

NGSS 3-Dimensional Learning and Assessment of Science and English Proficiency

Science Kickstart
Honolulu, Hawaii
July 17, 2017

Okhee Lee
New York University



In Collaboration with Rita Januszyk, Former Elementary School Teacher
NGSS Writer and NGSS Diversity and Equity Team Member

Topics

Topic 1: Three-Dimensional Learning

Topic 2: Three-Dimensional Assessment

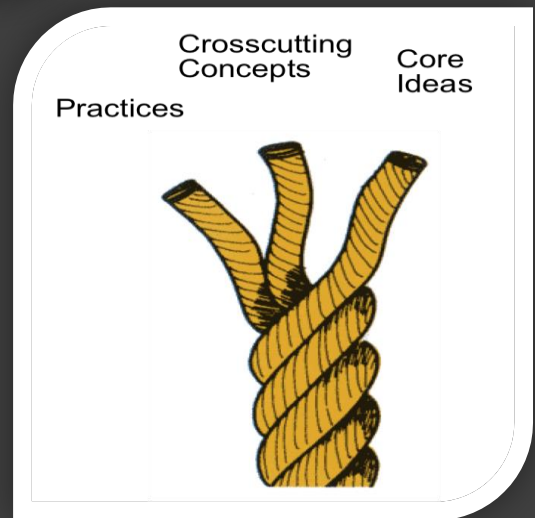
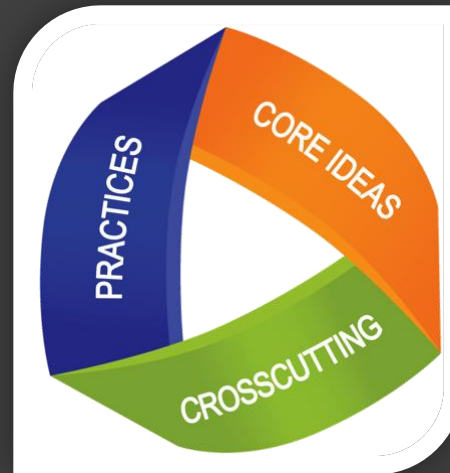
Topic 3: English Proficiency Assessment

How do you see an object?



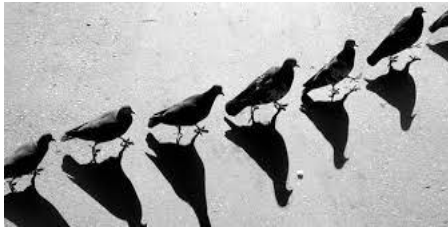
In Collaboration with Rita Januszyk, Former Elementary School Teacher,
NGSS Writer, and NGSS Diversity and Equity Team Member

Three-Dimensional Learning

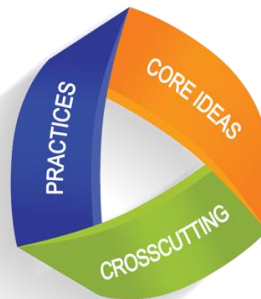


NGSS Instructional Shifts

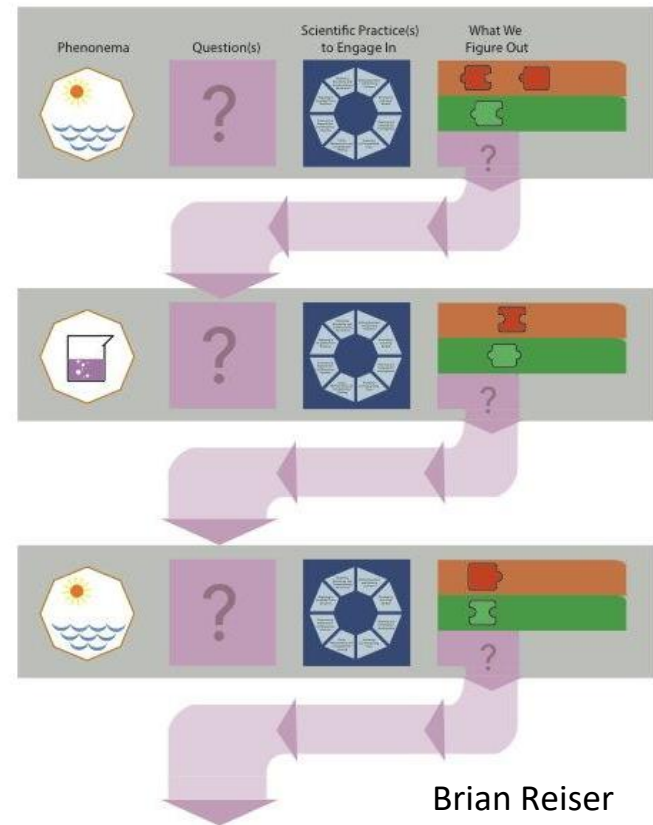
Shift 1: Explaining phenomena or designing solutions to problems



Shift 2: Three-dimensional learning



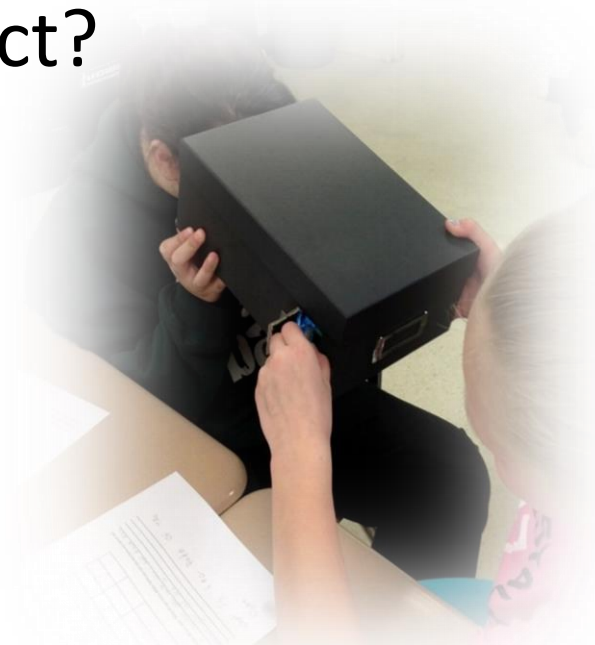
Shift 3: Coherence (or Learning progression)



Phenomenon (Shift 1)

Phenomenon: When you go to your bedroom at night, it is dark and you cannot see anything.

Question: How do you see an object?



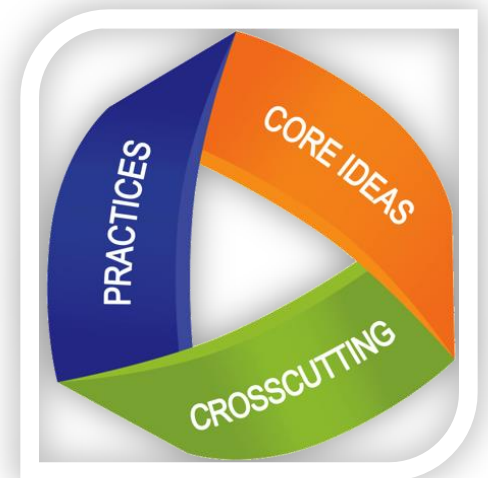
Three-Dimensional Learning (Shift 2)

4th Grade, Physical Science (PS)

4-PS4-2 **Develop a model to describe** that **light reflecting from objects and entering the eye allows objects to be seen.**

Three Dimensions

1. Science and engineering practices
2. Disciplinary core ideas
3. Crosscutting concepts



4. Structure, Function, and Information Processing

4. Structure, Function, and Information Processing

Students who demonstrate understanding can:

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

[Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. [Clarification Statement: Emphasis is on systems of information transfer.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Develop a model to describe phenomena. (4-PS4-2)
- Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2)

Engaging in Argument from Evidence

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- Construct an argument with evidence, data, and/or a model. (4-LS1-1)

Disciplinary Core Ideas

PS4.B: Electromagnetic Radiation

- An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)

LS1.A: Structure and Function

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

LS1.D: Information Processing

- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)

Crosscutting Concepts

Cause and Effect

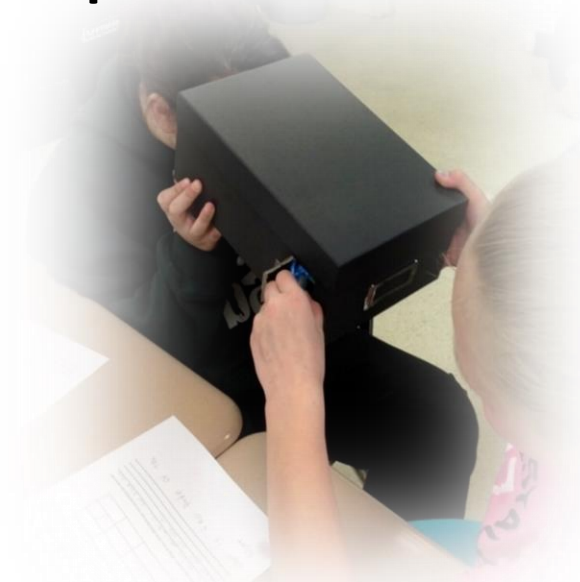
- Cause and effect relationships are routinely identified. (4-PS4-2)

Systems and System Models

- A system can be described in terms of its components and their interactions. (4-LS1-1), (LS1-2)

Develop a Model – NGSS Practice 3

- **Develop a model** that “shows” (i.e., explains) how you see an object
 - Models include **components**
 - Models show **relationships**
 - Models specify **cause and effect relationships**
- Components in the model include:
 - Object
 - Eye
 - Light
 - Open space



Develop a Model

- Form a group of 2-4 members
- Develop a model that **explains how you see an object**
 - Step 1: Look into the box with the flap closed
 - Step 2: Look into the box with the flap open
 - Step 3: Look into the box with flashlight shining through the flap**
- Develop a model for Step 3
- Make sure your group's model shows relationships between (1) object, (2) eye, (3) light, and (4) open space



