

Strand 2: People and Environment

Learning Objectives

	KS 1	KS 2
Knowledge and understanding	• to recognise the basic needs, features and growth process of living things • to recognise the simple classification of living things • to recognise living things in different environments and the interdependence among living things	• to know the major process of the life cycle of living things • to know the biodiversity and classification of living things • to recognise the interdependence between living things and their environment

Values and attitudes	• to appreciate that there are similarities and differences among different types of living things • to appreciate the interdependence of living things in the natural environment • to cultivate a caring attitude towards animals and plants • to show concern for environmental conservation and make wise use of natural resources	• to appreciate the wonder of the nature and show interest in exploring our environment • to respect and care for living things and show concern for endangered species • to recognise the importance of environmental conservation, and to actively participate in it • to be open-minded and objective towards different views

Curriculum and Assessment Guide p.49-p.68

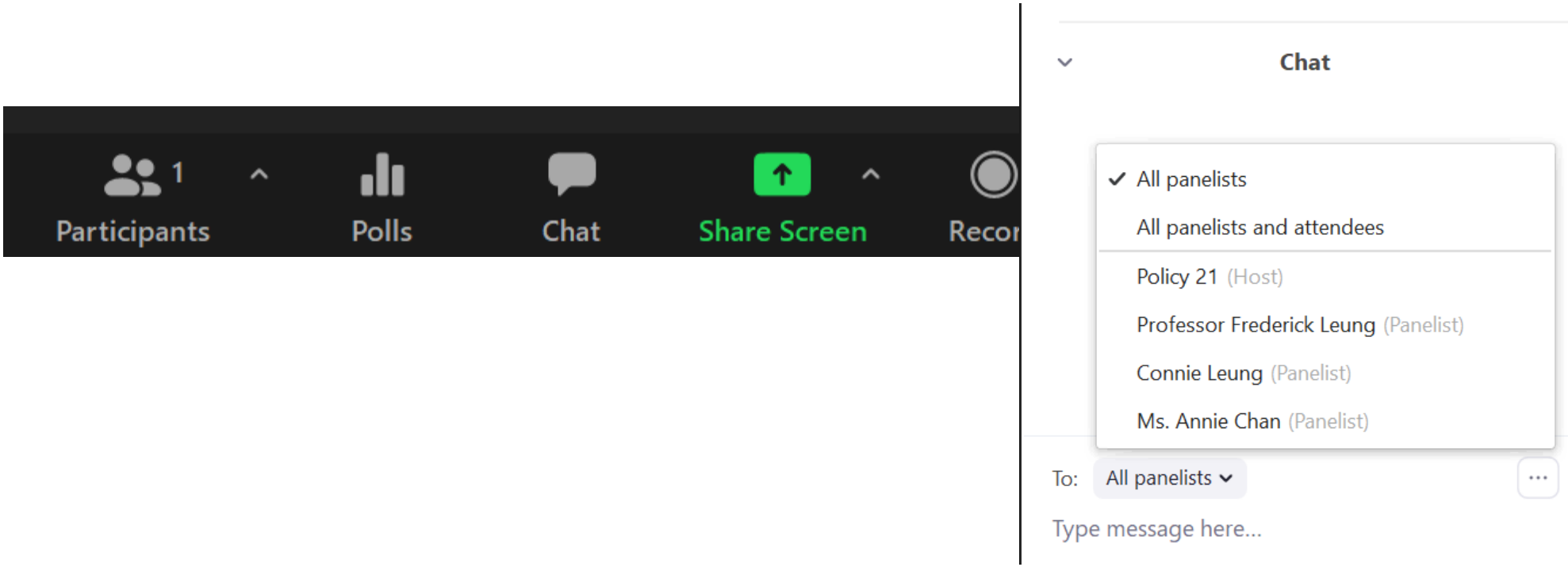
- 2.5 The Thematic Approach

Level	Theme	Module	Learning elements
Primary 1	Growing up	Plants and Animals	• Common characteristics of living things (e.g., growth, excretion, reproduction) • Simple classification of living things (e.g., animals and plants) • Growing environment of animals and plants and their interdependent relationship • Growing environment of plants
Primary 2	Growing up	Growth of Animals and Plants	• Growing plants – Basic needs of plants and their growth
Primary 3	The Natural Environment	Love of Nature	• Common animals and plants in Hong Kong • Simple classification of animals (distinct differences and similarities, e.g., feather, hair, fins) • Caring for and conserving the natural environment

