

Towards a Framework for Assessing 21st Century Science Skills

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Overview

- Understanding 21st century skills
- The 21st century science skills
- Overview of the assessment framework
- Examples of assessments
- The future

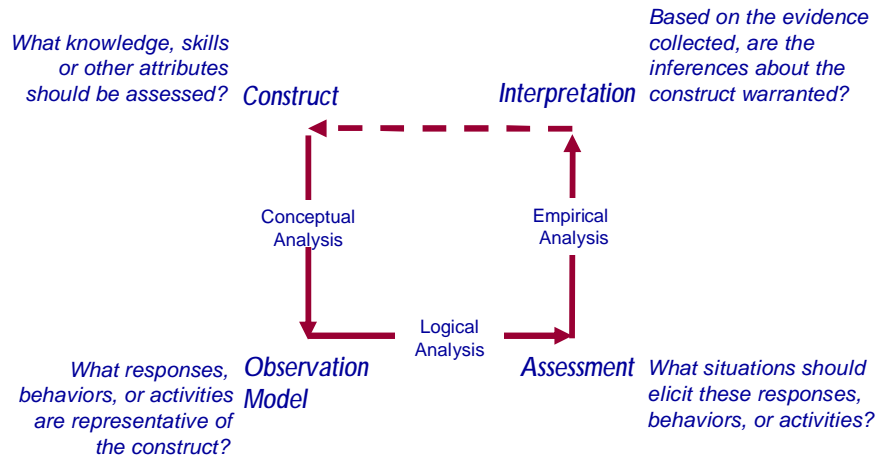
Understanding the 21st Century Skills

- Defining the skills
 - Identification of dimensions for each skill
 - Theoretical perspectives
 - Quality of empirical support
- Comparing frameworks: The commonalities
 - Partnership for the 21st Century Skills
 - The American Association of School Librarians (AASL) Standards for the 21st-Century Learner
 - enGauge 21st Century Skills for 21st Century Learners
- What skills are critical for assessment purposes?

The 21st Century Science Skills

- The NRC's strands of scientific proficiency
- Linking 21st century skills and scientific strands
- Critical alignments skills: Problem solving and complex communication

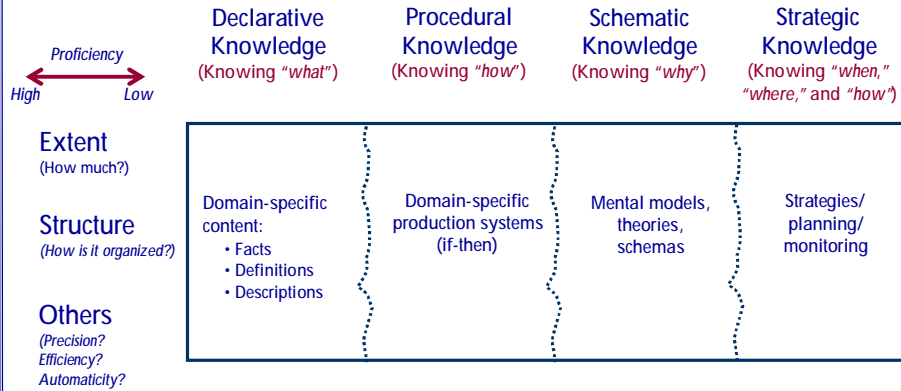
Developing and Evaluating Assessments: The Assessment Square



The Construct

Dispositions	Cross-Functional Skills	Content & Scientific Proficiencies
Adaptability & Self-Management	Problem-Solving & Complex Communication	<ul style="list-style-type: none"> -Knowledge, use, and interpretation of scientific explanations -Generate and evaluate evidence and explanations -Understand the nature and development of scientific knowledge -Participate productively in scientific practices and discourse