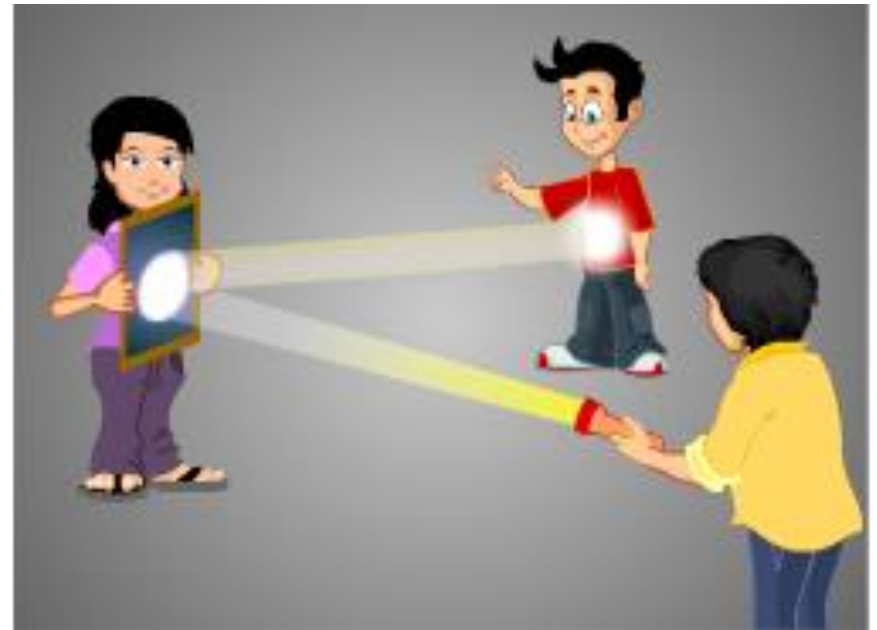
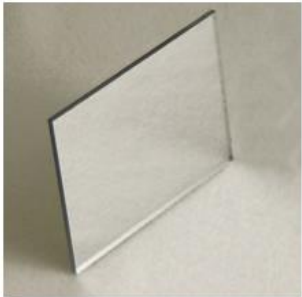
Learning Progression (Shift 3)

Instruction helps students develop an understanding over time . . .
(learning progression)



Learning Progression (Shift 3)