Level	Theme	Module	Learning elements
Primary 5	Wonders of life	Continuation of Life	• Biodiversity and classification of living things • Photosynthesis • The interdependent of living things and environment (e.g., food chain) • Caring about endangered species
Primary 6	Environment and living	Survival of the Fittest	• Form and functions of living things and their adaptations to the environment • The effect of human activities on the natural environment

Task 1: *Prediction Task*

- 1. Make a prediction of the student performance by ranking the items in terms of their performance (Best performance (1st rank) e.g., 1 > 2 >3)

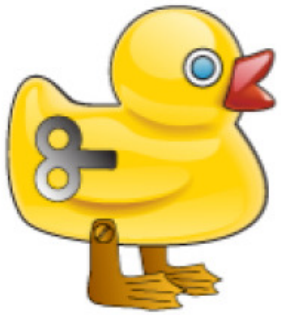


IEA eTIMSS 2019

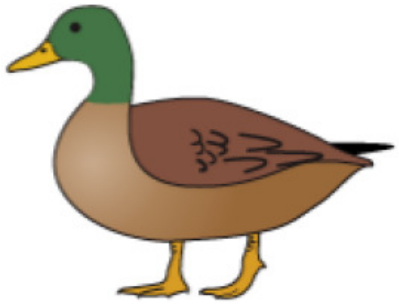
TIME LEFT 0

1

1 The pictures show a wind-up toy duck and a living duck.



toy duck



living duck

Do these characteristics describe **both** the toy duck and the living duck, or **only** the living duck?

Click one circle for each characteristic.

	Toy duck and living duck	Only living duck
needs water	A	B
needs air	A	B
can grow	A	B
can move	A	B
can reproduce	A	B

6.5 92.2
5.5 93.0
1.7 95.0
75.3 23.8
7.0 91.0

IEA eTIMSS 2019

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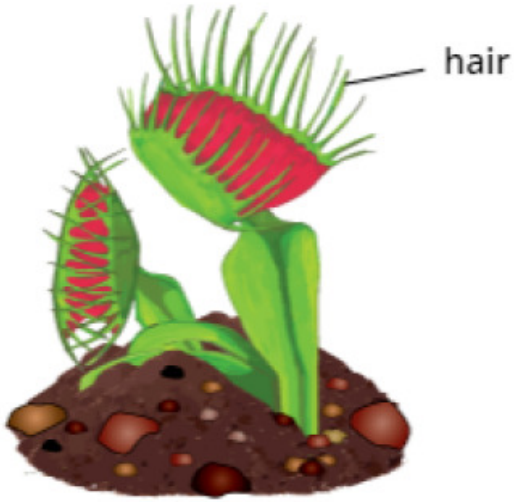
2 This plant is a Venus flytrap.



When an insect touches the hairs on the Venus flytrap, the trap closes around the insect. Then the plant digests the insect.

In what way is the Venus flytrap different from most other plants?

A The Venus flytrap attracts insects and other plants do not. 31.5

B The Venus flytrap gets nutrients from insects and other plants do not. 50.9

C The Venus flytrap helps insects reproduce and other plants do not. 7.1

D The Venus flytrap gets its water from insects and other plants do not. 10.0

IEA eTIMSS 2019

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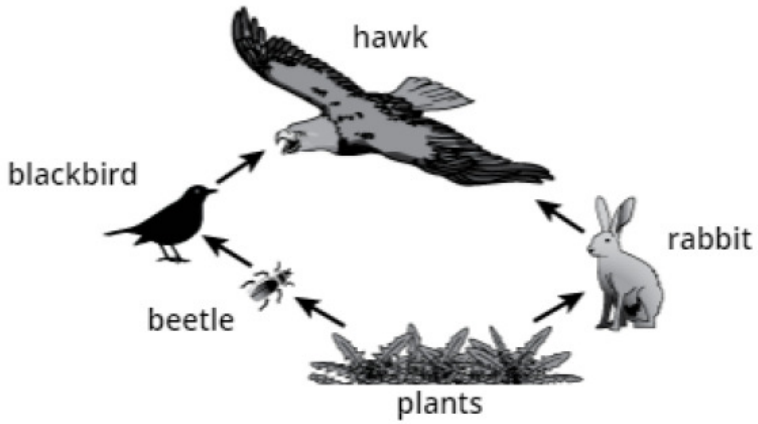
1

