MODEL-DRIVEN ASSESSMENT OF LEARNERS IN AN OPEN-ENDED LEARNING ENVIRONMENT

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OPEN-ENDED LEARNING ENVIRONMENTS

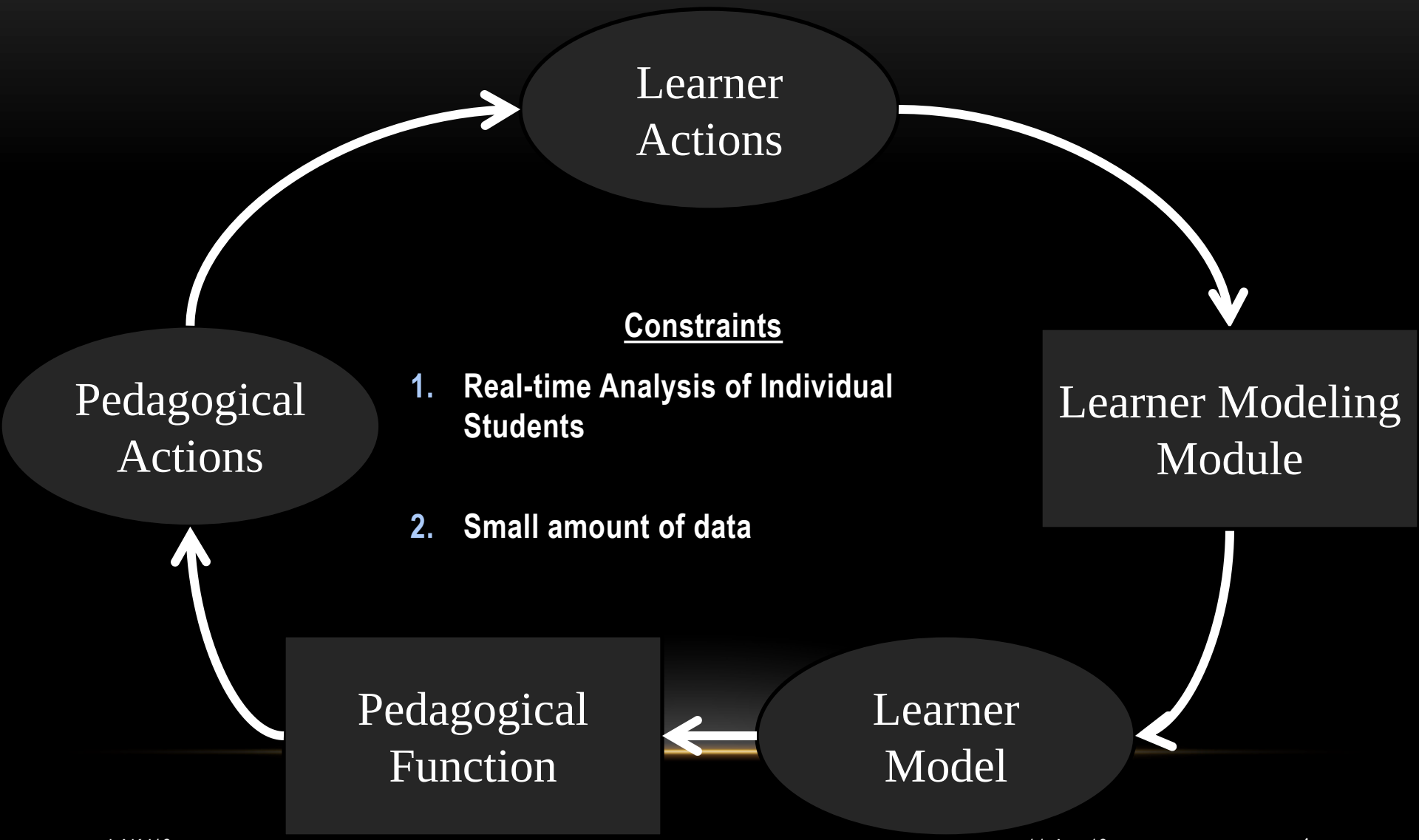
- Learner-centered, and based on constructivist theories of learning
  - Jonassen, 1991; Land, Hannafin, & Oliver, 2012
- Learners construct knowledge by negotiating meaning with the world in which they exist
  - Learning by doing: attempting solutions, making mistakes, reflecting on results
- Learning environment provides:
  - A learning context (*e.g.*, you are designing a wheelchair ramp for your grandfather)
  - Tools for:
    - Accessing and acquiring information
    - Constructing problem solutions
    - Assessing problem solutions