- Carry out group investigation
- Revise your group model

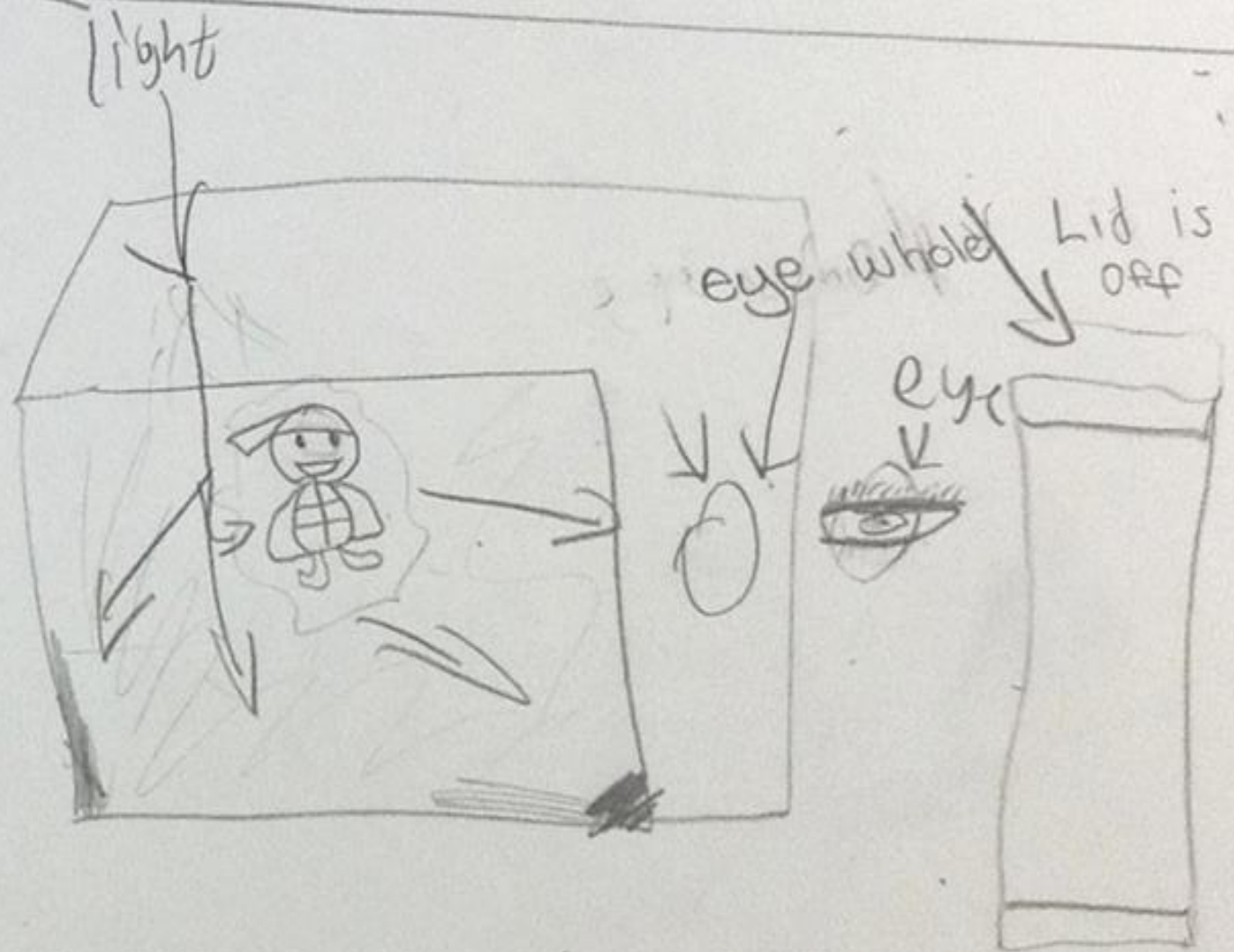


A mirror reflects a beam of light

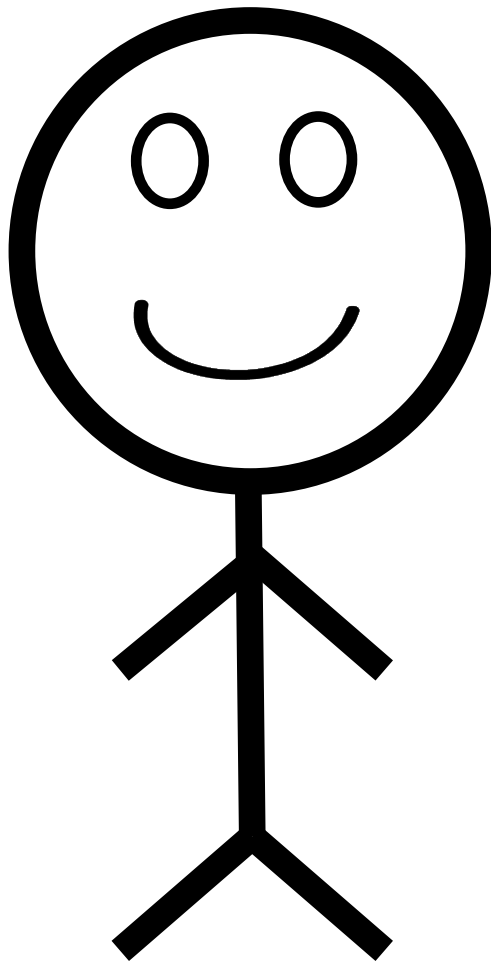
Initial Model



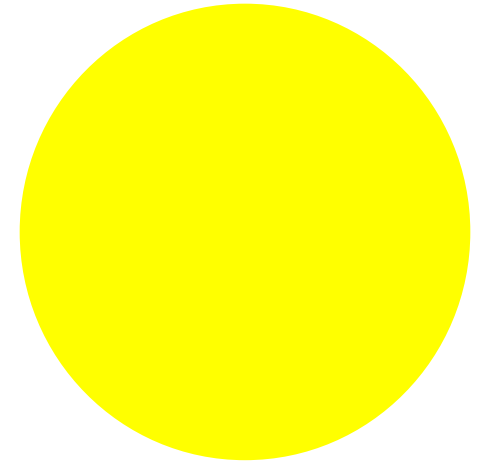
Revised Model

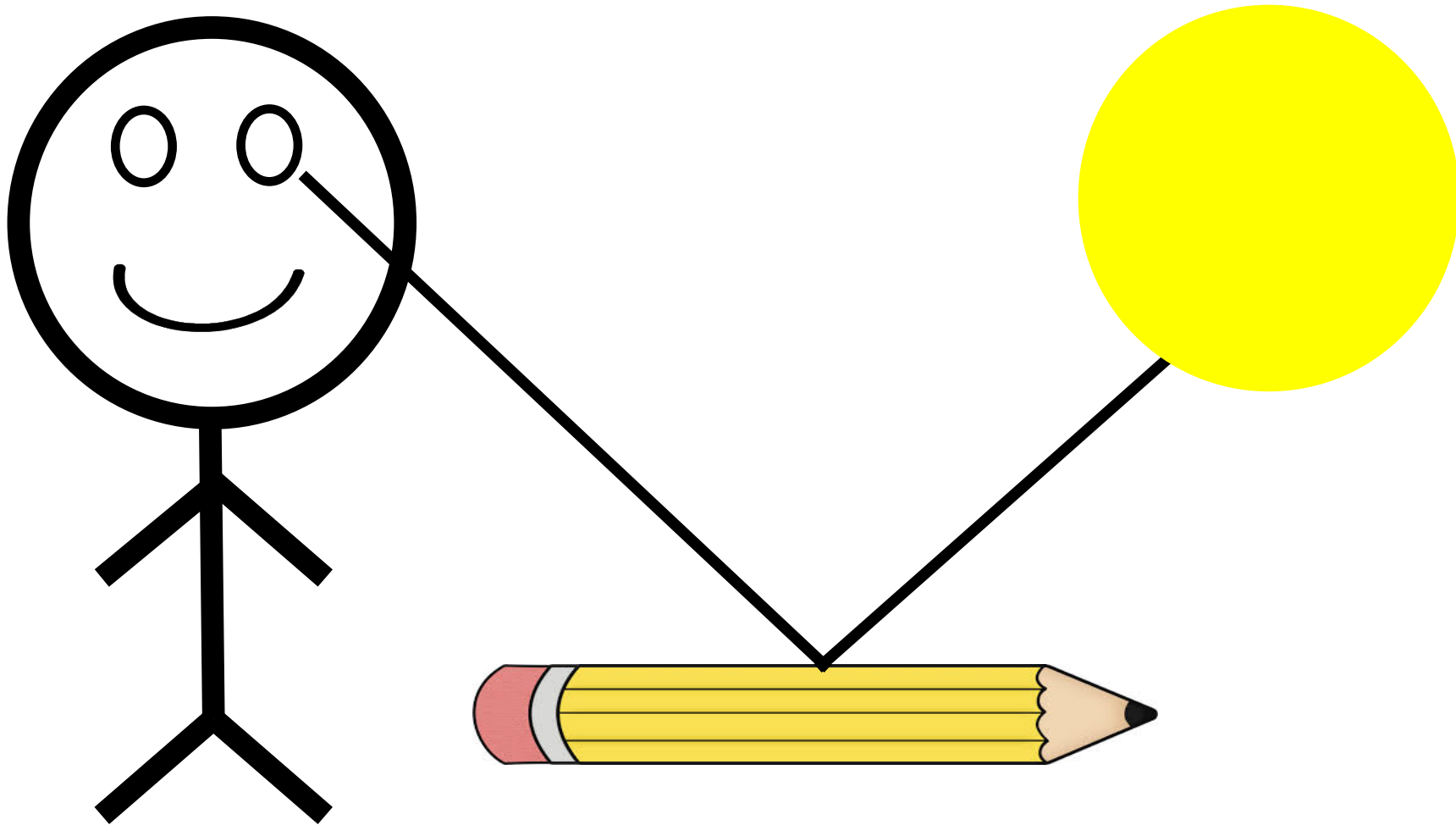


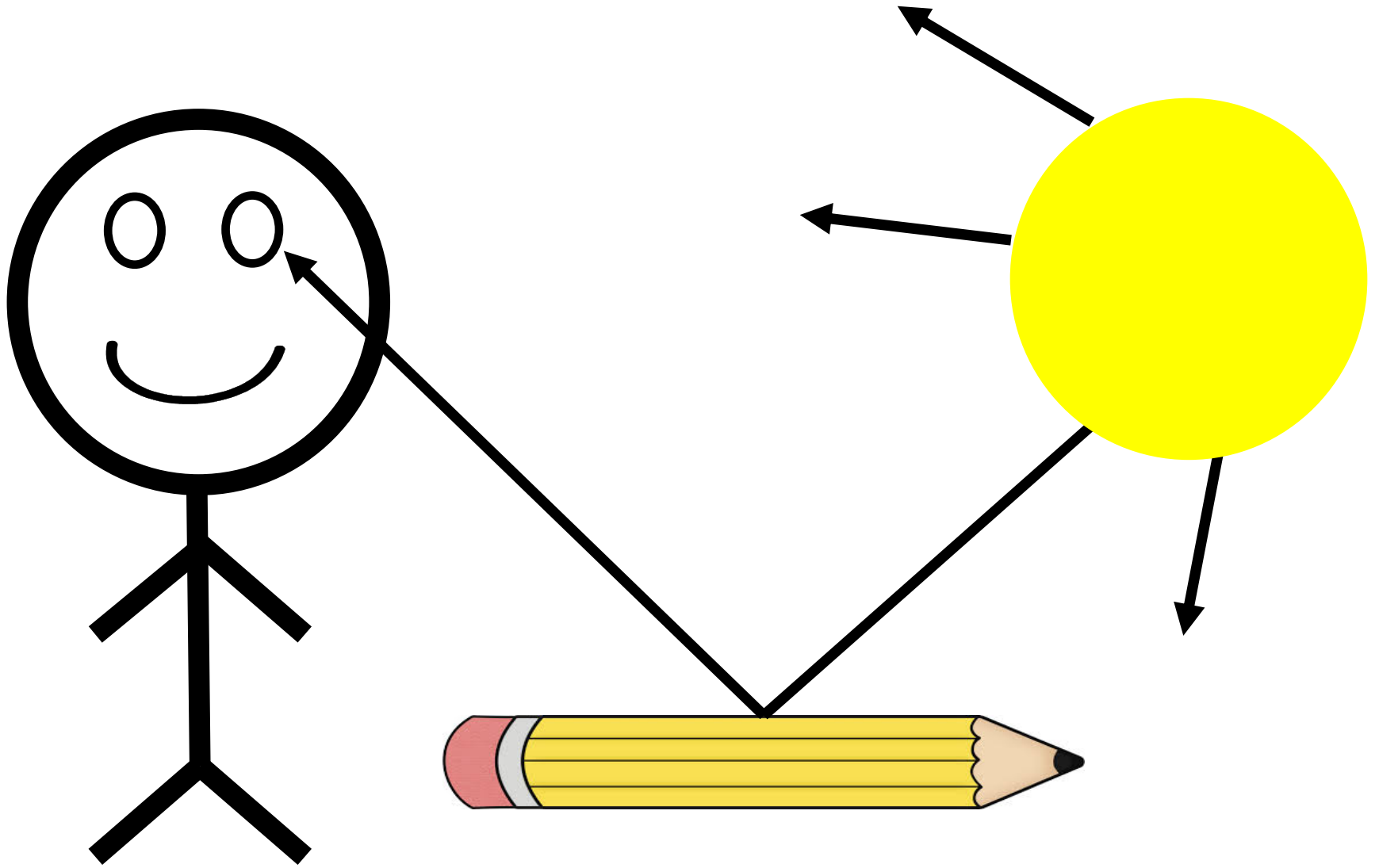
4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.



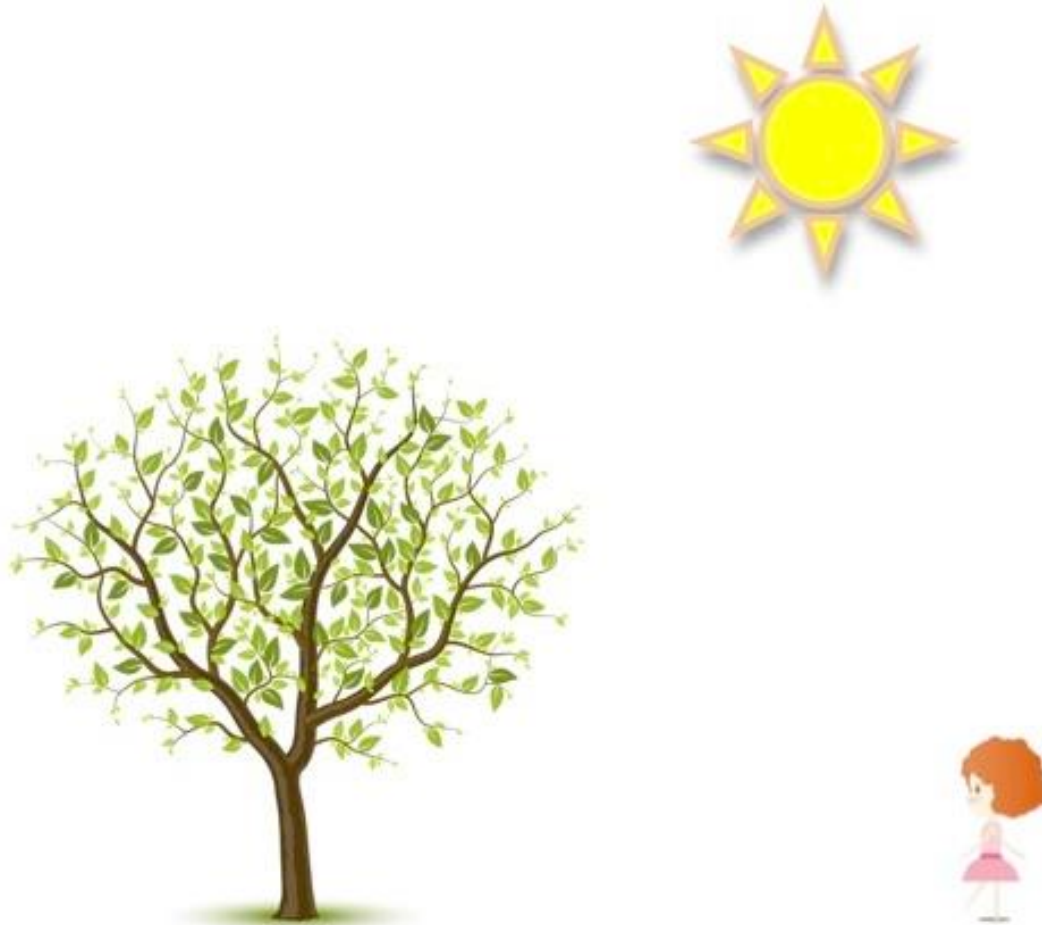
- Object
- Eye
- Light
- Open space



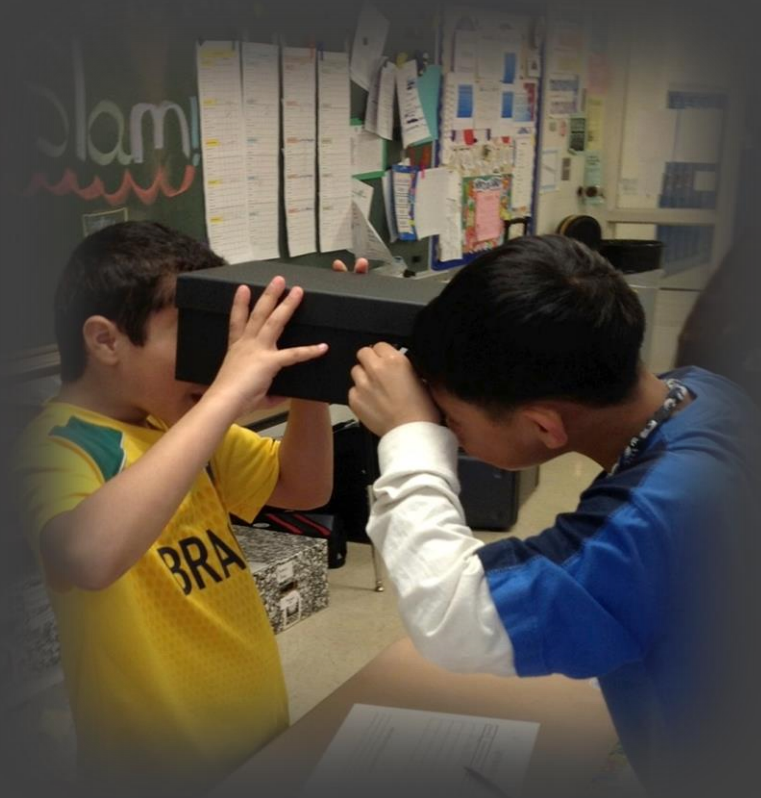




How can the girl see the tree?



