

I-SMART Goal 2

Scenario-based Tasks

Chapter 4: Think-Aloud Study

Overview of Chapters

1. Introduction
2. Testlet co-design
3. Testlet prototype walkthrough
4. Think-aloud study
5. What we learned

I-SMART Goal 2

Design, develop, and evaluate learning map model-based assessments that incorporate science disciplinary content and science and engineering practices in highly engaging, universally designed, technology-delivered formats.

Focus of This Study

- Co-design and evaluate testlets for “secondary population” students
- Scenario-based tasks to evaluate range of depth of knowledge (DOK)
- Deeper application of UDL principles
- Greater emphasis on formative use of instructionally embedded testlets

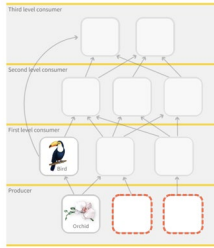
Research Questions

1. Do students understand how to interact with new item types?
2. Did students make effective explicit and implicit choices?
3. Does task assess a range of DOKs?

Task Design

Students complete models ...

Food web



Check my answer



1. First, the jaguar population is declining.



2. More of the jaguar's prey (iguanas) survive.

Causality storyboard

... while collecting evidence ...

Should we make laws to protect jaguars?

Pros

Cons

What are some benefits?

What are some problems?

Add

Add

Pros and cons clipboard

... all available to build an argument.

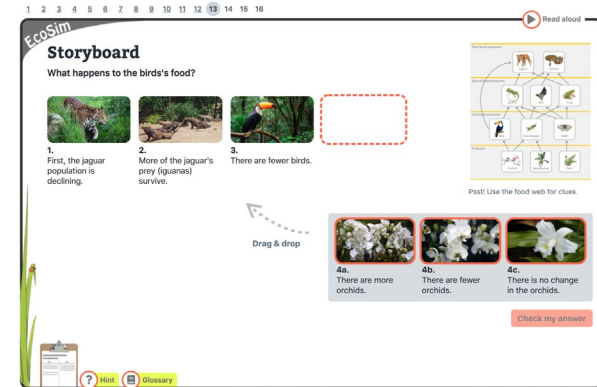
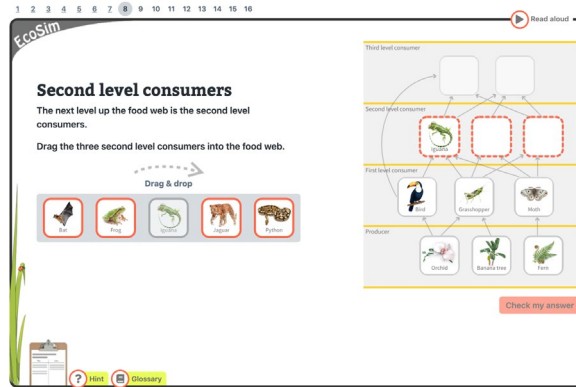
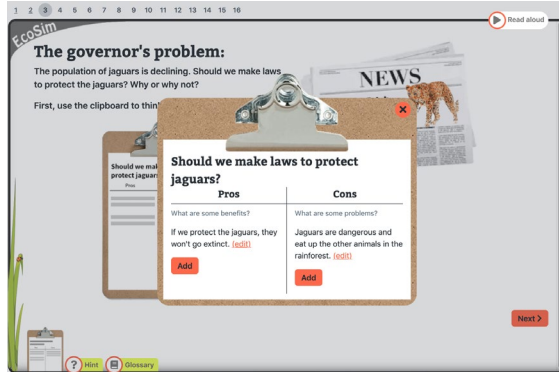
Advice letter to governor

Student Choice

1. Explicit choices
 - a. Which ecosystem to explore
 - b. Which evidence to use in constructing argument
2. Implicit choices
 - a. Use of accessibility tools (read-aloud & speech-recognition)
 - b. Use of hints
 - c. Use of glossary

Evidence Collected

1. Utterances and interactions during think-aloud portion of session
2. Responses during structured post-interview



Analysis

- Informal, structured coding of utterances and interactions during think-aloud portion of session and responses during structured post-interview
- Visual analysis of interaction patterns
- Comparison of basic and high-order DOK scores

Students

- Six middle school students in rural MO public school
- Three grade 6, three grade 7
- Three female, three male
- Three performing significantly below grade level in science, three near grade level

Sessions

- One-on-one with researcher
- Conducted remotely through video conferencing
- Video, audio, and screen recording
- 45-60 minute duration

General Observations

- All students ...
 - Reported they'd covered content previously within last year or two
 - Highly engaged in tasks
 - Believed they did well on testlet
- All but one successfully backed up argument citing balance in the ecosystem and cause & effect phenomena
 - One student's argument included both a Pro and a Con

Did you like this test?

- All responded yes
 - Four students used the word "fun"!
- *"Yes, got to choose your own answer, and how you wanted it [the governor's letter] to go"*
- *"Yeah, it went through things step by step. Like each question step by step, like the food chain step by step."*
- *"[I liked writing to the governor because there's] a bit of a story to it"*
- *"Other tests make you read big, long passages"*

What did we learn about you?

(Students asked, “What do you think we learned about you in terms of what you know and can do in science?”)