OPEN-ENDED LEARNING ENVIRONMENTS

*Provides opportunities for exercising metacognitive skills related to managing one's own problem solving tasks such as **planning** and **reflection***

This is difficult!

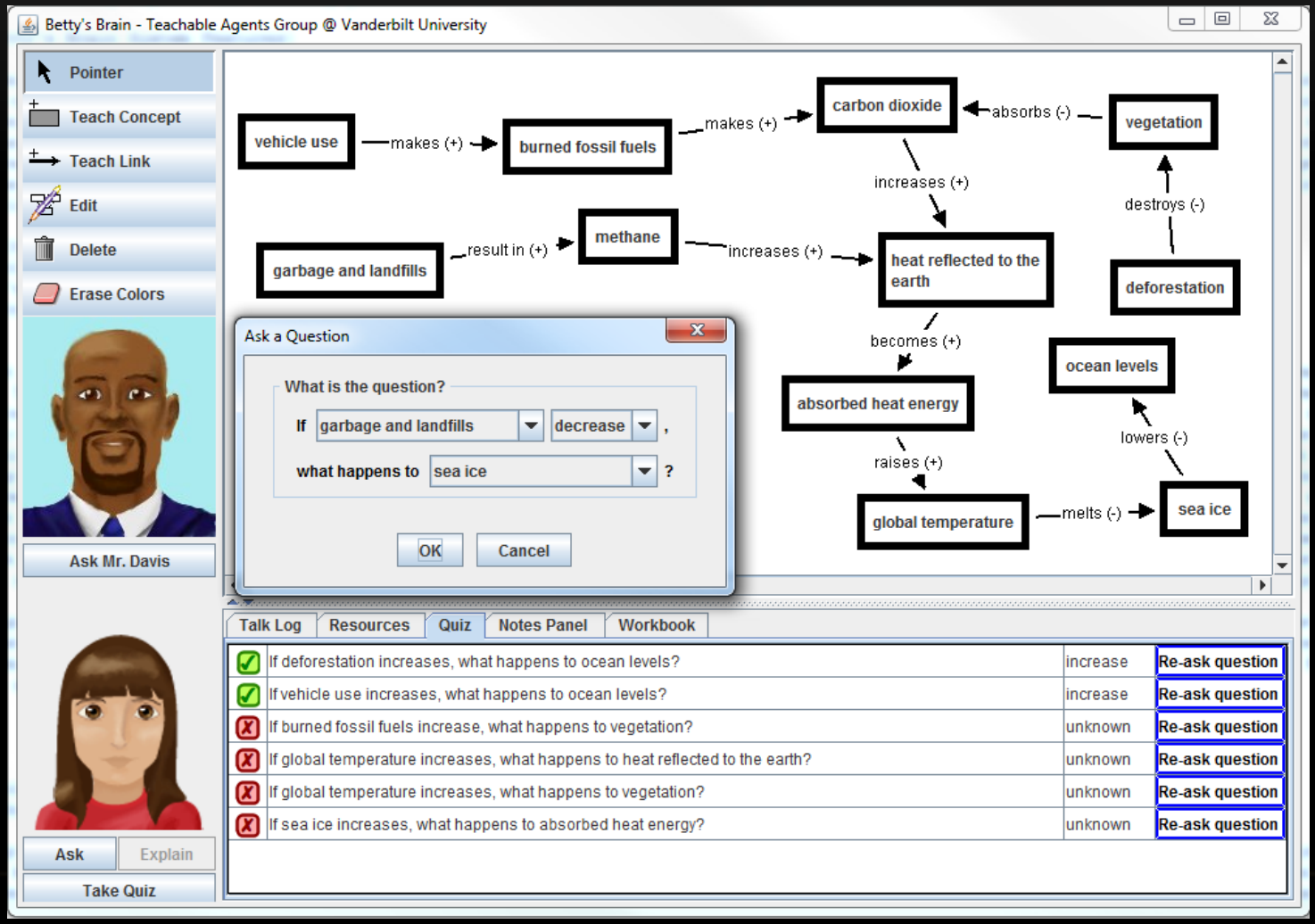
OVERVIEW: ADAPTIVE SCAFFOLDING



BETTY'S BRAIN: AN OPEN-ENDED LEARNING ENVIRONMENT

When humans shiver, their skeletal muscles expand and contract, and this creates friction.