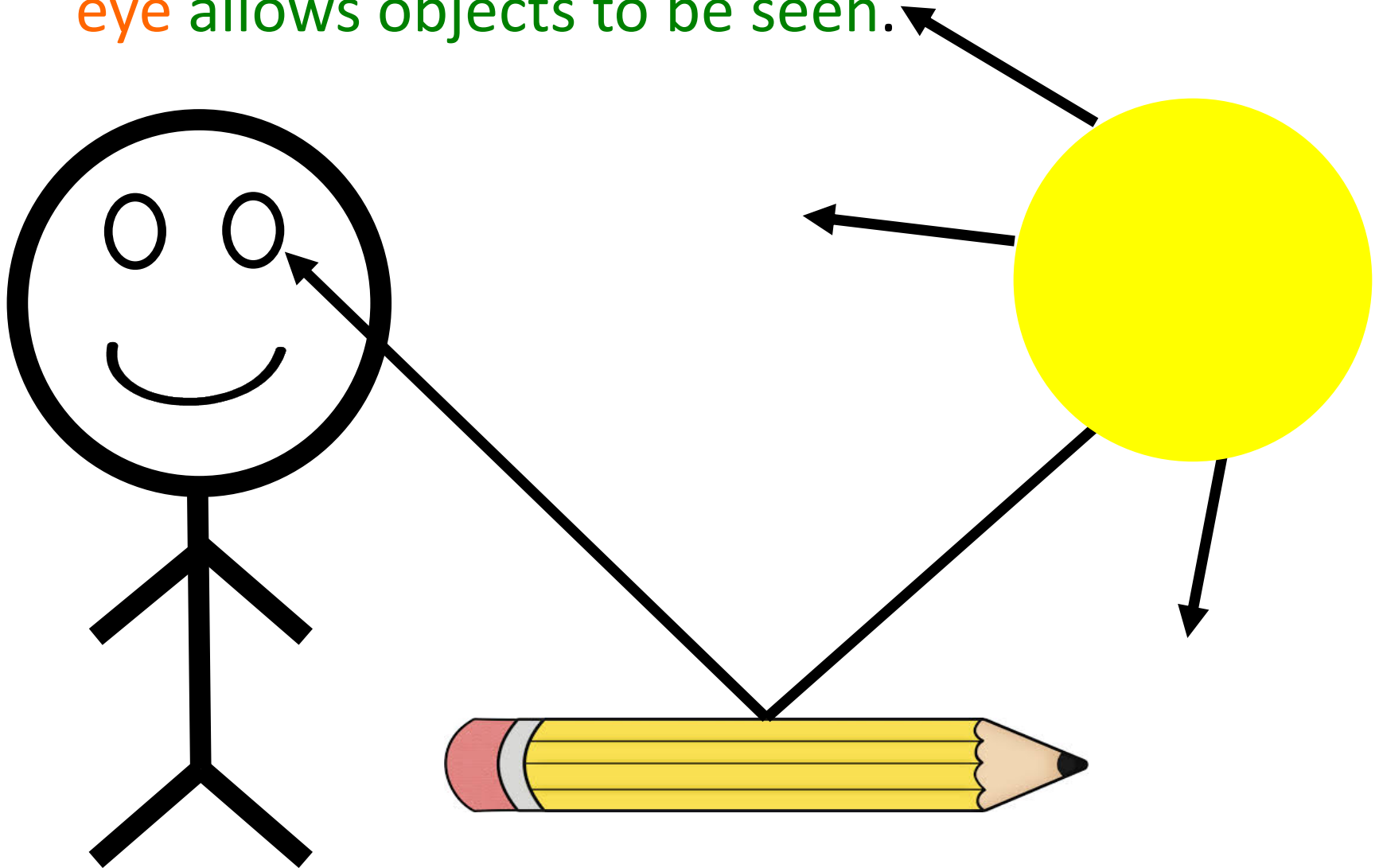
Three-Dimensional Assessment



Classroom-based Formative Assessment

- Artifacts that students create during or at the end of a lesson can serve as evidence of learning
- For example, use student models to assess:
 - prior knowledge through initial models
 - learning progression through revised models
 - mastery through final models
- Use information to guide subsequent instruction

4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.



3-Dimensional Assessment

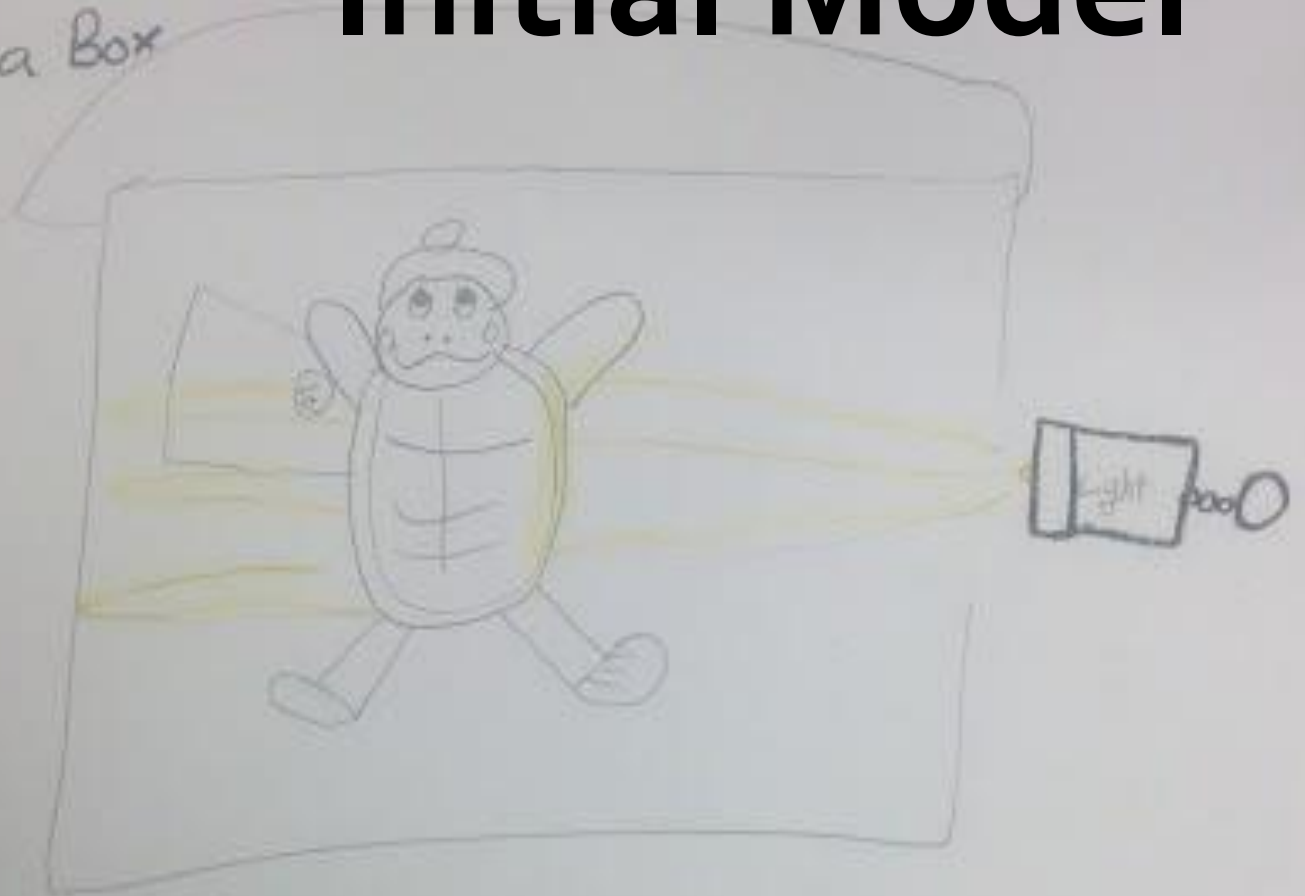
SEP: Components of a model (“develop a model to describe”)

DCI: Connections to science ideas (“light reflecting from objects and entering the eye”)

CCC: Cause and effect (“allows objects to be seen”)

