

Understanding Students' Minds: How to write more valid questions

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Validity

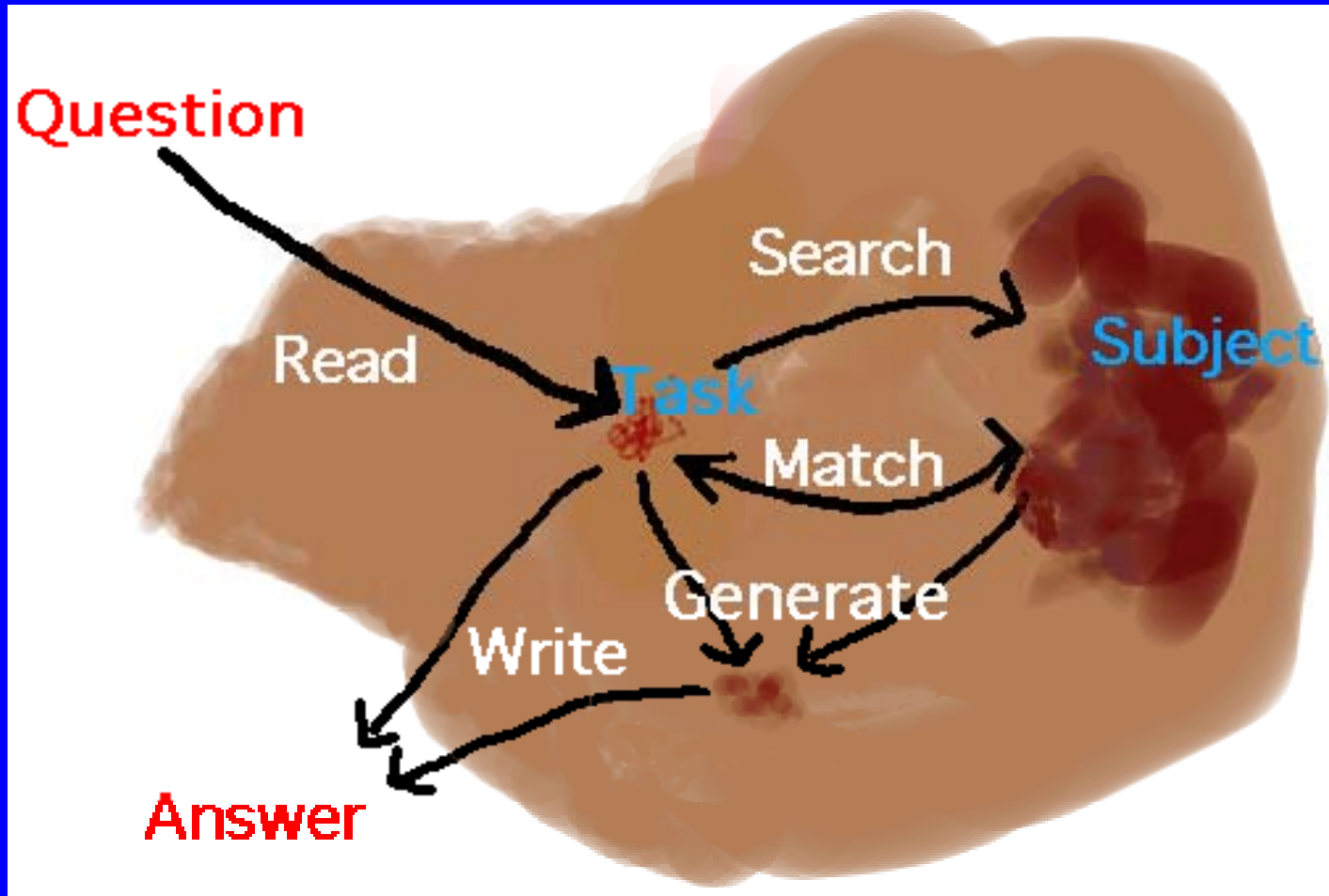
A question can only be valid if:

‘the students’ minds are doing the things we want them to show us they can do’

The four tools

- 1 Model of the Question Answering Process**
- 2 Sources of Difficulty and Easiness (SODs & SOEs)**
- 3 Outcome Space Generator**
- 4 Scale of Cognitive Demands**

Tool 1: The Question Answering Process



How students answer questions

- Learning
- Reading
 - activation of concepts
 - constructing a mental representation of the task
- Searching, Matching, Generating
- Writing

The Question Answering Process

Remember that **Learning** occurs over several years -
but **Reading, Searching, Matching, Generating and Writing** happen in a few minutes under conditions of examination stress.

Operating under exam conditions

Stress and:

- capacity
- proceduralisation
- closure and checking

Tool 2: General SODs and SOEs

- Question Design
- Physical Features
- Language
- Process
- Mark Scheme

Example: Highlighting

Version A 8% correct

Using Fig. 1 describe the shape of the valley along this cross-section.

Use the following headings:

Valley floor _____

Valley sides _____

Version B 38% correct

Using Fig. 1 describe the **SHAPE** of the valley along this cross-section.