BETTY'S BRAIN: AN OPEN-ENDED LEARNING ENVIRONMENT

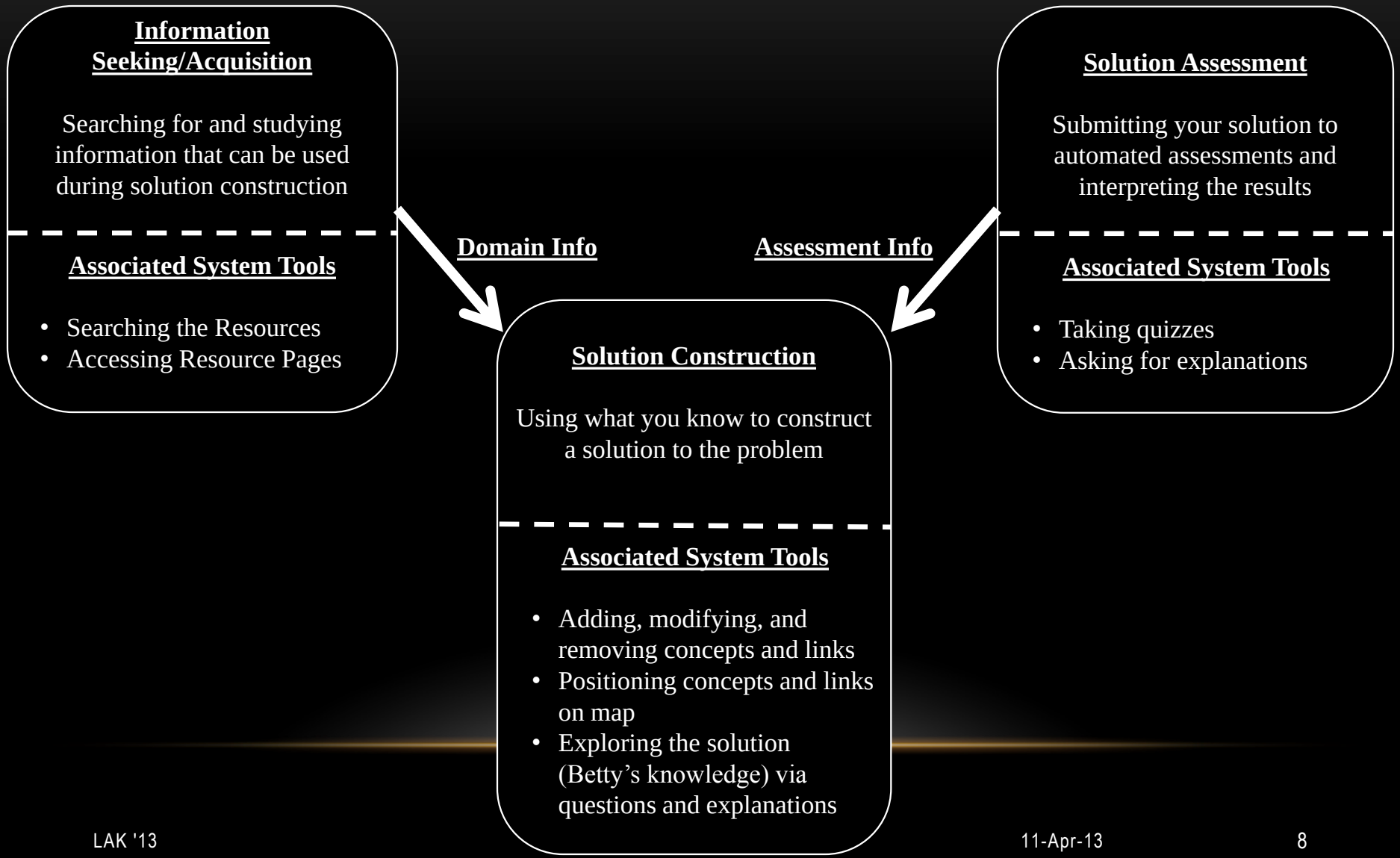


BETTY'S BRAIN: QUIZZES FOR MONITORING PROGRESS

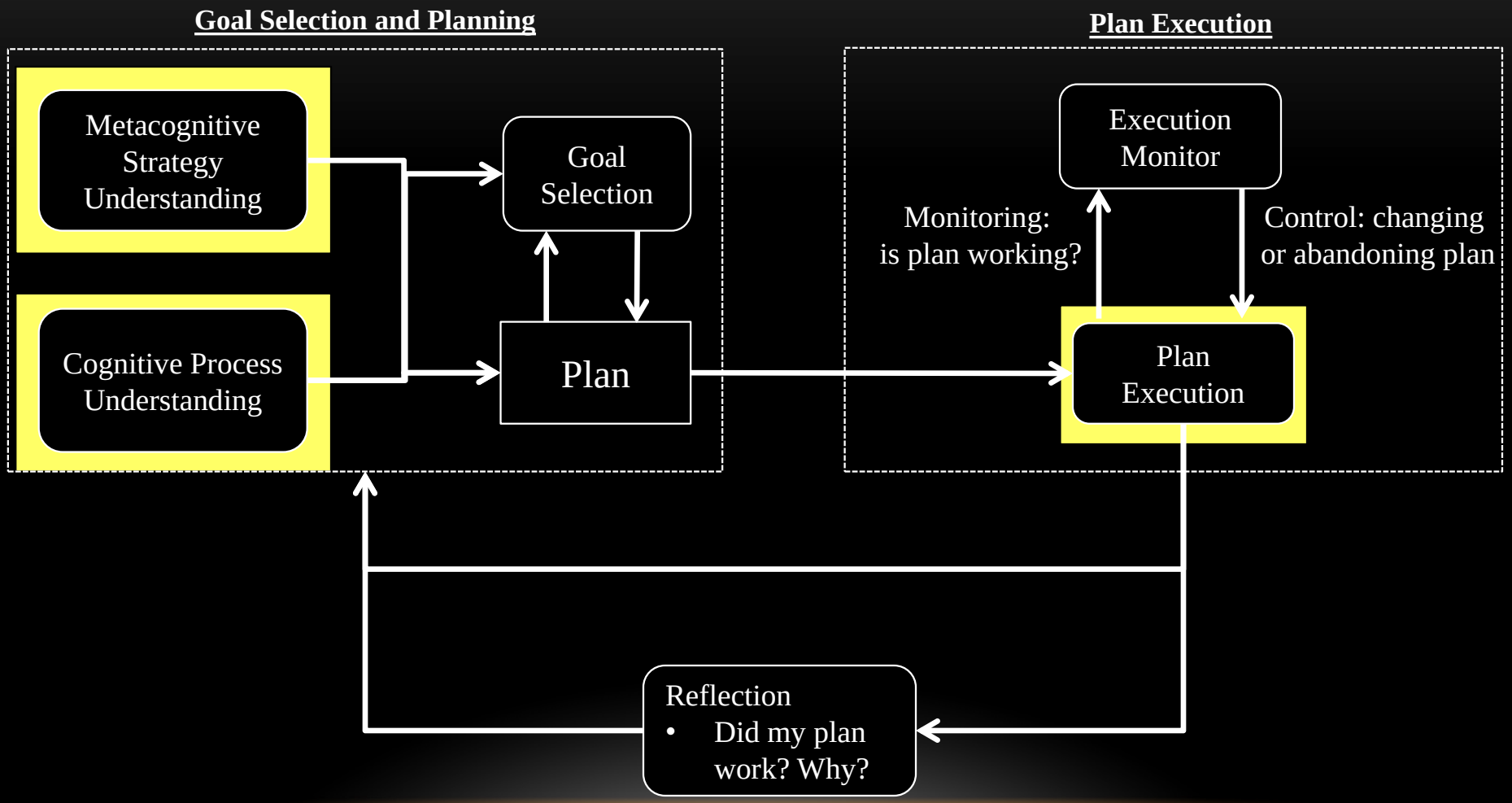
#	Question	Answer	Grade
1.	If cold temperatures increase, what happens to body temperature?	body temperature will decrease.	✓
2.	If heat generation increases, what happens to cold detection?	cold detection will decrease.	✗
3.	If cold detection increases, what happens to body temperature?	I don't know	✗

