# Science Assessment: Current Issues and Perspectives

**EDNET Broadcast**

Thursday, February 17, 3:30 – 4:30 p.m.


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# **Enduring Understanding**:

Participants will increase in their understanding of science assessment at the Standardized and Classroom Level.

# Essential Questions

1. How are the CRTs constructed?
2. How is standardized assessment connected to classroom assessment?
3. What constitutes science assessment?
4. What is available to assist educators in science instruction and assessment?
5. What are accountability issues in science assessment?

# Overview

- Test Development Process
- Pieces of the Development Puzzle
  - Equating of Test Forms
  - Scaling of Scores
- Assessment in the Classroom
- Resources
- Accountability Systems
  - NCLB
  - U-PASS
- Summary

# Test Development Process

1. Core curriculum development
2. Blueprint development
3. Item development w/ UT teachers
4. Reviewed by content experts
5. Item review committee
6. Bias/Sensitivity review
7. Pilot testing of items
8. Advisory committee review of items
   - Content alignment
   - Pilot statistics
   - Appropriateness of item
   - Content accuracy within items
9. Form Construction
10. Advisory committee review of form
11. Finalization of Print-Ready test form
12. Printing and Distribution
13. Analysis of test data

# Test Development Process
## Item Alignment

Know the mark you are aiming for

Design of the Curriculum and the Core Curriculum Document

tour the core curriculum

http://www.usoe.k12.ut.us/curr/science/

# Test Development Process
## Item Alignment

- Dual Axis Alignment
  - **ILOs**
  - Content
    - Benchmarks
    - **Standards**
    - **Objectives**
    - Indicators

# Test Development Process
## Item Alignment

Definition of Item Alignment: Question that needs to be answered in the affirmative for an item to be aligned:

**Whether the student answers the question correctly or incorrectly, does their response shed light on their understanding or lack of understanding of the objective and standard?**

# Test Development Process
## Item Alignment

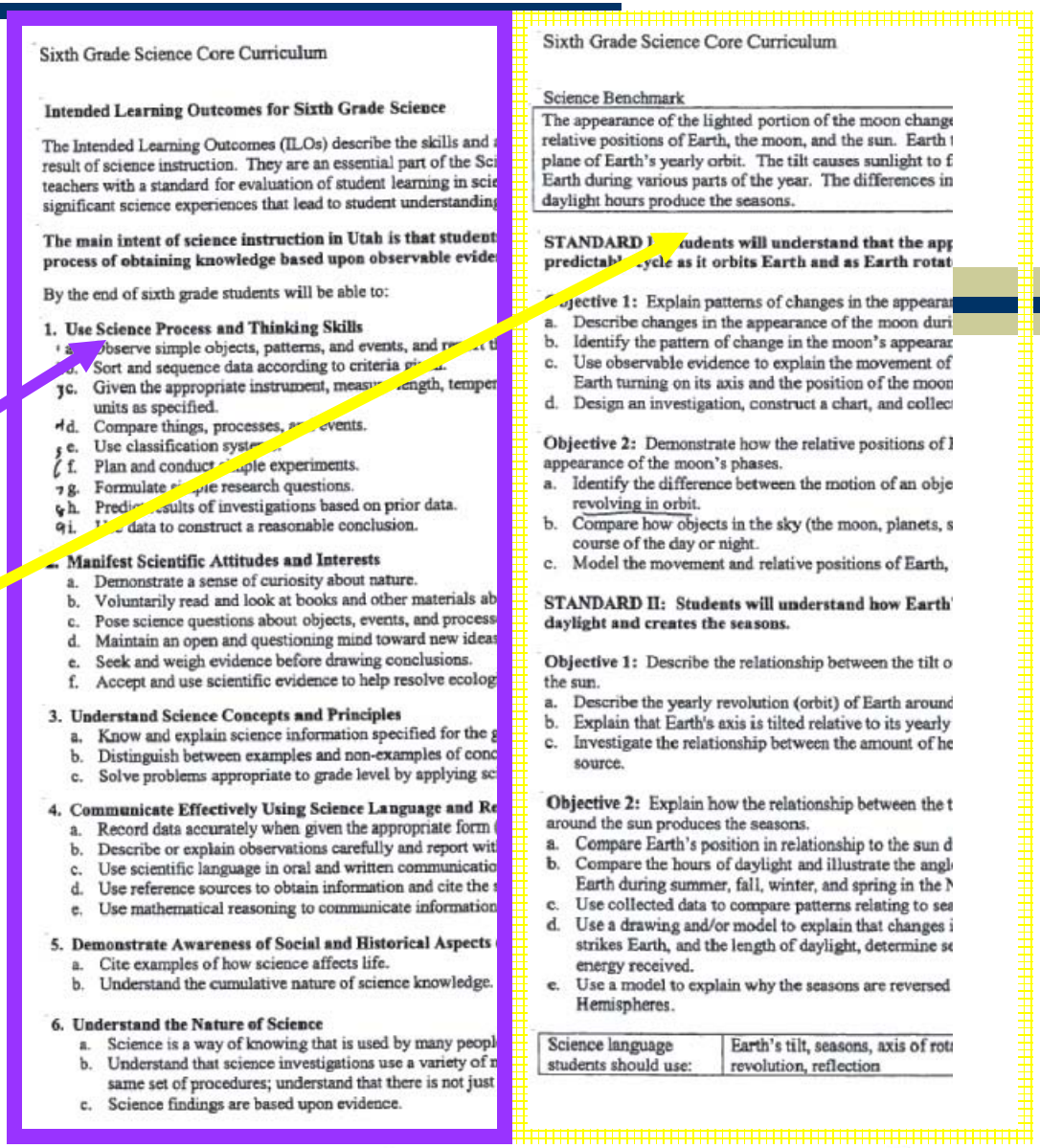
- Instructional Alignment
  - Question that needs to be answered in the affirmative for an item to be aligned:

    **Will the instruction as designed lead towards student understanding, application, and retention of the curriculum?**

# Science Reading the Core Curriculum 101

**ILOs**

**Content**



Sixth Grade Science Core Curriculum

**Intended Learning Outcomes for Sixth Grade Science**

The Intended Learning Outcomes (ILOs) describe the skills and
result of science instruction. They are an essential part of the Sci
teachers with a standard for evaluation of student learning in scie
significant science experiences that lead to student understandin

**The main intent of science instruction in Utah is that student
process of obtaining knowledge based upon observable evide**

By the end of sixth grade students will be able to:

**1. Use Science Process and Thinking Skills**
- a. Observe simple objects, patterns, and events, and r
- b. Sort and sequence data according to criteria
- c. Given the appropriate instrument, measu ength, temper units as specified.
- d. Compare things, processes, a events.
- e. Use classification syste
- f. Plan and conduct ple experiments.
- g. Formulate si ple research questions.
- h. Predic sults of investigations based on prior data.
- i. U data to construct a reasonable conclusion.

**2. Manifest Scientific Attitudes and Interests**
- a. Demonstrate a sense of curiosity about nature.
- b. Voluntarily read and look at books and other materials ab
- c. Pose science questions about objects, events, and process
- d. Maintain an open and questioning mind toward new ideas
- e. Seek and weigh evidence before drawing conclusions.
- f. Accept and use scientific evidence to help resolve ecolog

**3. Understand Science Concepts and Principles**
- a. Know and explain science information specified for the g
- b. Distinguish between examples and non-examples of conc
- c. Solve problems appropriate to grade level by applying sc

**4. Communicate Effectively Using Science Language and Re**
- a. Record data accurately when given the appropriate form
- b. Describe or explain observations carefully and report wit
- c. Use scientific language in oral and written communicatio
- d. Use reference sources to obtain information and cite the
- e. Use mathematical reasoning to communicate information

**5. Demonstrate Awareness of Social and Historical Aspects**
- a. Cite examples of how science affects life.
- b. Understand the cumulative nature of science knowledge.

**6. Understand the Nature of Science**
- a. Science is a way of knowing that is used by many peopl
- b. Understand that science investigations use a variety of m same set of procedures; understand that there is not just
- c. Science findings are based upon evidence.

