ACTRC

Science Inquiry Skills Test: Development, Analysis and Feedback to Teachers

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Australian Aid

Science Inquiry Skills Test (SIST)

Purpose

- To determine the extent to which science inquiry standards are being met
- To assess Grade 8 students' science inquiry skills across a range of difficulty

Coverage

- simple measurements
- classification tasks
- control of several variables
- interpretation of multivariate data

Science Inquiry Skills Test (SIST)

Constraints

- Minimize science content knowledge, that is, to be as content-free as possible.
  - ➢ To assess the science inquiry skills of the students without interference caused by differences in knowledge of science content due to different curricula.
- Minimize the reading load.

Method

Samples

- 22 science teachers of Grade 8
- 11 schools
- 2 teachers per school
- 2 sections per teacher

Diverse sample of school settings in terms of

- class size
- access to resources

SIST

Development process

- Definition of science inquiry
- Description of the domain
- Identification of the subskills
- Development of blueprint (Table of Specifications)
- Development of items
- Panelling of items
- Piloting of items in the field
- Analysis of test results
- Finalization of test

SIST

Development process

Definition of science inquiry

Five essential features of science inquiry

1. (EQ) Learner begins with a **question** that can be answered in a scientific way.
2. (EV) Learner gathers **evidence** in attempting to answer the question.
3. (EX) Learner forms an **explanation** to answer the question based on the evidence collected.
4. (EK) Learner connects explanations to scientific knowledge.
5. (EC) Learner communicates and justifies explanations.

(National Science Education Standards, 1996)

Development Process

Key Stage Standards from the Science Curriculum

K–3	4–6	7–10	11-12
At the end of Grade 3, the learners should have acquired healthful habits and have developed curiosity about self and their environment using basic process skills of observing, communicating, comparing, classifying, measuring, inferring and predicting.	At the end of Grade 6, the learners should have developed the essential skills of scientific inquiry – designing simple investigations, using appropriate procedure, materials and tools to gather evidence, observing patterns, determining relationships,drawing conclusions based on evidence, and communicating ideas in varied ways to make meaning of the observations and/or changes that occur in the environment.	At the end of Grade 10, the learners should have developed scientific, technological, and environmental literacy & can make that would lead to rational choices on issues confronting them. .....they should recognize that the central feature of an investigation is that if one variable is changed (while controlling all others), the effect of the change on another variable can be measured.	At the end of Grade 12, the learners should have gained skills in obtaining scientific and technological information from varied sources about global issues that have impact on the country. .....They should be able to process information to get relevant data for a problem at hand.

Development Process

Test blueprint for each key stage (K-3, Gr4-6, Gr7-10, Gr11-12)

	EQ scientifically oriented questions	EV ....evidence in responding to questions	EX ...explanations from evidence	EK ... connects explanations to scientific knowledge	EC ....communicates and justifies explanations
Standard					
Develop–mental progression					
Item ideas					
Number of items					

SIST

Skills section from test blueprint and Key stage standards

Grade		Learner formulates explanations from evidence
11-12	Standard	skills in obtaining scientific and technological information from varied sources
	Developmental progression	able to reconcile evidence from multiple sources
7-10	Standard	the effect of the change on another variable can be measured
	Developmental progression	able to interpret quantitative data and to formulate scientific explanations in terms of associations and cause and effect
4-6	Standard	observing patterns, determining relationships, drawing conclusions based on evidence
	Developmental progression	able to interpret measurements and explain findings of empirical investigations based on reason
K-3	Standard	comparing, classifying inferring and predicting
	Developmental progression	able to describe observations and measurements made

Analysis of Test Results

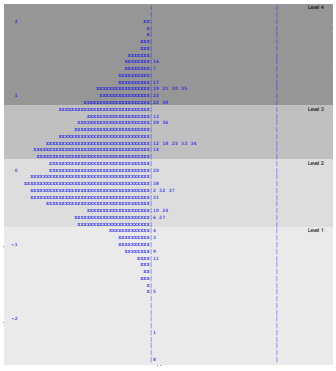
- Variable map was generated based on student test data.
- Map shows a schematic representation of how item difficulty and student ability relate to each other with respect to science inquiry skills.
- Diagram also shows relative difficulty of the tested skills.
- **X** in the left column represents the students, where most able student is at the top and the least able at the bottom.

Analysis of Test Results

- The numbers in the right column refers to the test questions. The item numbers at the top indicates the most difficult questions. Easiest questions are at the bottom.
- Generalized descriptions of increasing competence were developed based on the clustering of test items.
- Levels identify the kinds of skills that students are ready to learn.

SIST

Item-person map showing the relative difficulty of science inquiry skills



Feedback to Teachers

- Results describe the performance of only the two classes handled by a teacher. The data should not be construed as a reflection of general school performance.
- Results are not expressed as numeric scores but in terms of students' emerging abilities—the levels at which they are ready to learn a particular set of science inquiry skills.

Feedback to teachers

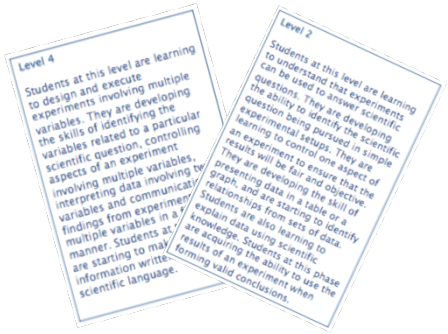
Developmental progression of science inquiry skills

- Skills in each level build on those in the previous levels.
- Each level description is an indication of the kinds of ideas those students are ready to engage in.

Levels	
4	Ability to experiment with multiple variables
3	Ability to relate answers to current scientific knowledge
2	Ability to answer questions using results from scientific inquiries
1	Ability to measure, observe and classify

Feedback to teachers

Developmental progression of science inquiry skills - examples



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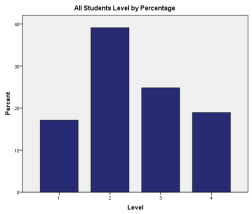
Student results from test pilot



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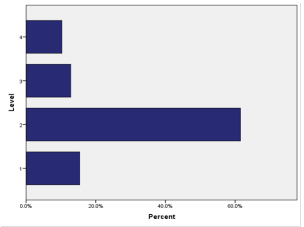
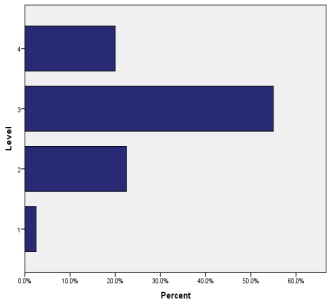
Student results from one class



SIST

Student results from another class



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