- **Correct**: All links used to answer the question are correct
- **Incorrect**: At least one link used to answer the question is incorrect
- **Can't Answer**: At least one link is missing

BETTY'S BRAIN: COGNITIVE PROCESSES



BETTY'S BRAIN: METACOGNITIVE PROCESSES



APPROACH: MODEL-DRIVEN ASSESSMENTS

- Assess cognitive process understanding via ***effectiveness***

Solution Construction Effectiveness: The addition, removal, or modification of a causal link is *effective* if it improves the quality of Betty's causal map.

Solution Assessment Effectiveness: A question evaluation, quiz, or explanation is *effective* if it generates information about the correctness or incorrectness of a causal link.

- Assess metacognitive strategy understanding via ***coherence among actions***

Coherence: Two actions in an OELE are *coherent* if the second action, *y*, logically follows from information generated by the first action, *x*.

x provides *support* for y, and y is *supported* by x.

POST-HOC ANALYSIS OF DATA FROM BETTY'S BRAIN

- 40 8th grade students from a middle TN public school.

- Procedure:
  - **Day 1**: brief introduction to thermoregulation
  - **Day 2**: pre-test
  - **Days 3-4**: instruction on causal reasoning and how to use Betty's Brain
  - **Days 5-9**: students worked on Betty's Brain
  - **Day 10**: post-test, identical to pre-test

ANALYSIS: MEASURES CALCULATED

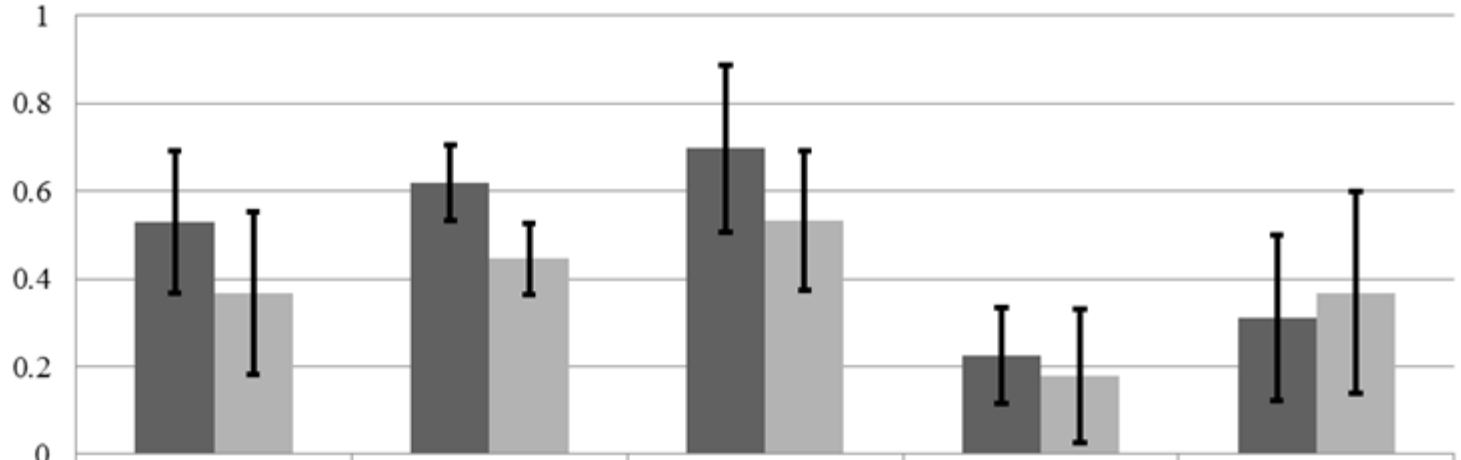
- **Actions per Minute**: How often did students use tools related to solution construction and assessment?
- **Solution Construction Effectiveness Rate**: Percentage of map edits considered effective
- **Solution Assessment Effectiveness Rate**: Percentage of solution assessment actions considered effective
- **Information Seeking Support Rate**: The percentage of causal map edits supported by previous resource accesses (10 minute window)
- **Solution Assessment Support Rate**: The percentage of causal map edits supported by previous solution assessment actions (10 minute window)