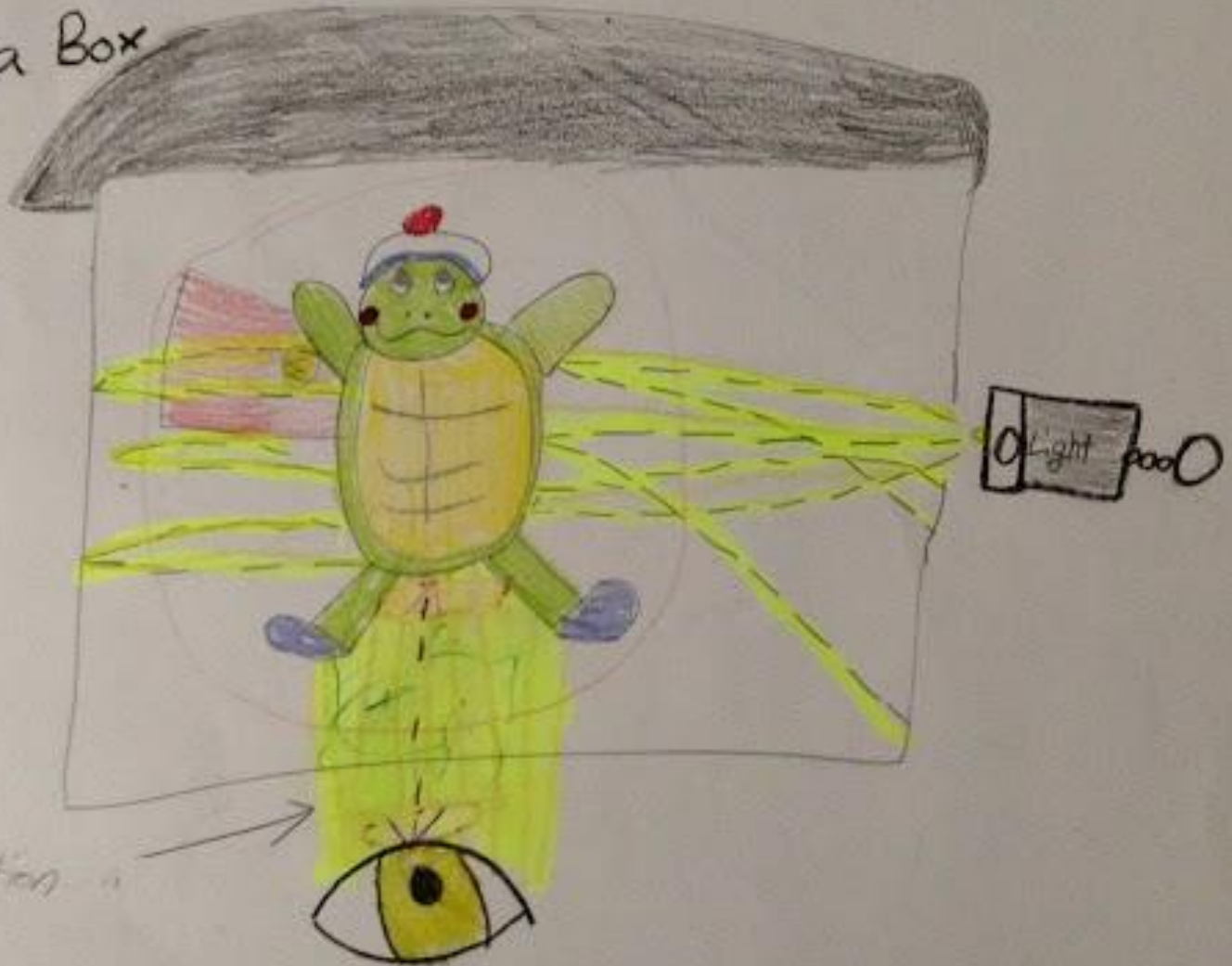
Initial Model

Turtle in a Box



Revised Model

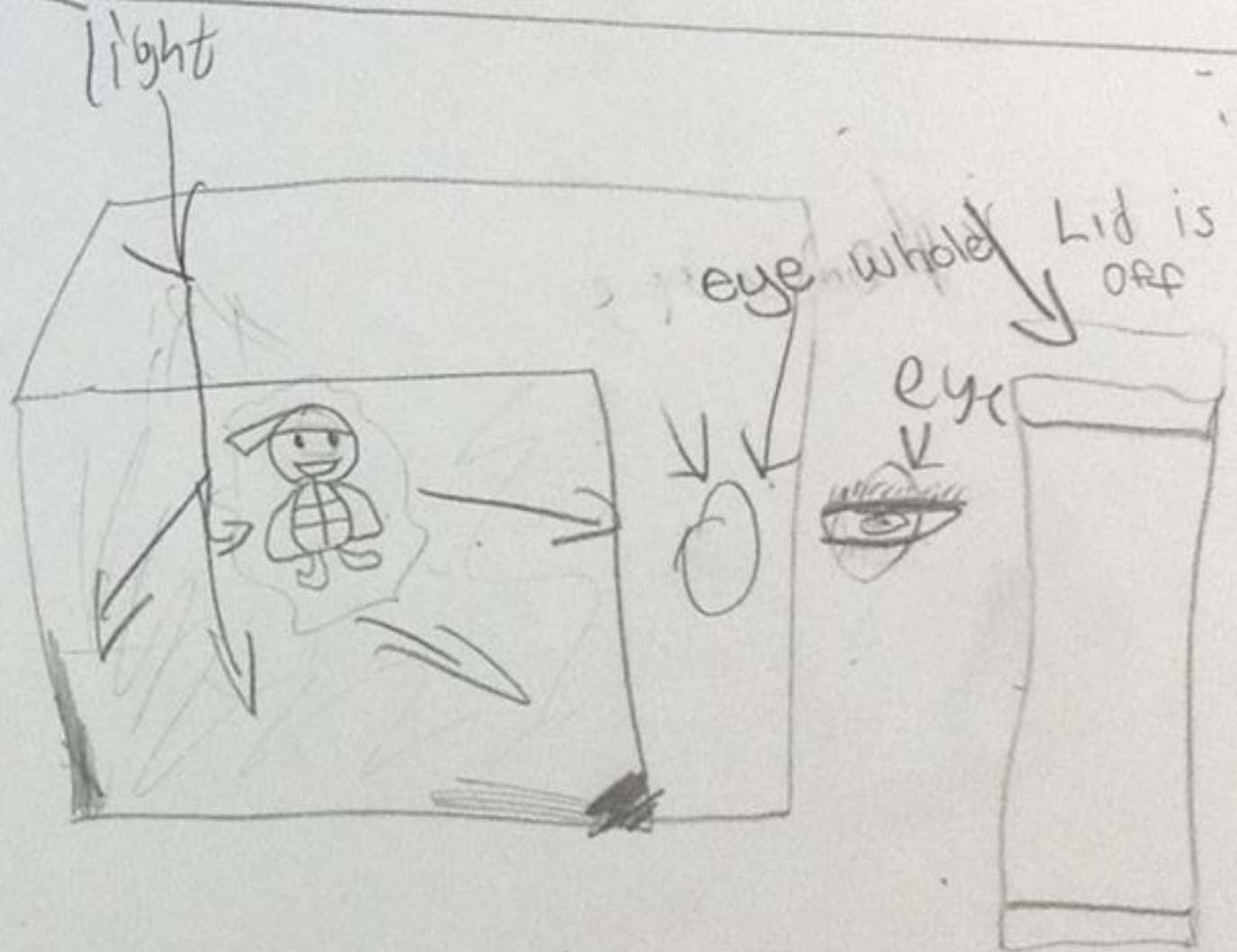
Turtle in a Box

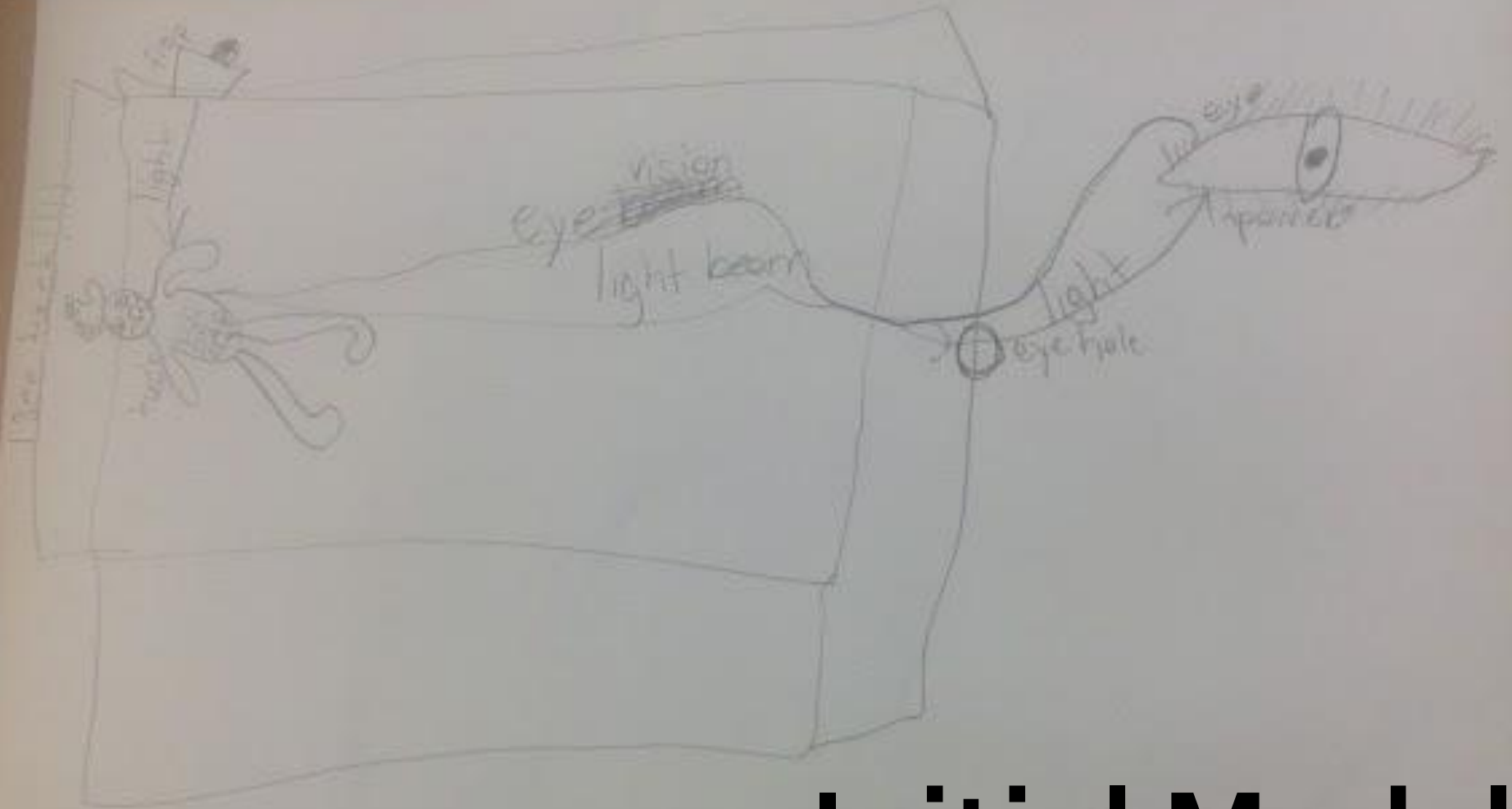


Initial Model



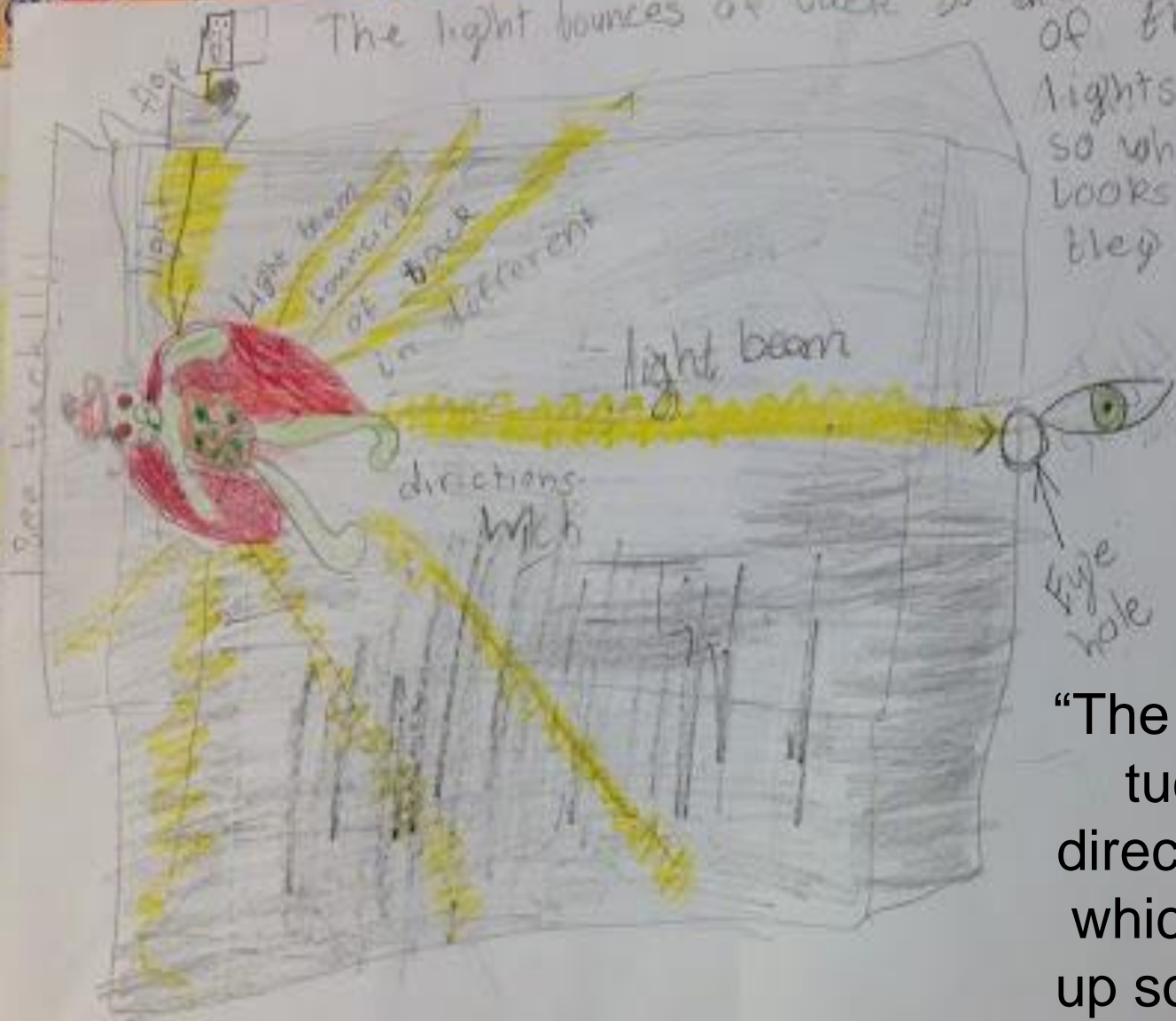
Revised Model





Initial Model

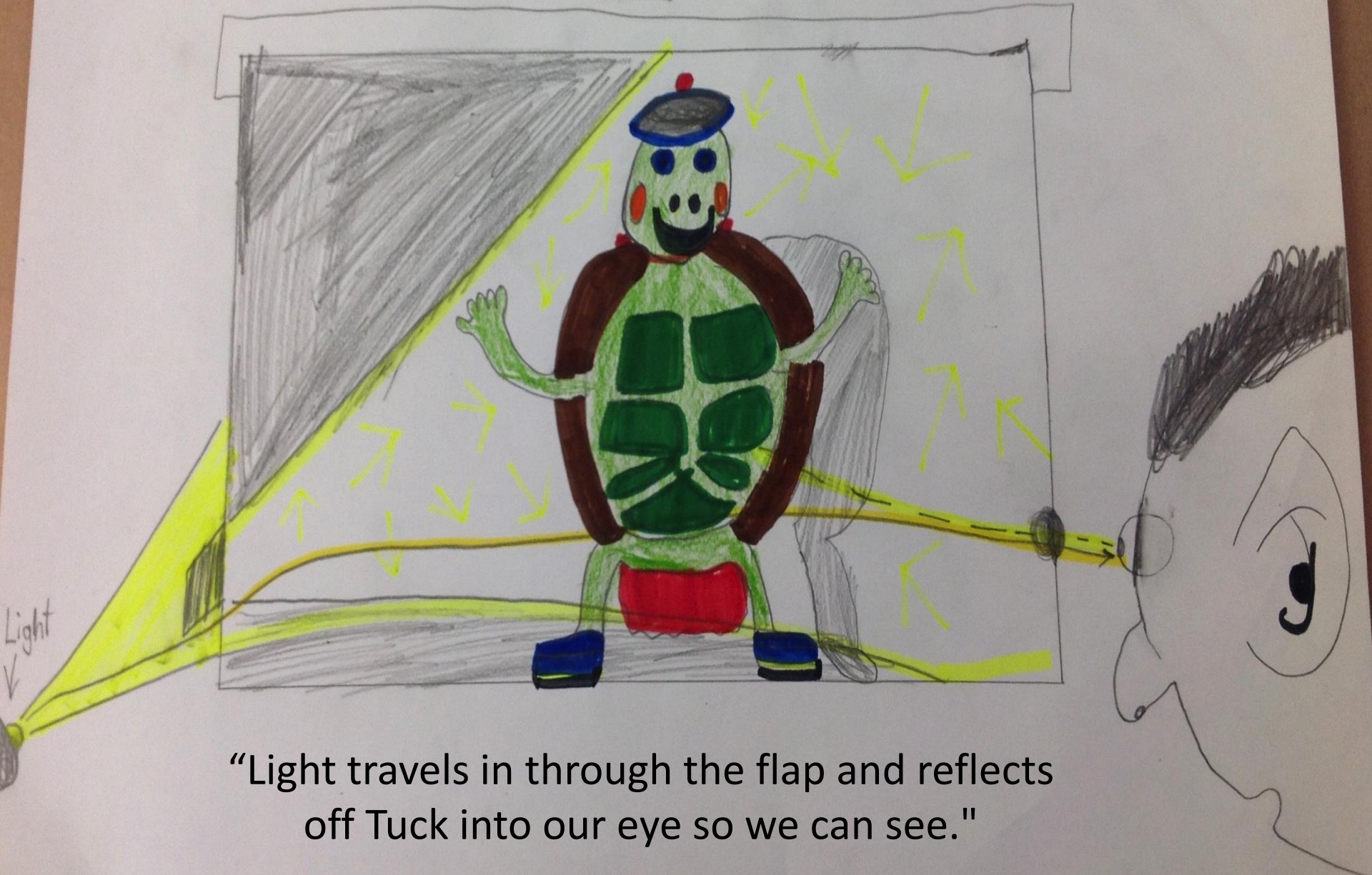
The light bounces of tuck to different directions of the box; which lights the box up so when a person looks in the box they can see tuck.



Revised Model

“The light bounces of tuck to different directions of the box, which lights the box up so when a person looks in the box they can see tuck.”

1. Light travels in through the flap and reflects off Tuck into our eye so we can see.
Tuck. 2. the light reflects everywhere and comes to us and lights up Tuck.



"Light travels in through the flap and reflects off Tuck into our eye so we can see."