Example: Everyday language

(c) One method of neutralising the acid in paper is to use sodium carbonate.

When sodium carbonate reacts with sulphuric acid there are three products.

What are they?

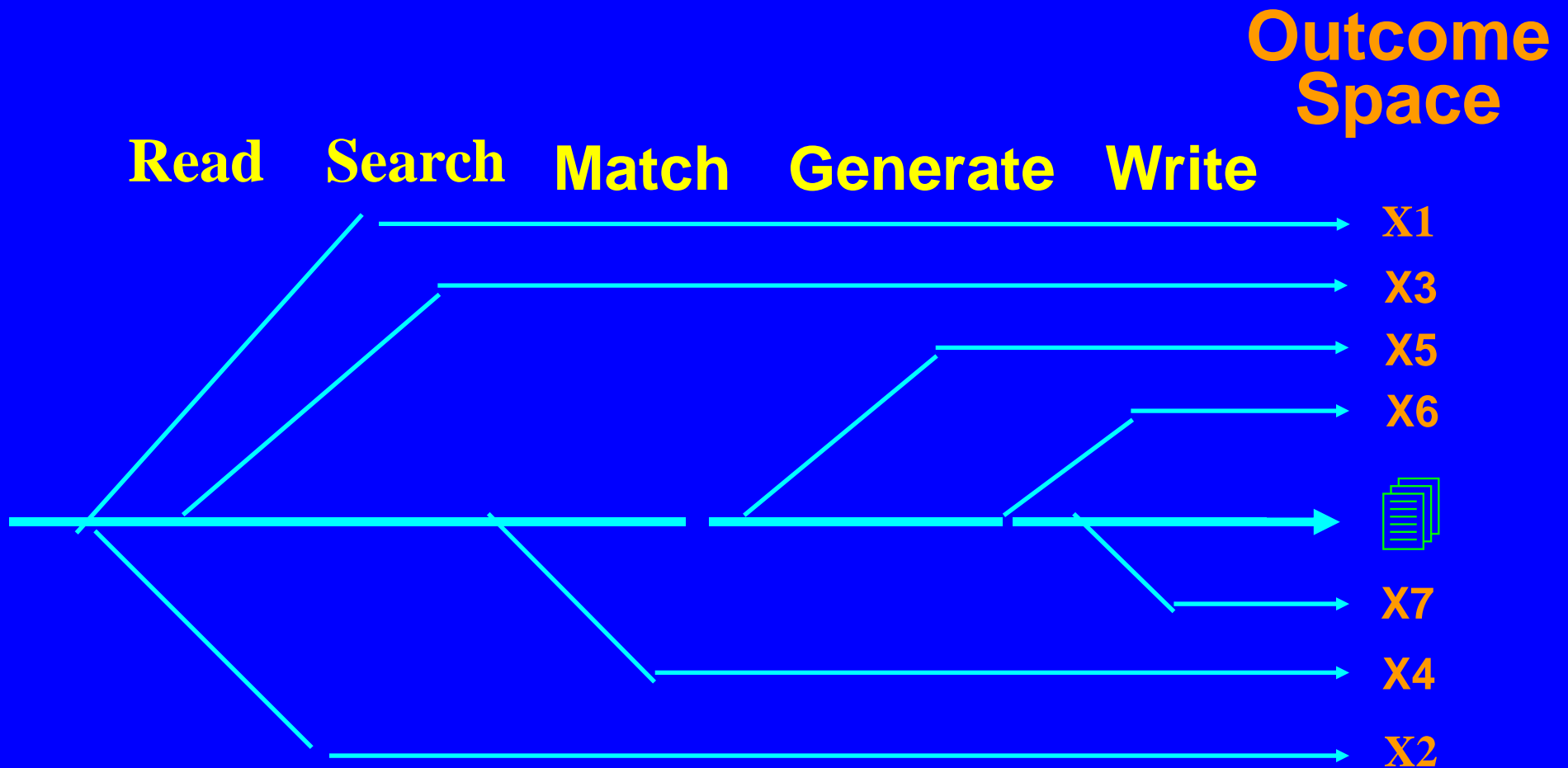
- 1 Soap
- 2 Shampoo
- 3 Kitchen cleaner

The word 'product' has more than one meaning. For this student the everyday meaning dominated.

Outcome Space

- The range of answers, or of types of answers, to a question or task.
- Qualitative differences
 - A *Writer's expected range*
 - B *Observed range*
- The match between these two 'spaces' is a matter of test validity.