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Sixth Grade Science Core Curriculum

Science Benchmark

The appearance of the lighted portion of the moon change relative positions of Earth, the moon, and the sun. Earth t plane of Earth's yearly orbit. The tilt causes sunlight to f Earth during various parts of the year. The differences in daylight hours produce the seasons.

**STANDARD I: Students will understand that the app predictable cycle as it orbits Earth and as Earth rotat**

**Objective 1:** Explain patterns of changes in the appearan
- a. Describe changes in the appearance of the moon duri
- b. Identify the pattern of change in the moon's appearan
- c. Use observable evidence to explain the movement of Earth turning on its axis and the position of the moon
- d. Design an investigation, construct a chart, and collec

**Objective 2:** Demonstrate how the relative positions of E appearance of the moon's phases.
- a. Identify the difference between the motion of an obje revolving in orbit.
- b. Compare how objects in the sky (the moon, planets, s course of the day or night.
- c. Model the movement and relative positions of Earth,

**STANDARD II: Students will understand how Earth daylight and creates the seasons.**

**Objective 1:** Describe the relationship between the tilt o the sun.
- a. Describe the yearly revolution (orbit) of Earth around
- b. Explain that Earth's axis is tilted relative to its yearly
- c. Investigate the relationship between the amount of he source.

**Objective 2:** Explain how the relationship between the t around the sun produces the seasons.
- a. Compare Earth's position in relationship to the sun d
- b. Compare the hours of daylight and illustrate the angl Earth during summer, fall, winter, and spring in the N
- c. Use collected data to compare patterns relating to sea
- d. Use a drawing and/or model to explain that changes i strikes Earth, and the length of daylight, determine se energy received.
- e. Use a model to explain why the seasons are reversed Hemispheres.

| | |
|---|---|
| Science language students should use: | Earth's tilt, seasons, axis of rot revolution, reflection |

6

# 7TH GRADE SCIENCE TEST BLUEPRINT*

SCIENCE CRT PROJECT--PILOT 2002 P/P--OPERATIONAL 2003 P/P--COMPUTER BASED 2004

| STD | OBJ | ILO 1 | ILO 2 | ILO 3 | ILO 4 | ILO 5 | ILO 6 | OBJ TOTAL | STANDARD TOTAL | STANDARD PERCENT |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 1 | 0 | | 2 | 0 | 2 | 1 | 5 | 15 | 25% |
| | 2 | 2 | | 2 | 1 | 0 | 0 | 5 | | |
| | 3 | 1 | | 1 | 1 | 1 | 1 | 5 | | |
| II | 1 | 2 | | 1 | 0 | 1 | 1 | 5 | 10 | 17% |
| | 2 | 1 | | 1 | 2 | 1 | 0 | 5 | | |
| III | 1 | 1 | | 2 | 1 | 1 | 0 | 5 | 10 | 17% |
| | 2 | 1 | | 2 | 1 | 1 | 0 | 5 | | |
| IV | 1 | 1 | | 1 | 1 | 2 | 0 | 5 | 10 | 17% |
| | 2 | 1 | | 1 | 0 | 2 | 1 | 5 | | |
| V | 1 | 1 | | 0 | 2 | 1 | 1 | 5 | 15 | 25% |
| | 2 | 2 | | 1 | 1 | 1 | 0 | 5 | | |
| | 3 | 0 | | 0 | 2 | 2 | 1 | 5 | | |
| TOTALS | | 13 | | 14 | 12 | 15 | 6 | | 60 | |
| PERCENTS | | 22% | | 23% | 20% | 25% | 10% | | | |

* 7th Grade Integrated Science is a half year course

**CRT Blueprint Disclaimer**

While every effort is made to have the CRTs match the blueprint exactly, this is not guaranteed.
The expected values within a blueprint can and do sometimes fluctuate, however; very minimally.
The overall totals and percentages in all categories have a high degree of consistency.