We could use a scoring rubric for 3-dimensional assessment

SEP: Components of a model

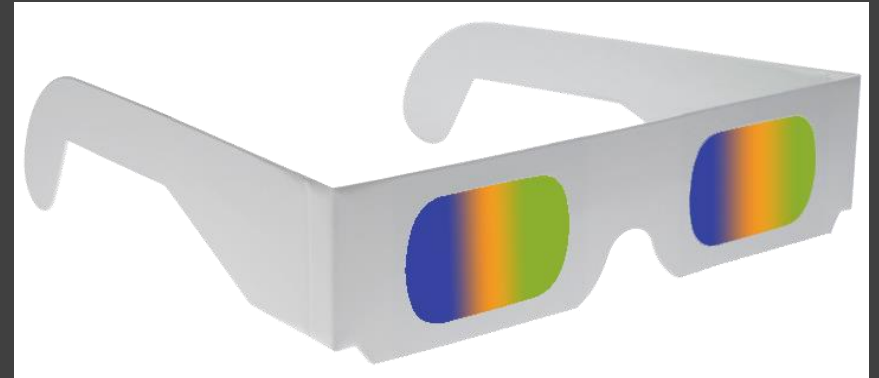
DCI: Connections to science ideas

CCC: Cause and effect


*We need to develop detailed description of each rating

Rating 4	Rating 3	Rating 2	Rating 1
1) Complete	1) Adequate	1) Some	1) Minimal
2) Complete	2) Adequate	2) Some	2) Minimal
3) Complete	3) Adequate	3) Some	3) Minimal

English Proficiency Assessment



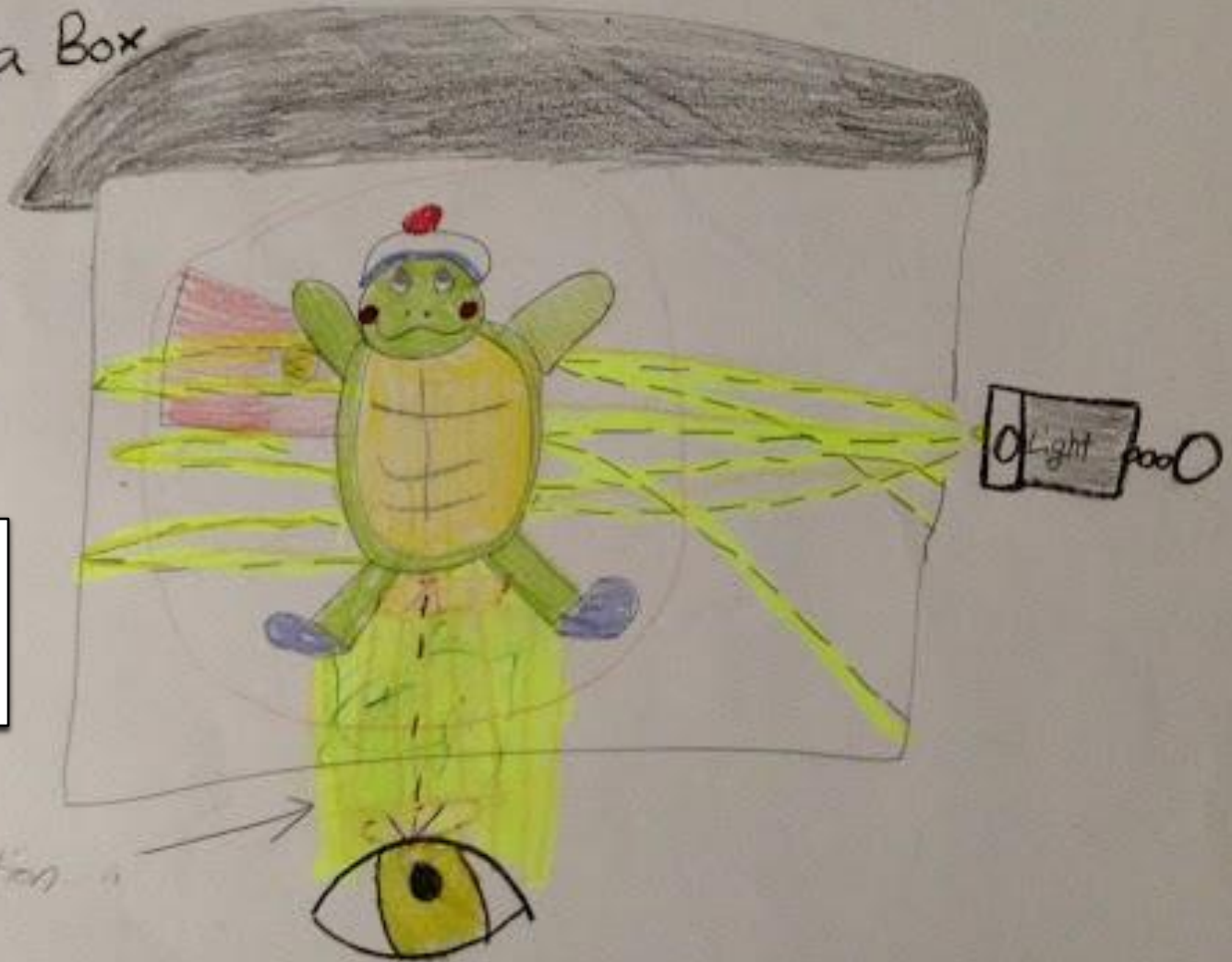
Modalities and Registers

Modalities	Registers	
<ul style="list-style-type: none">● Talk● Text● Diagram<ul style="list-style-type: none">➤ Drawing➤ Table➤ Graph➤ Chart	<p>Colloquial/ everyday talk and text</p> 	<p>Specialized/ disciplinary talk and text</p> <ul style="list-style-type: none">● Precision: Is the language exact enough to communicate discipline-specific ideas (e.g., using discipline-specific terms)?● Explicitness: Can someone who is not in the classroom understand?

Modalities and Registers Across Time

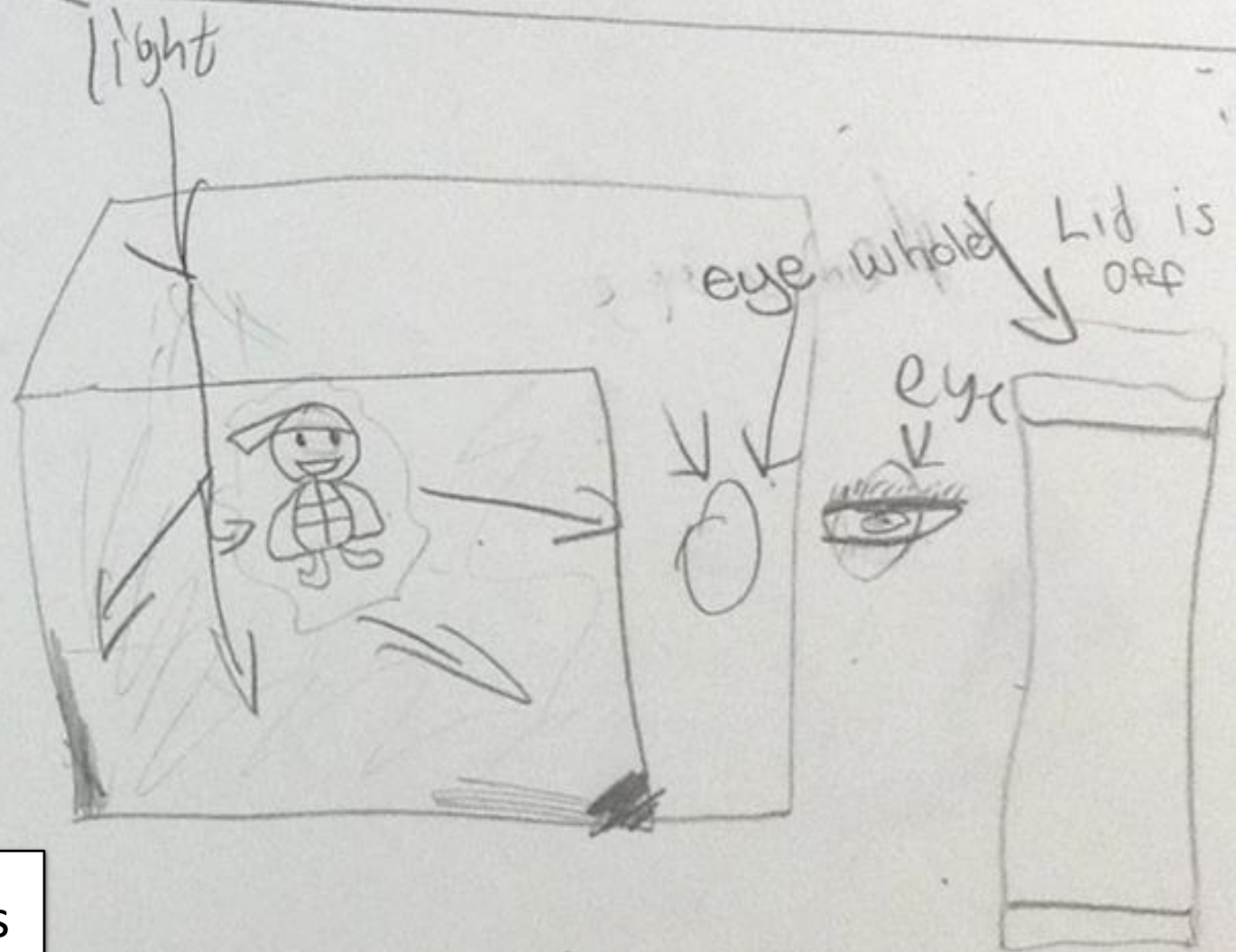
	Across the Unit, Grade Level, or K-12
Modalities	Increasingly strategic use of multiple modalities
Registers	Increasingly specialized / disciplinary registers