- A couple students demonstrated basic metacognitive skill (*“That I’m slow at typing. That I’m relatively smart. And that I like the rainforest”* and *“That I’m not a good speller [laughed]. That I had a few questions where it takes me a while to figure them out.”*)

Research Question 1:

Do students understand how to interact with new item types?

Student Interaction with New Item Types

- Most students clear on what to do and used interfaces skillfully.
- Tendency to start work with minimal regard for instructions.
- All students liked Check My Answer
 - *"Gives you a chance to fix your mistakes, and you learn from your mistakes."*
 - *"It's helpful because I understood what I got wrong, which one did I need to work on, and which ones I don't need as much work on."*
- Pros and Cons Clipboard easy to use, but purpose not always clear, and created some conceptual confusion in terms of double- and triple-negatives (e.g., *"less people getting killed"* as a “pro” to making a law to protect jaguars)

Behavior and Interaction Patterns



Key

- No scored content
- Full points on first attempt
- Partial points on first attempt
- Zero points on first attempt
- Multiple attempts
(Example: partial points first attempt; 3 total attempts)
- Usability blocker
- Student uses tool / support
G = glossary
RA = read aloud
STT = speech-to-text
H = hints
- Researcher intervention
- Student adds pro(s) / con(s)
- Student opens but doesn't add pro(s) / con(s)

Scoring

Basic Knowledge, Skills & Understanding (KSU)
Screens 5-8 & 11-13
1pt per item; 10 possible pts



Higher-order KSUs
Screen 15
10 possible pts



Higher-order KSU scoring rubric: the degree to which evidence provided supports student's final claim + the degree to which that evidence is sound/logical

Research Question 2:

Did students make effective explicit and implicit choices?

Explicit Choice-Making: Ecosystem

- All students liked being able to choose ecosystem (three chose rainforest, two chose ocean, one chose vacant lot).
- Cited reasons focused on engagement and agency.
 - *"Definitely [liked being able to choose]. I like projects where you can choose what you want to do and not be forced to do something that you wouldn't want to do."*
 - *"You want to go with the one that feels like it helps you improve."*
 - *"Yeah [being able to choose made a difference] cause people might know about this one ecosystem but other people might not know or not be interested in the other one as much."*

Explicit Choice-Making: Evidence

- Two students used three sources of evidence, three students used one, one student used none.
- In two cases, sculpting evidence began before final screen.
 - *E.g., during initial use of Clipboard, student thought aloud that coyotes "help regulate the population of whatever they eat" but recording nothing, despite referring to glossary and hints. Returned to Clipboard after completing Food Web, when able to articulate the animals that coyotes eat. Later, when using that note as evidence, generalized animals to, "prey" and added that the "ecosystem would be less balanced" without a law protecting coyotes.*

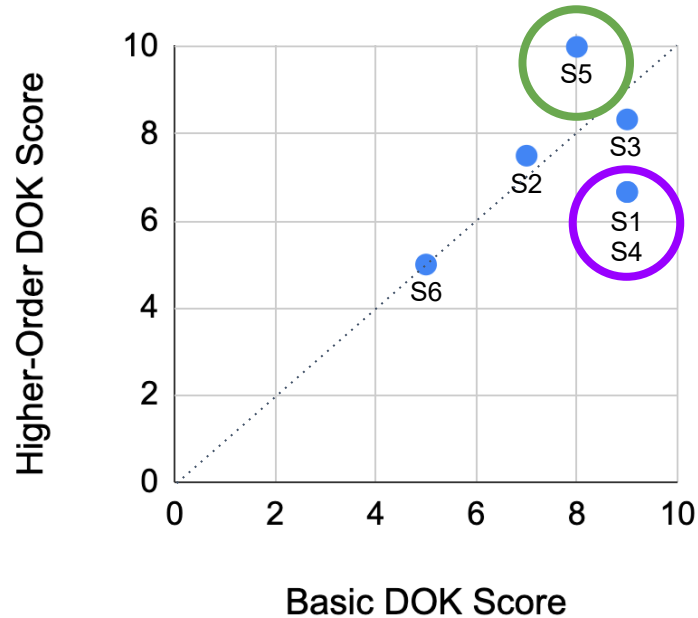
Implicit Choice-Making

- Students generally made little use of hints and glossary, even when they would likely have helped.
- Students rarely used read-aloud, even when it would have likely helped
 - E.g., students struggled decoding and (likely) comprehending terms such as “ecologist.”
- Students reticent to use speech recognition, even when it would have likely helped
 - E.g., while writing in clipboard, student thought-aloud a well-articulated "Pro" then struggled to type in a less elaborate response.

Research Question 3:

Does task assess a range of DOKs?

RQ3: Does Task Assess a Range of DOKs?



Behavior and Interaction Patterns



Storyboard: *The iguanas and orchids will flourish and birds will perish*

Pros & cons: *you should protect the sharks because they might get hurt cause they might hurt people*

Pros & cons: *The coyotes regulate the population of its prey. Without the coyotes the ecosystem would be less balanced.*

Food web: *There would be less squirrels to regulate the population of dandelions.*

Storyboard: *The snakes might overpopulate the ecosystem.*

Next Up ...

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