# Test Development Process
## Appropriate Language

| | |
|---|---|
| Science language students should use: | food web, food chain, photosynthesis, respiration, predator, energy flow, solar energy, chemical energy, mechanical energy, producer, consumer, prey, mutualism, parasitism, competition, environment, capacity, organism, decomposer |

# Test Development Process
## ie's and eg's

- **Objective 2:** Generalize the dependent relationships between organisms.
- a. Categorize the relationships between organisms (**i.e.,** = id est producer/consumer/decomposer, predator/prey, (this and only this) mutualism/parasitism) and provide examples of each.
- b. Use models to trace the flow of energy in food chains and food webs.
- c. Formulate and test a hypothesis on the effects of air, temperature, water, or light on plants (**e.g.,** seed germination, growth rates, seasonal adaptations). = exempli gratia (as an example)
- d. Research multiple ways that different scientists have investigated the same ecosystem.

# Test Development Process
## Item Writing Rules

1. The stem should pose a clear question or problem and should contain as much of the item as possible. It should be written as a question.
2. The stem should be stated simply, using correct English.
3. Avoid use of direct statements from textbooks.
4. Avoid use of trick and ambiguous questions.
5. Avoid use of negatives such as none or not.
6. All alternatives should be grammatically related to the stem
7. All alternatives should be listed in some logical numerical or systematic form.
8. The length of the alternatives should be consistent, not vary with being correct or incorrect. Test-wise students know that the correct answer is often the longest one with the most qualifiers.
9. Avoid use of wordy stems.
10. Avoid use of verbal clues such as a, an.

# Test Development Process
## Item Writing Rules, cont.

11. DO NOT use response alternatives such as "none of the above," "none of these," "both (a) and (c) above," or "all of the above."
12. When testing for knowledge of a term, it is preferable to put the word in the stem, and alternative definitions in the response alternatives.
13. Each alternative should be independent so as not to give clues to answer another alternative.
14. All alternatives should be written so that they are all plausible to the less informed student.
15. Be aware of bias and sensitivity issues.
16. Use appropriate vocabulary
    1. age appropriate
    2. words found in “Science language students should use”
    3. words students were held responsible for in previous courses
    4. words found in “ie’s” in objectives
17. Alignment, questions need to align to Standard, Objective, AND ILO

# Pieces of the Development Puzzle

- Equating of Test Forms
- Scaling of Scores
- Reporting

# Pieces of the Puzzle
# Overarching Considerations

- Overarching considerations
  - NEW Tests each year
    - Need to be new (different items), but equal
  - Need to be able to track progress

# Pieces of the Puzzle
# Equating

- Equating: a statistical method of *relating* the scores on one test to the scores on a second test.
  - New tests, equivalent scores
  - Some common items between test forms
  - Statistical comparison of common items for equivalent difficulty level.
  - This is a statistical process that ensures that results from year-to-year are accurately comparable and not subject to fluctuations due to unintentional changes in item difficulty.