Tool 3: The Outcome Space Generator



The Outcome Space Generator

Example

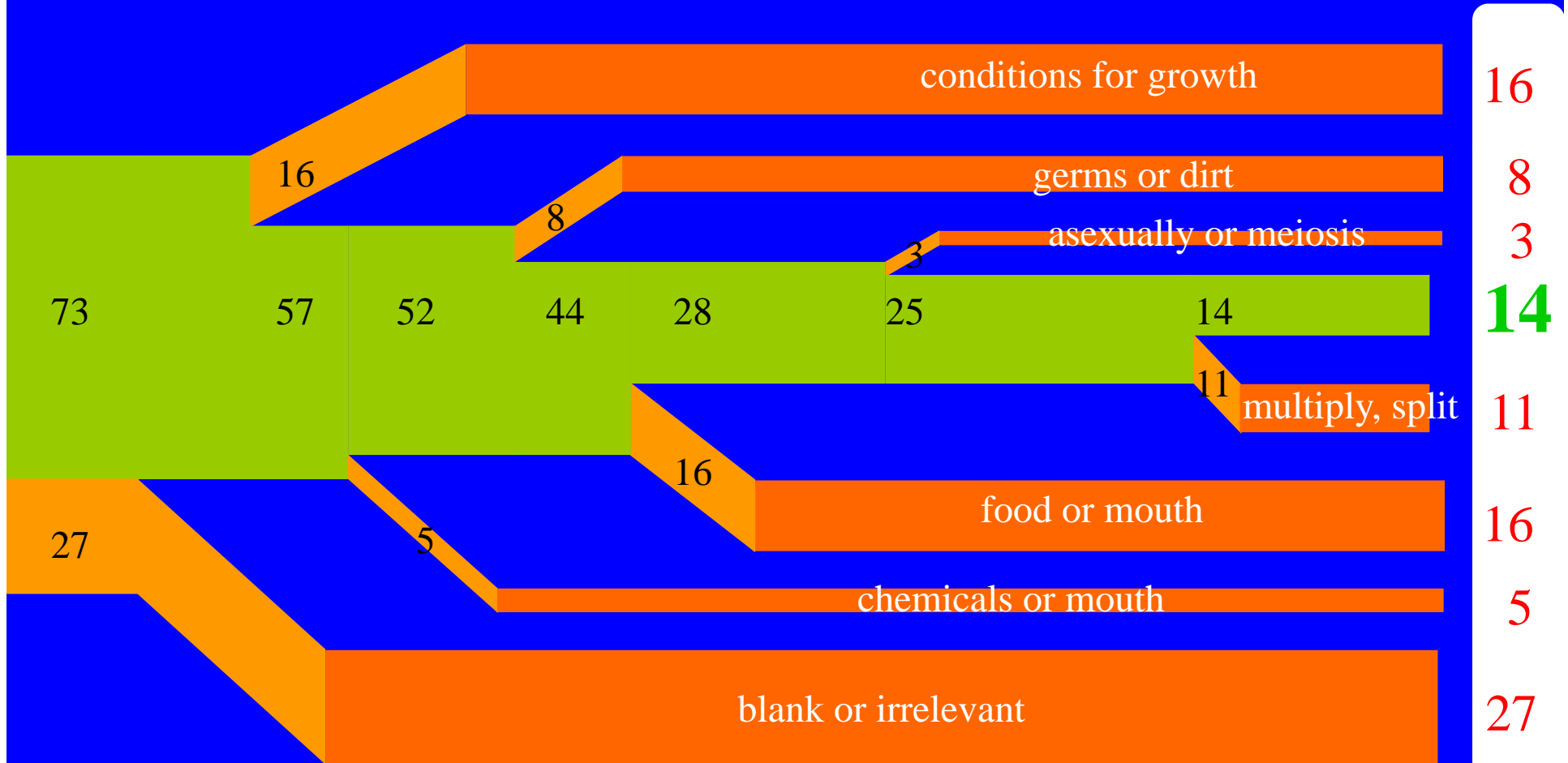
Joy uses a new toothpaste.

The toothpaste contains a chemical which stops bacteria growing in her mouth.

(a) (i) How do bacteria reproduce?

The Outcome Space Generator Example

Learn Read Search Match/Generate Write %



Tool 4: Five-dimension Scale of Cognitive Demands

| | 1 | 2 | 3 | 4 | 5 |
|---|-----|---|------|---|-----|
| <p>Complexity The number of components or operations or ideas and the links between them</p> | <-- | <p>Simple operations (ie ideas/steps) No comprehension, except that required for natural language No links between operations</p> | <--> | <p>Synthesis or evaluation of operations Requires technical comprehension Makes links between operations</p> | --> |
| <p>Resources The use of data and information</p> | <-- | <p>All and only the data/information needed is given</p> | <--> | <p>Student must generate the necessary data/information</p> | --> |
| <p>Abstractness The extent to which the student deals with ideas rather than concrete objects or phenomena</p> | <-- | <p>Deals with concrete objects</p> | <--> | <p>Highly abstract</p> | --> |
| <p>Task Strategy The extent to which the student devises (or selects) and maintains a strategy for tackling the question</p> | <-- | <p>Strategy is given No need to monitor strategy No selection of information required</p> | <--> | <p>Students need to devise their own strategy Students must monitor the application of their strategy Must select content from a large, complex pool of information</p> | --> |
| <p>Response Strategy The extent to which students have to organise their own response</p> | <-- | <p>Organisation of response not required</p> | <--> | <p>Must organise how to communicate response</p> | --> |

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