3 The picture below shows a food web in a forest ecosystem.



A. Based on what you can see in the food web, what does the hawk eat?

- (A) only the blackbird
- (B) only the rabbit
- (C) the blackbird and the rabbit
- (D) the beetle, the blackbird, and the rabbit

B. Based on what you see in the food web above, which two animals compete with each other for food?

1. _____

2. _____

17.9
3.0
53.8
24.1

Correct: 40.0
Wrong: 53.8

A Short Summary:

- HK students performed well in the 2019 TIMSS items (Life Science)
- Reasons that may account for differential performance
  - Cognitive demands of the items
  - Whether the items target at student difficulties
  - Items not in the curriculum
    - Students do not have opportunities to learn/study a particular content
  - Items in the curriculum
    - Cognitive demands in the item and the cognitive demands with which the content is taught do not match

Task 2: *Video Analysis*

Episode A: *Ecosystem*

(Sabrina Van-Phanz & Dora Kastel)

Context of the video:

- Grade 6 US
- Organisms and Ecological Relationships
- ~25 students

Let’s share your ideas:

What did you notice?

- ***Task:*** *Group work* - Students were given 12 picture cards showing organisms in the Yellowstone National Park and tasked with sorting the organisms into groups with their own reasons

- ***Students:*** 3-4 students worked in group and reasoned about how and why they sorted the organisms. Students reported on the whiteboard to indicate the teachers had heard their reasoning

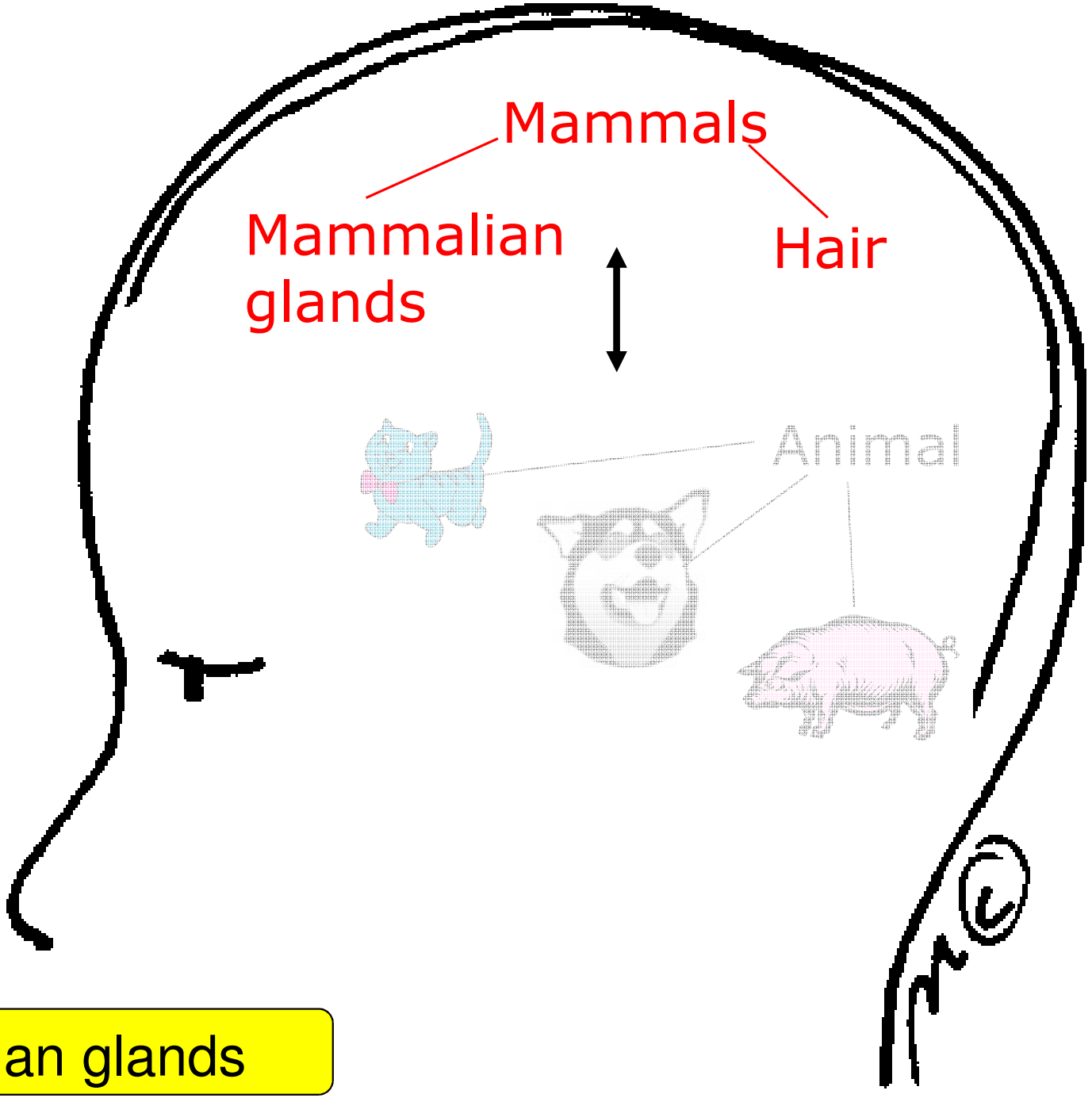
- ***Teachers:*** Teachers circulated the group and understand students' reasoning