# Pieces of the Puzzle
# Scaling of Scores

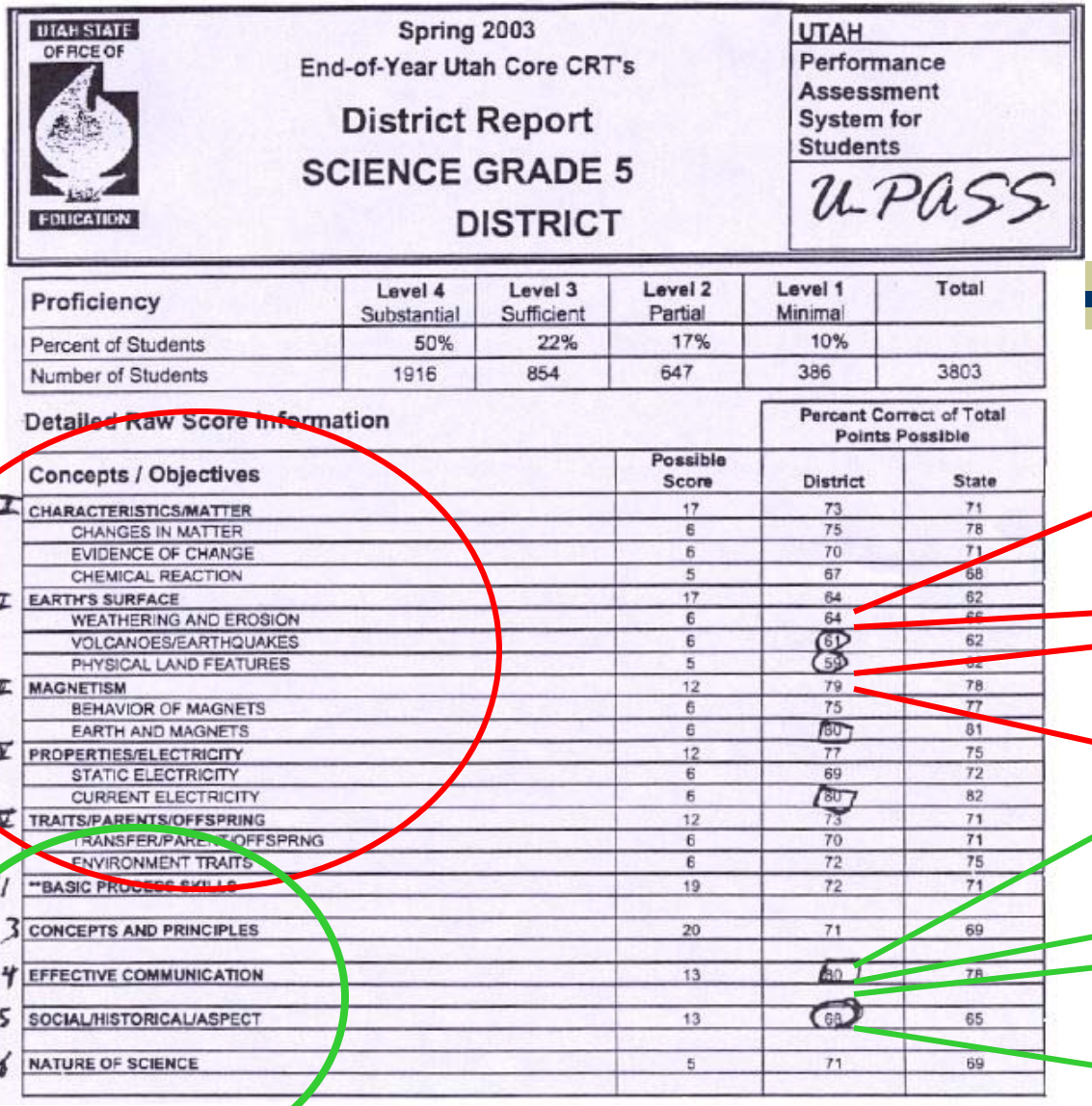
- Reported scores are scaled for the majority of standardized tests developed for the State of Utah
  - These include all CRTs (ELA, Math, and Science) and UBSCT
- Scaled scores offer the advantage of simplifying the reporting of results
  - Common score reporting for each level and tests
  - No more specific percentages for cut scores for each subject and test
  - Far greater comparability between tests and years

# Pieces of the Puzzle
## Scaling of Scores

- The Scale
  - Scores reported on the SAME scale for all tests
  - Scale is 100-199.
  - Proficiency cut is set at 160.
    - This cut will be constant year to year, test to test.

# Pieces of the Puzzle
# Reporting

- Individual Student Scores (100-199, with 160 as proficient) and Proficiency Level (1-4, 3&4 being proficient)
- By Standard, Objective, ILO
  - Course, school, district, and state



UTAH STATE OFFICE OF EDUCATION

Spring 2003
End-of-Year Utah Core CRT's
District Report
SCIENCE GRADE 5
DISTRICT

UTAH Performance Assessment System for Students
U-PASS

| Proficiency | Level 4 Substantial | Level 3 Sufficient | Level 2 Partial | Level 1 Minimal | Total |
|---|---|---|---|---|---|
| Percent of Students | 50% | 22% | 17% | 10% | |
| Number of Students | 1916 | 854 | 647 | 386 | 3803 |