RESULTS – ALL STUDENTS

	Actions/Min	Effectiveness
Solution Construction	0.439 (0.190)	0.525 (0.113)
Model Assessment	0.194 (0.126)	0.370 (0.218)

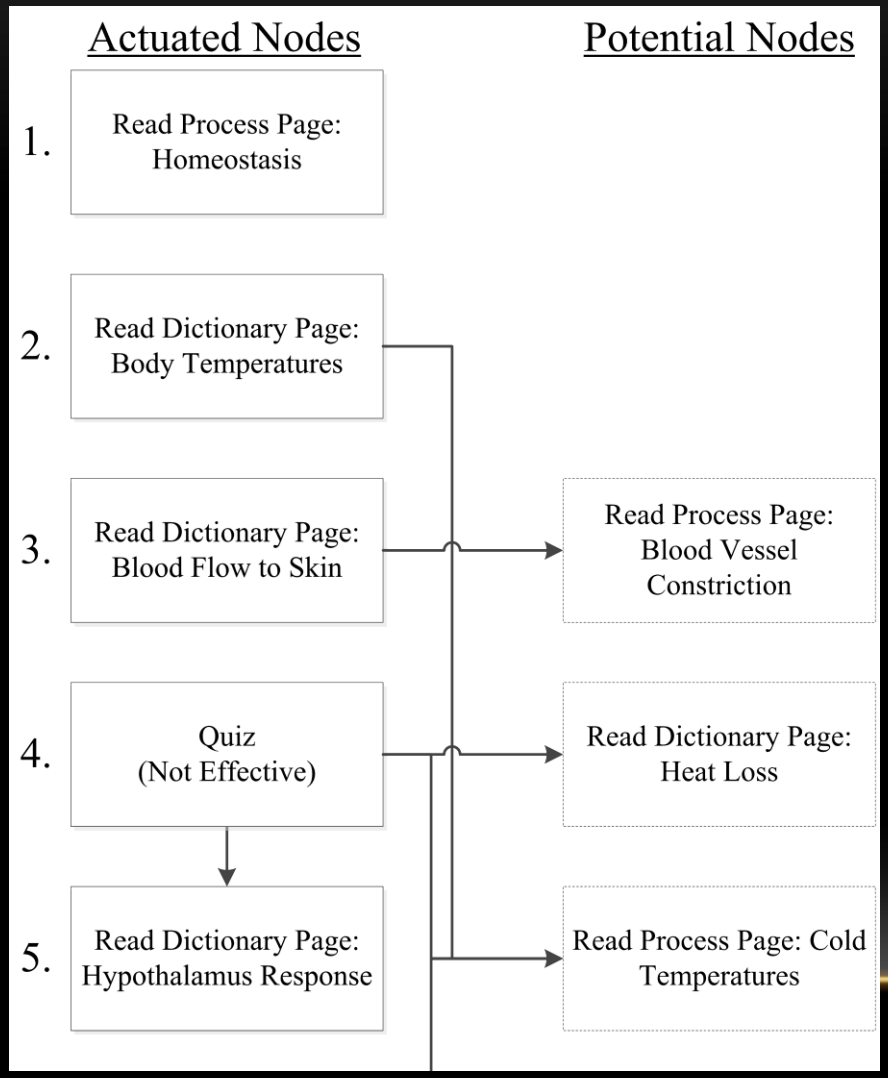
Information Seeking Support %	60.2% (18.5%)
Model Assessment Support %	0.8% (1.4%)