Types of Knowledge



Linking Types of Knowledge & Types of Assessments

	Declarative Knowledge (Knowing "what")	Procedural Knowledge (Knowing "how")	Schematic Knowledge (Knowing "why")	Strategic Knowledge (Knowing "when," "where," and "how")
Extent	<ul style="list-style-type: none"> • Multiple-Choice • Short Answer • Student Notebooks 	<ul style="list-style-type: none"> • Performance Assessments • Multiple-Choice • Student Notebooks 	<ul style="list-style-type: none"> • Multiple Choice • Predict-Observe-Explain • Student Notebooks • Constructed Response 	<ul style="list-style-type: none"> • Performance Assessments • Student Notebooks
Structure	Concept Maps	Procedural Maps (e.g., flowcharts) (?)	Diagrams (?)	<ul style="list-style-type: none"> • Computer Simulations • Interactive Multimedia Exercises

Nature of Problem

Problem Characteristics

Well-Structured	←————→	Ill-Structured
Routine	←————→	Non-Routine
Lean	←————→	Rich
Schooled	←————→	Un-Schooled
Independent	←————→	Collective
Un-Timed	←————→	Timed

Communication

Short-Answer	←————→	Constructed-Response
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CLA – Analytic Writing Task

Sample CLA Analytic Writing Task: Critique an Argument

A well-respected professional journal with a readership that includes elementary school principals recently published the results of a two-year study on childhood obesity. (Obese individuals are usually considered to be those who are 20 percent above their recommended weight for height and age.) This study sampled 50 schoolchildren, ages 5-11, from Smith Elementary School. A fast food restaurant opened near the school just before the study began. After two years, students who remained in the sample group were more likely to be overweight—relative to the national average. Based on this study, the principal of Jones Elementary School decided to confront her school's obesity problem by opposing any fast food restaurant openings near her school.

CLA – Performance Task

You are the assistant to Pat Williams, the president of DynaTech, a company that makes precision electronic instruments and navigational equipment. Sally Evans, a member of DynaTech's sales force, recommended that DynaTech buy a small private plane (a SwiftAir 235) that she and other member of the sales force could use to visit customers. Pat was about to approve the purchase when there was an accident involving a SwiftAir 235. You are provided with the following documentation.

- 1: Newspaper articles about the accident
- 2: Federal Accident Report on in-flight breakups in single engine planes
- 3: Pat's e-mail to you & Sally's e-mail to Pat
- 4: Charts on SwiftAir performance characteristics
- 5: Amateur Pilot article comparing SwiftAir 235 to similar planes
- 6: Pictures and description of SwiftAir Models 190 and 235



Please prepare a memo that addresses several questions, including what data support or refutes the claim that the type of wing on the SwiftAir 235 leads to more in-flight breakups, what other factors might have contributed to the accident and should be taken into account, and your overall recommendation about whether or not DynaTech should purchase the plane.

School Milk Study PISA 2006

In 1992, a large scale study was carried out in one month in a region of Scotland. For four months, some schools received free milk and some did not. The head teachers in each school chose which of their students received milk. Here is what happened:

- 5,120 school children received an amount of unpasteurized milk each school day
- Another 5,000 school children received the same amount of pasteurized milk
- 10,000 school children did not receive any milk at all

All 21,000 children were weighed and had their height measured at the beginning and the end of the study.

QUESTION 21: SCHOOL MILK STUDY

Is it likely that the following questions were research questions for the study?

Quick 'Yes' or 'No' for each answer:

Is it likely that this was a research question for the study?	Yes/No?
What is the best time for a school to give milk?	Yes/No
What effect does the drinking of additional milk have on school children?	Yes/No
What effect does milk pasteurization have on school children's growth?	Yes/No
What effect does being in different regions of Scotland have on school children's health?	Yes/No

Question 22: SCHOOL MILK STUDY

On average, the children who received milk during the study gained more in height and weight than the children who did not receive milk.

One possible explanation for the study's conclusion is that school children who drink a lot of milk gain faster than those who do not drink a lot of milk.

To have confidence in the conclusion, individuals must question the study to determine about these two groups of students to the study.

Conclusions

- Define better the 21st century skills and define the criticality of the skills
- Test the development approach proposed
- Define assessment purposes and let these purposes define the validity arguments
- Use computer-based technology for administering assessments