6	S1:	What would eat a tick?
7	S2:	Well, let's [inaudible].
8	S3:	I think some of these animals may eat ticks.
9	S1:	Ticks are nasty.
10	S4:	Tick or the pine seeds?
11	S5:	Birds eat seeds.
12	S6:	Both of them would, so we could put it like this.
13	T1:	How did you group your cards?
14	S7:	So the prey would eat the plants and then the predator would eat the prey.
15	T1:	So it's kind of like a tiered level, right? A hierarchy.
16	S3:	Grizzly bears, they are mammals because mammals are basically anything that
17		doesn't have eggs.
18	T2:	Okay.
19	S3:	These are all mammals.
20	T2:	All right. So these are your three groups.
21	T1:	And these are the ones that are...
22	S8:	Don't eat meat.
23	T1:	Mostly are herbivores. And what do you mean by herbivores?
24	S9:	They really eat plants, seeds and not meat.
25	T1:	Go ahead person number four, check off for Team Einstein.
26	S10:	Check off the first one.

Today we talk about mammal.

The features of mammal are (a) having hair..

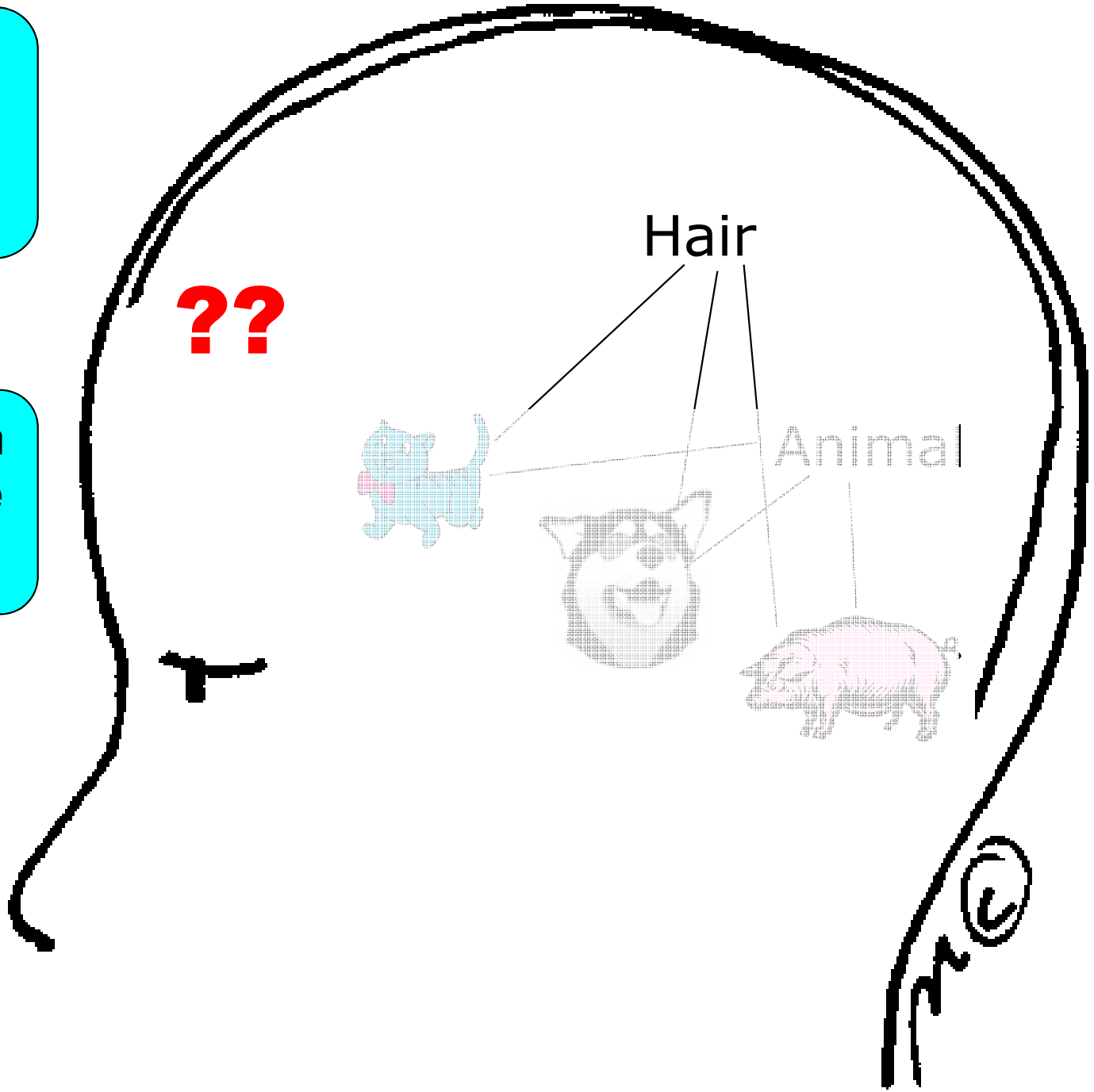
(b) Mammalian glands



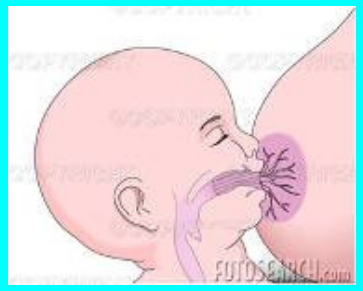
Cats, dogs and pigs are a kind of **animals**…

What do they have in common? They have **hair**.

They are also like us, they have **mammalian glands**.



Think about this:



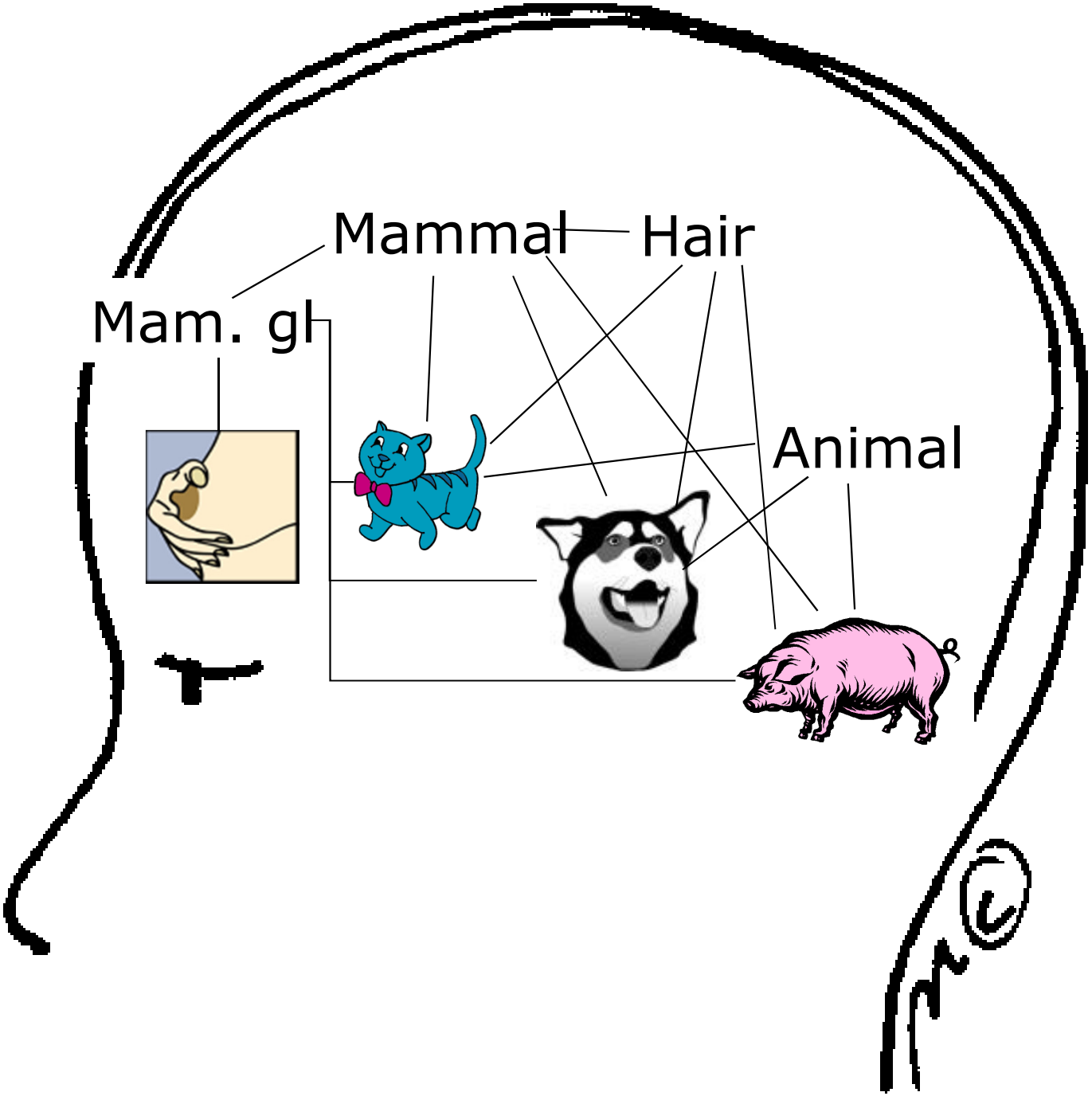
Hair

Mam. gl

Animal

These animals, which have these features, are called ‘mammals’.

These have hair and mammalian glands.