Detailed Raw Score Information

| | Concepts / Objectives | Possible Score | Percent Correct of Total Points Possible: District | State |
|---|---|---|---|---|
| I | CHARACTERISTICS/MATTER | 17 | 73 | 71 |
| | CHANGES IN MATTER | 6 | 75 | 78 |
| | EVIDENCE OF CHANGE | 6 | 70 | 71 |
| | CHEMICAL REACTION | 5 | 67 | 68 |
| II | EARTH'S SURFACE | 17 | 64 | 62 |
| | WEATHERING AND EROSION | 6 | 64 | 66 |
| | VOLCANOES/EARTHQUAKES | 6 | 61 | 62 |
| | PHYSICAL LAND FEATURES | 5 | 59 | 62 |
| III | MAGNETISM | 12 | 79 | 78 |
| | BEHAVIOR OF MAGNETS | 6 | 75 | 77 |
| | EARTH AND MAGNETS | 6 | 80 | 81 |
| IV | PROPERTIES/ELECTRICITY | 12 | 77 | 75 |
| | STATIC ELECTRICITY | 6 | 69 | 72 |
| | CURRENT ELECTRICITY | 6 | 80 | 82 |
| V | TRAITS/PARENTS/OFFSPRING | 12 | 73 | 71 |
| | TRANSFER/PARENTS/OFFSPRNG | 6 | 70 | 71 |
| | ENVIRONMENT TRAITS | 6 | 72 | 75 |
| 1 | **BASIC PROCESS SKILLS | 19 | 72 | 71 |
| 3 | CONCEPTS AND PRINCIPLES | 20 | 71 | 69 |
| 4 | EFFECTIVE COMMUNICATION | 13 | 80 | 78 |
| 5 | SOCIAL/HISTORICAL/ASPECT | 13 | 68 | 65 |
| 6 | NATURE OF SCIENCE | 5 | 71 | 69 |