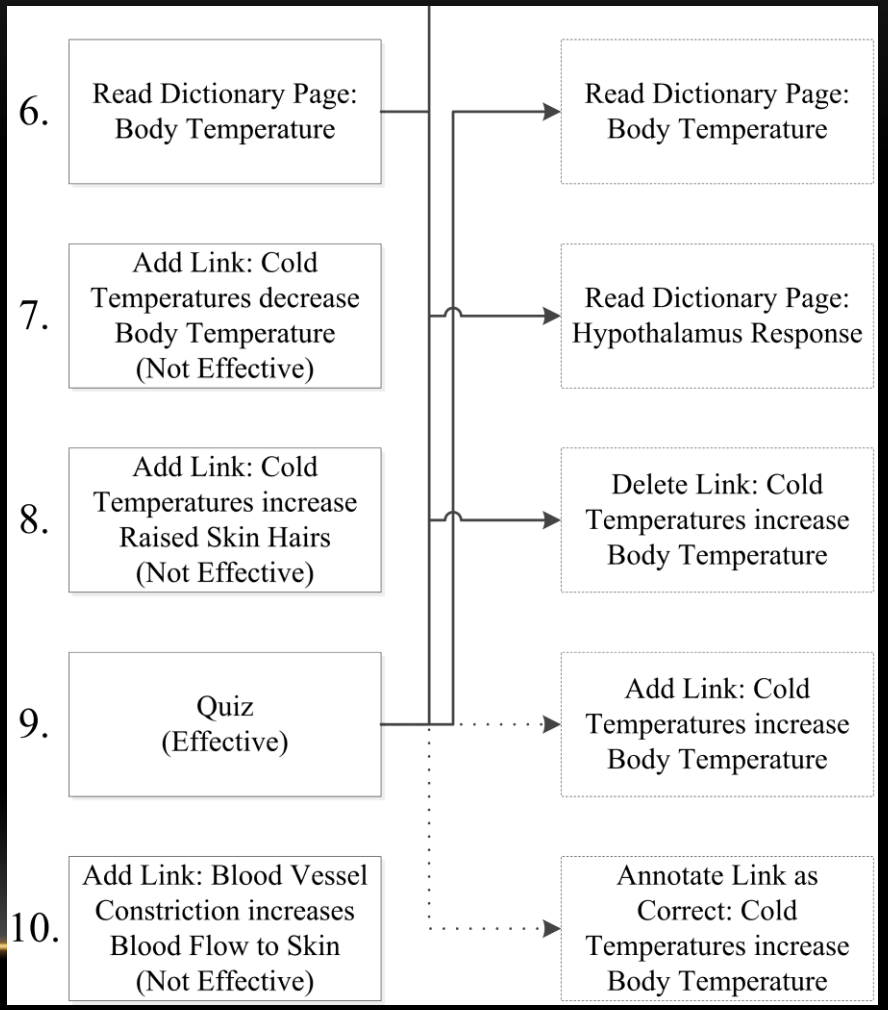
RESULTS – HIGH VS. LOW



	Solution Construction			Model Assessment	
	Actions/Min	Effectiveness	Total Support %	Actions/Min	Effectiveness
High Mean	0.528 (0.162)	0.618 (0.087)	0.697 (0.191)	0.224 (0.110)	0.311 (0.189)
Low Mean	0.367 (0.187)	0.445 (0.082)	0.532 (0.160)	0.178 (0.153)	0.368 (0.231)

FUTURE DIRECTION – COHERENCE GRAPHS





QUESTIONS

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For more information, or to try Betty's Brain at home:

www.teachableagents.org