Turtle in a Box



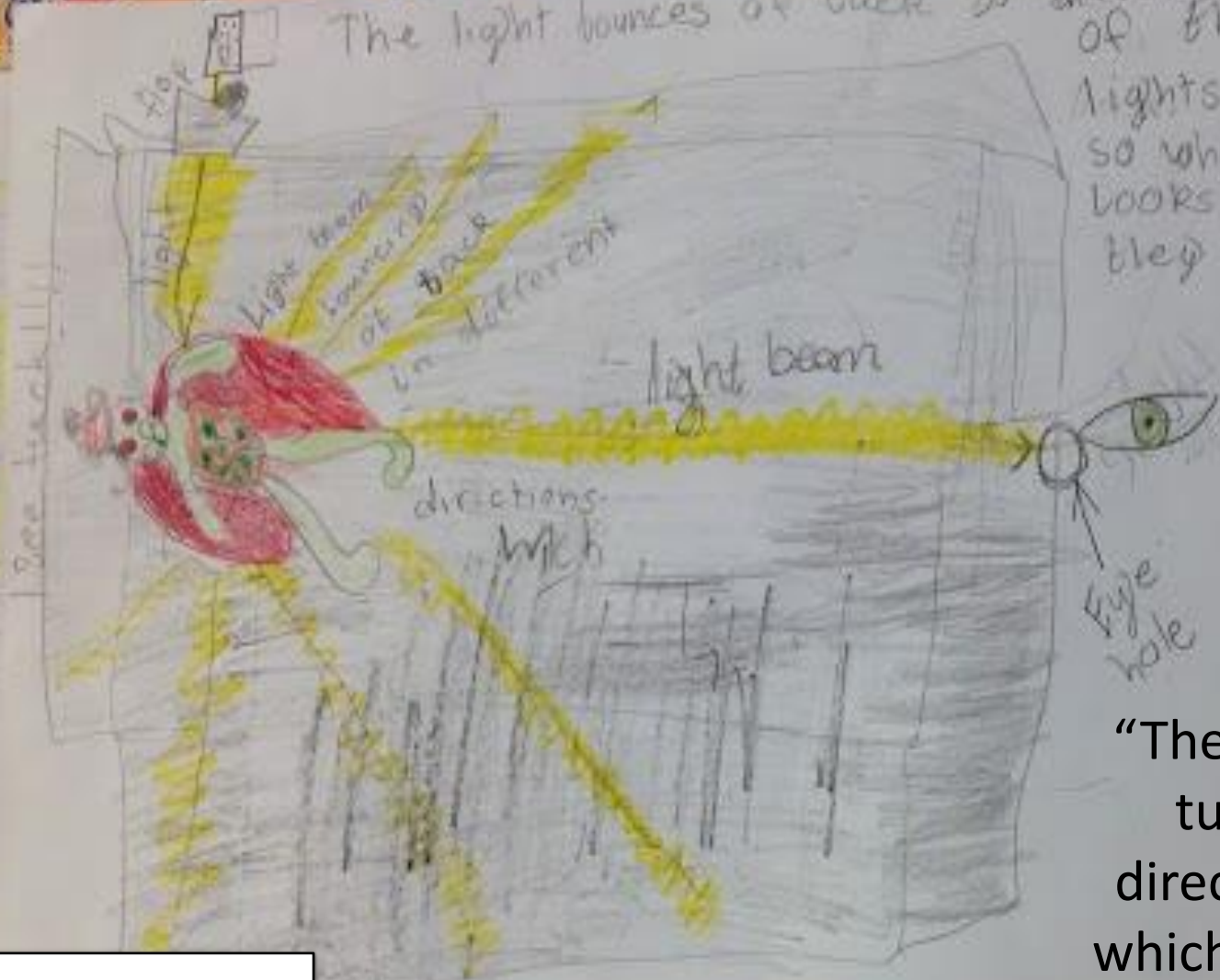
- Modalities
- Registers

↑ eye



- Modalities
- Registers

The light bounces of tuck to different directions of the box; which lights the box up so when a person looks in the box they can see tuck.

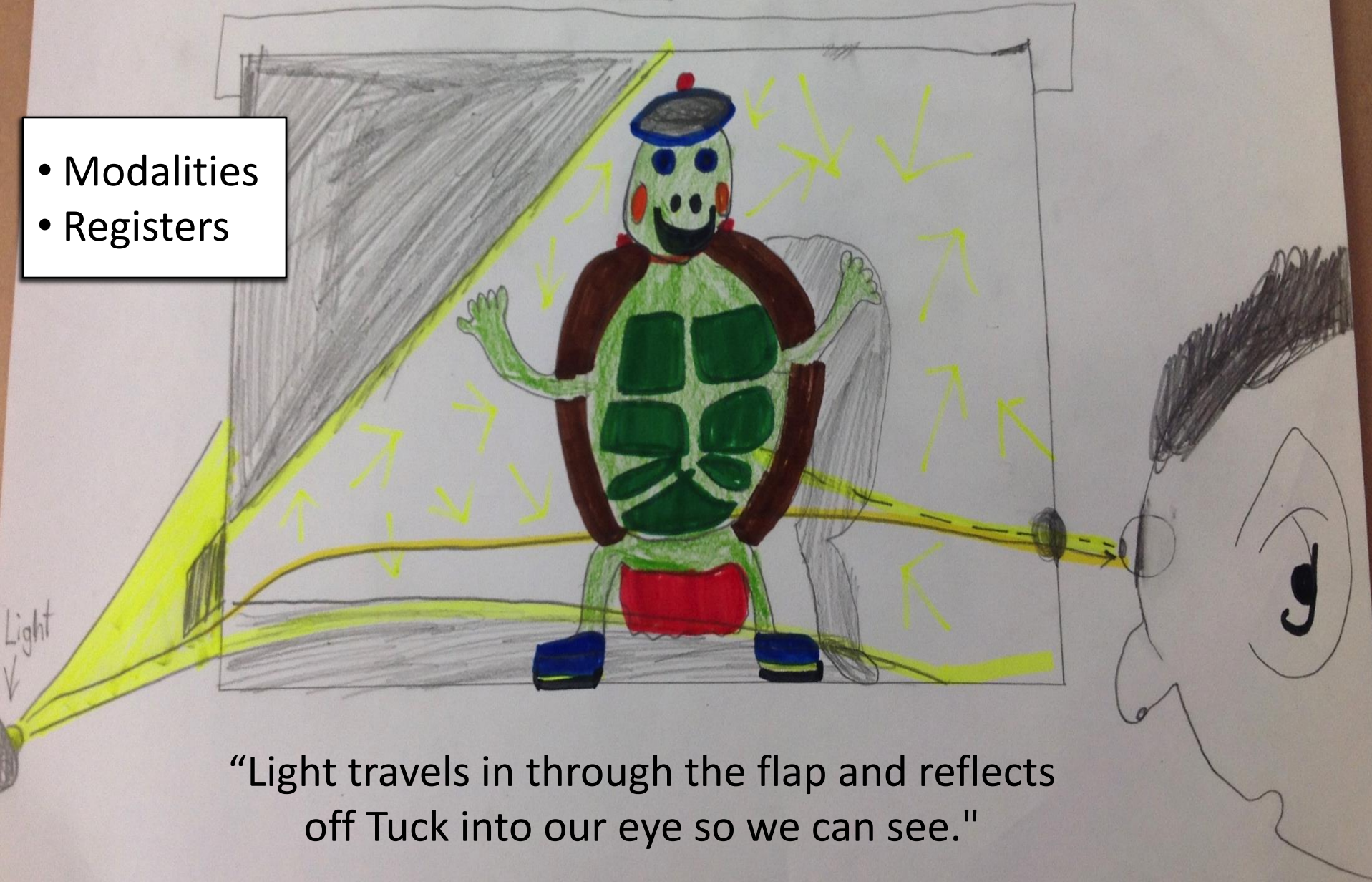


“The light bounces of tuck to different directions of the box, which lights the box up so when a person looks in the box they can see tuck.”

- Modalities
- Registers

1. Light travels in through the flap and reflects off Tuck into our eye so we can see.
Tuck. 2. the light reflects everywhere and comes to us and lights up Tuck.

- Modalities
- Registers



"Light travels in through the flap and reflects off Tuck into our eye so we can see."

We could use a scoring rubric for language proficiency assessment

	Level 1	Level 2	Level 3	Level 4
Modalities	Increasingly strategic use of multiple modalities appropriate to the discipline (e.g., science) —————→			
Registers	Increasingly precise and explicit use of registers appropriate to the discipline (e.g., science) —————→			

We could use a scoring rubric for language proficiency assessment

	Level 1	Level 2	Level 3	Level 4
Modalities	Drawings, symbols, and limited text	Drawings, symbols, and some text	Strategic combination of drawings, symbols, and extensive text	Strategic combination of drawings, symbols, and extensive text
Registers	Words and memorized chunks of text	Words and familiar patterns of text	Everyday/ colloquial terminology and text	Specialized/ disciplinary terminology and text
Example of Registers	“light” “Reflection” “Turtle in a Box”	“light” “eye” “eye whole” “Lid is off”	“The light bounces off Tuck [name of the toy turtle] to different directions of the box, which lights the box up so when a person looks in the box they can see Tuck.”	“Light travels through the flap and reflects off Tuck into our eye so we can see.”

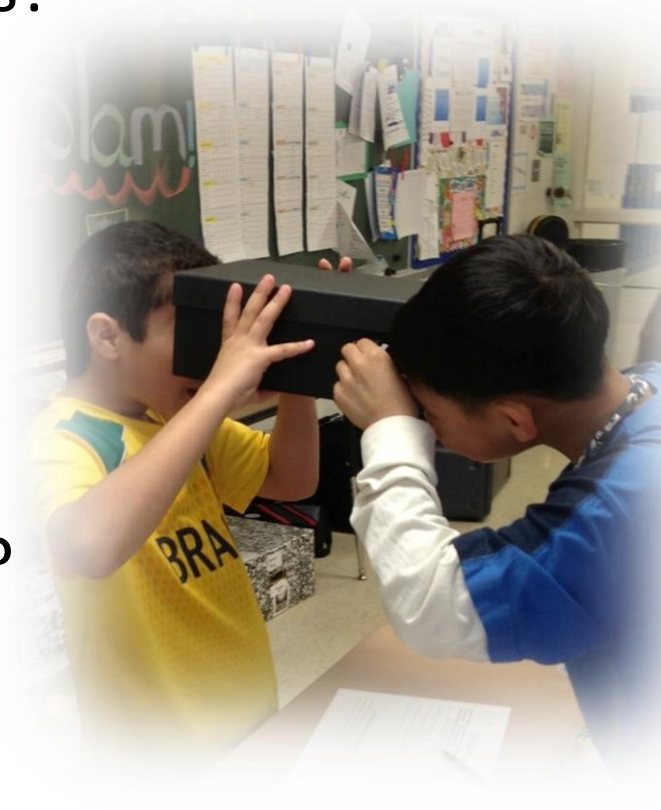
Assessment of Your Group Model

3-Dimensional Assessment

- Does your model explain causal relationships among the components?
- Does your model show evidence?

Language Proficiency Assessment

- What modalities does your model use? Does the model make strategic use of multiple modalities?
- What registers does your model use? Does the model use precise and explicit language?





Questions? Comments?



Thank You!