Content

ILOs

64

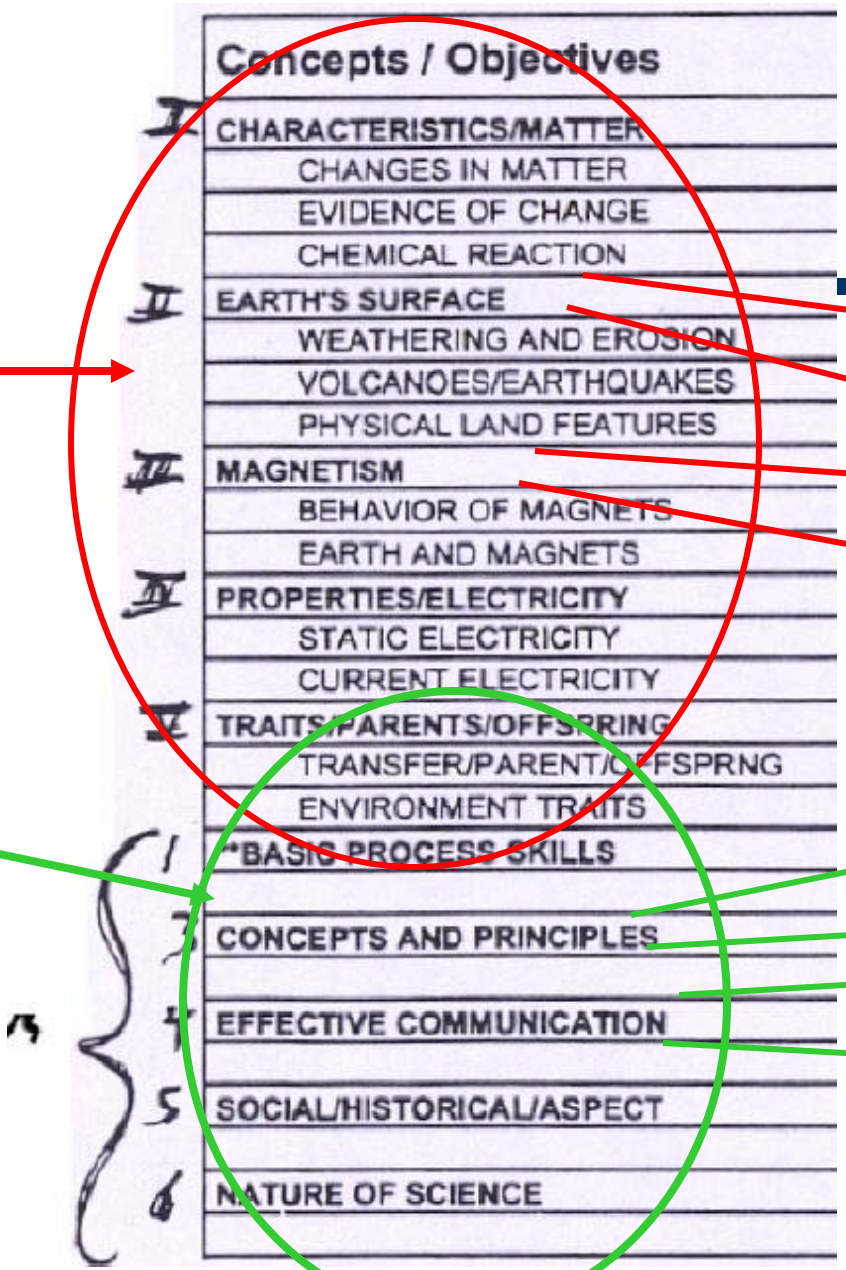
79

80

68

Content

ILOs




64

79

80

68

# What the Score Report Will Look Like in 2005

| |
|---|
| I CHEMICAL/PHYSICAL CHNGE |
| I1 CHANGES IN MATTER |
| I2 PHYSICAL CHANGE EVIDENCE |
| I3 CHEMICAL REACTION EVIDENCE |
| II RESHAPE EARTHS SURFACE |
| II1 WEATHERING/EROSION |
| II2 VOLCAN/ERTHOK/UPLI |
| II3 BUILD UP/BREAK DOWN |
| III OBSERVE MAGNETISM |
| III1 BEHAVIOR/MAGNETISM |
| III2 MAGNETIC FIELDS |
| IV FEATURES/ELECTRICITY |
| IV1 STATIC ELECTRICITY |
| IV2 CURRENT ELECTRICITY |
| V HEREDITY/SURVIVAL |
| V1 TRANSFER OF TRAITS |
| V2 CHARACTER ADVANTAGE |
| |
| 1 SCI PROCESS SKILLS |
| |
| 3 CONCEPTS/PRINCIPLES |
| |
| 4 EFFECTIVE COMMUNICATION |
| |
| 5 SOCIAL/HISTORY ASPECT |
| |
| 6 NATURE OF SCIENCE |

# Testing tips and preparation

- Focus on teaching the whole curriculum
  - Process/skill (ILO) as well as content
- Practice with students on applying information

# Measuring Student Understanding of the Core Curriculum

- Emphasis on Classroom Assessment and Instruction
- CRTs are one measure of understanding
  - What are other ways to assess understanding???

# Other Ways to Assess Understanding

- Discussions
- Short answer
- Short essay
- Multiple choice
- Performance tasks
- Observations
- Products

# Other Ways to Assess Understanding Primary Purposes for Assessment

1. To inform instruction
2. To evaluate attainment of instruction

# Other Ways to Assess Understanding

## Discussions

- Listen to what students are saying
- Release of teacher control so it can be a DISCUSSION, not direct instruction
- Use to learn what students know and don't know
- Adjust the discussion as needed by guiding, not lecturing

# Other Ways to Assess Understanding

Short answer (fill in the blank)

- is really a form of selected response
- factual, vocabulary focused
- simply tells us factual knowledge, not understanding

# Other Ways to Assess Understanding

Short essay

- effective if grade appropriate
- need a clearly define rubric for assignment and scoring to be fair
- can provide information on misconceptions as well as understanding
- feedback is vital for learning to occur
- IF misconceptions are documented, can impact instruction

# Other Ways to Assess Understanding

## Multiple Choice

- All statements are made in context of a well-written item
- Can provide significant information on understanding and misconceptions
- Results should be analyzed towards what questions were completed correctly, BUT ALSO what distractors were marked
- Great sources of multiple choice questions are previous short essay answers

# Other Ways to Assess Understanding

## Performance tests and tasks

- Requires students to complete some required skill
- Requires observation of student during test or task (not continuous)
- Requires some interaction, how much depends on how summative the performance needs to be.