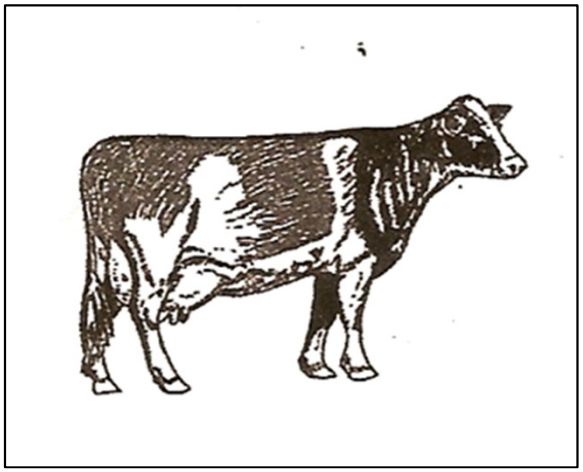
Animals

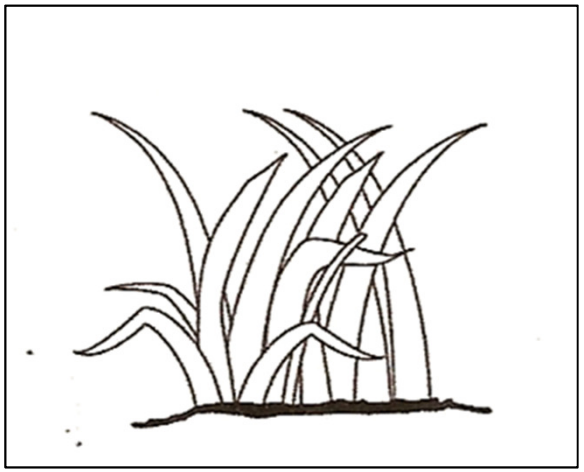
Scientific view

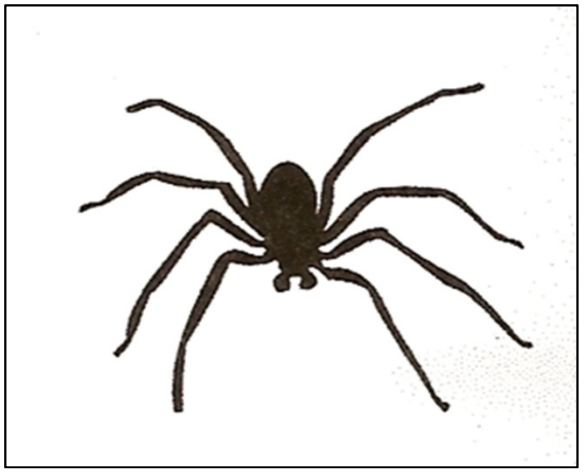
- Animals are living things that carry out these life processes:
  - move, reproduce, responds to stimuli, grow, respire, excrete, feed/eat.

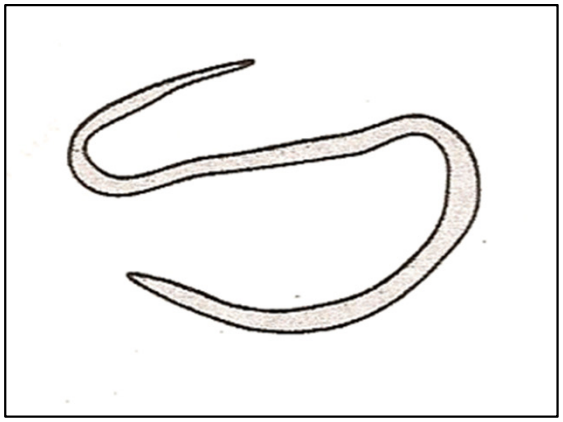
Students' views?

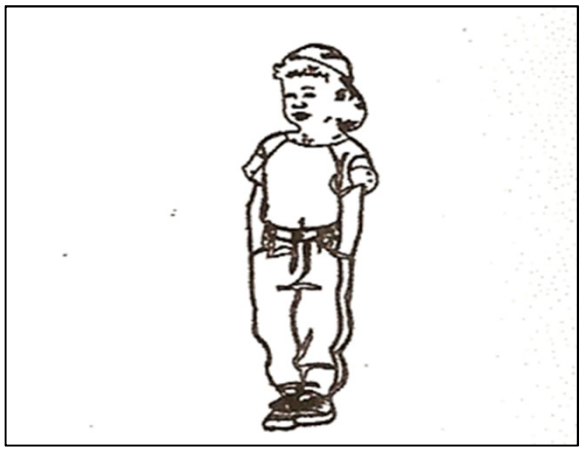
We need to find out!











Is this an animal?	11 years old (N=49)
Cow	98%
Boy	57%
Worm	37%
Spider	22%
Grass	0

Animals

Students' views:

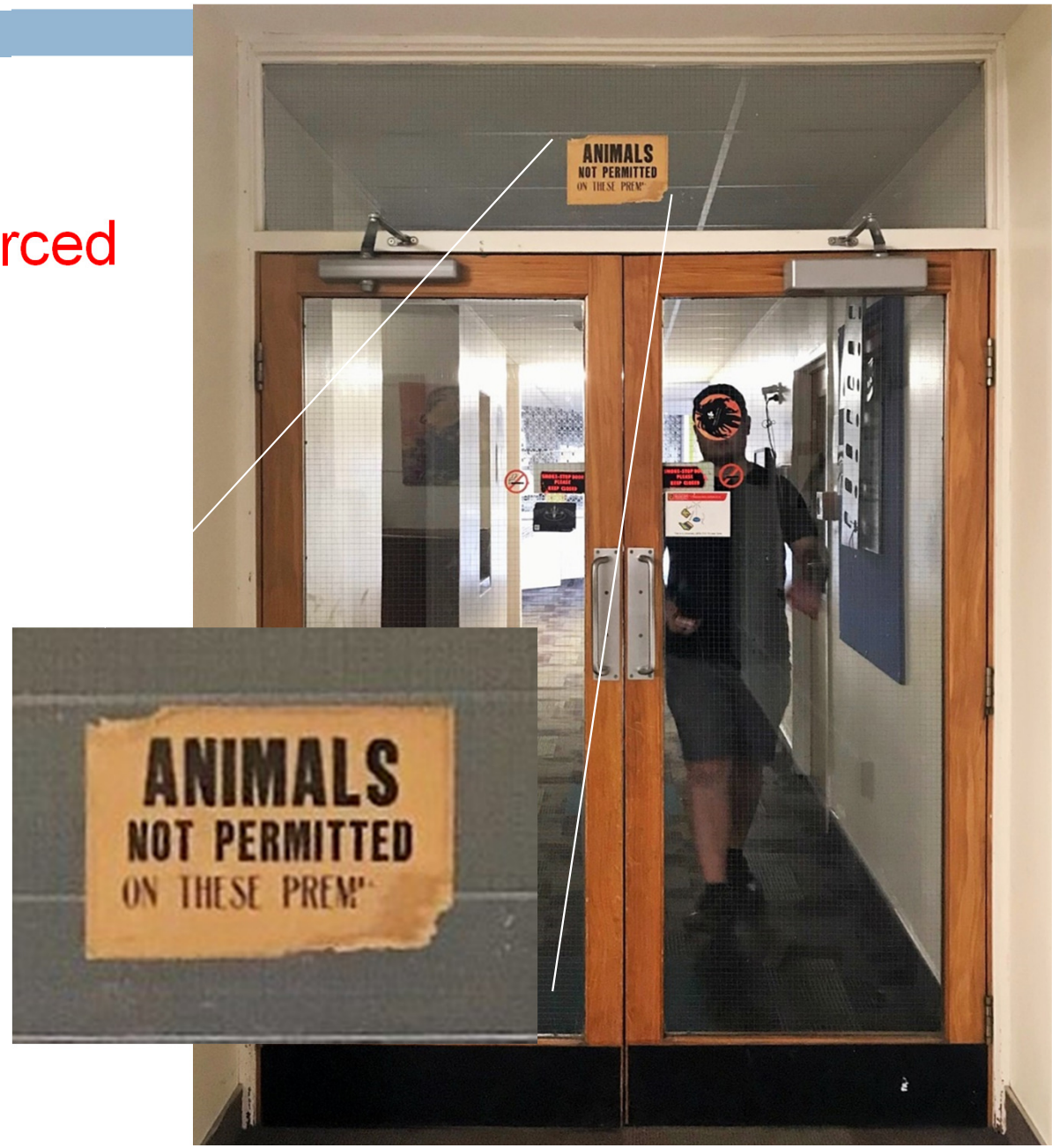
- Animals are large and have four legs, they have fur
  - humans are *not* animals
  - spiders and worms are *not* animals

Scientific view:

- Animals move, reproduce, responds to stimuli, grow, respire, excrete, feed/eat.

Animals

- Some of the unscientific existing ideas are reinforced in our daily lives.



Task 2: *Video Analysis*

Episode A: *Ecosystem*

(Sabrina Van-Phanz & Dora Kastel)

Let’s share your ideas:

What did you notice?

- ***Task:*** *Group work* - Students were given markers to indicate the relationships between the organisms. A student was asked to visit other groups and report back the differences amongst the groups. Students were given scientific information to read.

  Whole class discussion – Students shared their thinking.

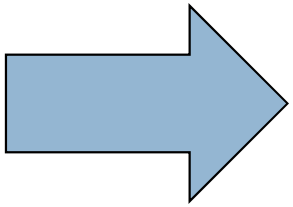
- ***Students:*** 3-4 students worked in group to indicate the feeding relationships and read other peer groups' ideas. Students then read scientific information and refined their ideas using another marker. Students also predicted what happened when wolf was introduced.

- ***Teachers:*** Teachers provided scientific information after the students expressed their initial ideas. Teacher highlighted the importance of cause and effect relationship.

Notable strategies used by teachers:

- Teachers elicited initial ideas and reasoning
- Teachers allowed students to compare their ideas with their peers
- Teachers provided scientific information for students to read and refine their initial ideas
- Teachers discussed common errors and highlighted ‘tool of scientific thinking’

- As teachers, our task is to move students from

Everyday understanding  *Coherent scientific understanding*

Take Home/ Stay Home Messages:

- Our students performed well in the 2019 Grade 4 TIMSS items (life science)
- We may consider restructure our teaching in a way that engages elicitation of students' prior knowledge and initial thinking and reasoning
- We can use some strategies (card sort) to elicit student thinking
- We can provide thinking tool (e.g., cause and effect relationship) to promote their high order thinking

Go to Part 3