# Other Ways to Assess Understanding

## Observations

- Can be very effective IF you OBSERVE and not just WATCH
- Can be formal or informal, but purpose of determining understanding should always be present
- Other reasons to observe; direction following and behavior.

# Other Ways to Assess Understanding

## Products

- Reports, presentations, posters, powerpoints, etc.
- Separate out purposes; directions following, skill demonstration, understanding expression

# Professional Development

- Formative Assessment Course
- CORE Academy
- Involvement in assessment development
- Performance Assessment for Science Teachers
  - Online course
- Utah Rural Schools Conference
- Happy to present as requested

# Professional Development

**Using Formative Assessment to Improve Instruction**

- Instructors: Dr. Hugh Baird and Kevin King (USOE Science Assessment Specialist)
- Two Locations:
  - 1. UVSC Heber City Campus Dates: June 27 – 30, 2005
  - 2. Sevier Training Center Dates: July 18 - 21, 2005
- Registration fee and deposits: $325 registration fee (will waived if a team is attending), $75 non-refundable deposit (will roll into registration fee)
- Target Group: Elementary and Secondary Science Teachers and District Administrators

- Preference will be given to Educator Teams (at least 3 educators, including at least one member with administrative responsibilities)
- Lodging (sharing rooms is preferred) and meals will be provided
- Credit: 2 credits

# Resources

- Science Curriculum Home Page
  - http://www.usoe.k12.ut.us/curr/Science/default.htm
- Science Assessment Home Page
  - http://www.usoe.k12.ut.us/eval/_Science1/default.htm
    - Reference Sheets
    - Blueprints
    - Additional Resources
- UTIPS

# Thank You

## **Enduring Understanding**:

Participants will increase in their understanding of science assessment at the Standardized and Classroom Level.

- Essential Questions

1. How are the CRTs constructed?
2. How is standardized assessment connected to classroom assessment?
3. What constitutes science assessment?
4. What is available to assist educators in science instruction and assessment?
5. What are accountability issues in science assessment?

Any Questions?

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# Accountability Systems

- Accountability is reporting of performance, usually with expectations and/or judgments attached.
- Two major impacting systems
  - NCLB
  - U-PASS

# Federal Accountability
## NCLB

- No Child Left Behind Legislation
- Federal Goal is for ALL schools to have 100% of students proficient by 2014
- Remediation implementation for Title 1 schools
- All other schools are “simply” labeled as making or not making AYP – Adequate Yearly Progress
- Implications are evident at all levels
  - Positive and negative

# Accountability Systems
## NCLB

- NCLB Major Components
  - Highly Qualified designations for teachers
  - Content Standards for Science (by ’05-’-6)
  - Assessments for Science (by ’07-’08)
    - Aligned to Content Standards
    - Performance Standards
    - Reporting
    - AYP (**not** required for science)

# Accountability Systems
## NCLB related to Science

## How are we doing?

- Meeting ALL requirements, in ongoing discussions with US-DOE.
- USOE has submitted to US-DOE statements of intent for what Utah is doing to meet NCLB requirements

## AYP?

Current NCLB legislation does NOT require AYP determinations for science

# State Level Accountability
## U-PASS

- Utah Performance Assessment State System
- Core CRTs, DWA, UAA, MWAC, and UBSCT
- Developing a system to recognize what schools are doing
  - A status and progress model
- Identifying schools in need of assistance to meet state level of performance
- Performance Plus is part of this

# Accountability Systems
## U-PASS

- U-PASS Major Components
  - Compensatory, NOT Conjunctive
    - One overall score, NOT 40 individual marks that all need to be reached
  - Considers status and progress
  - Includes scores for science

# Thank You

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