

# Understanding Students' Minds: How to write more valid questions

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# Validity

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A question can only be valid if:

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

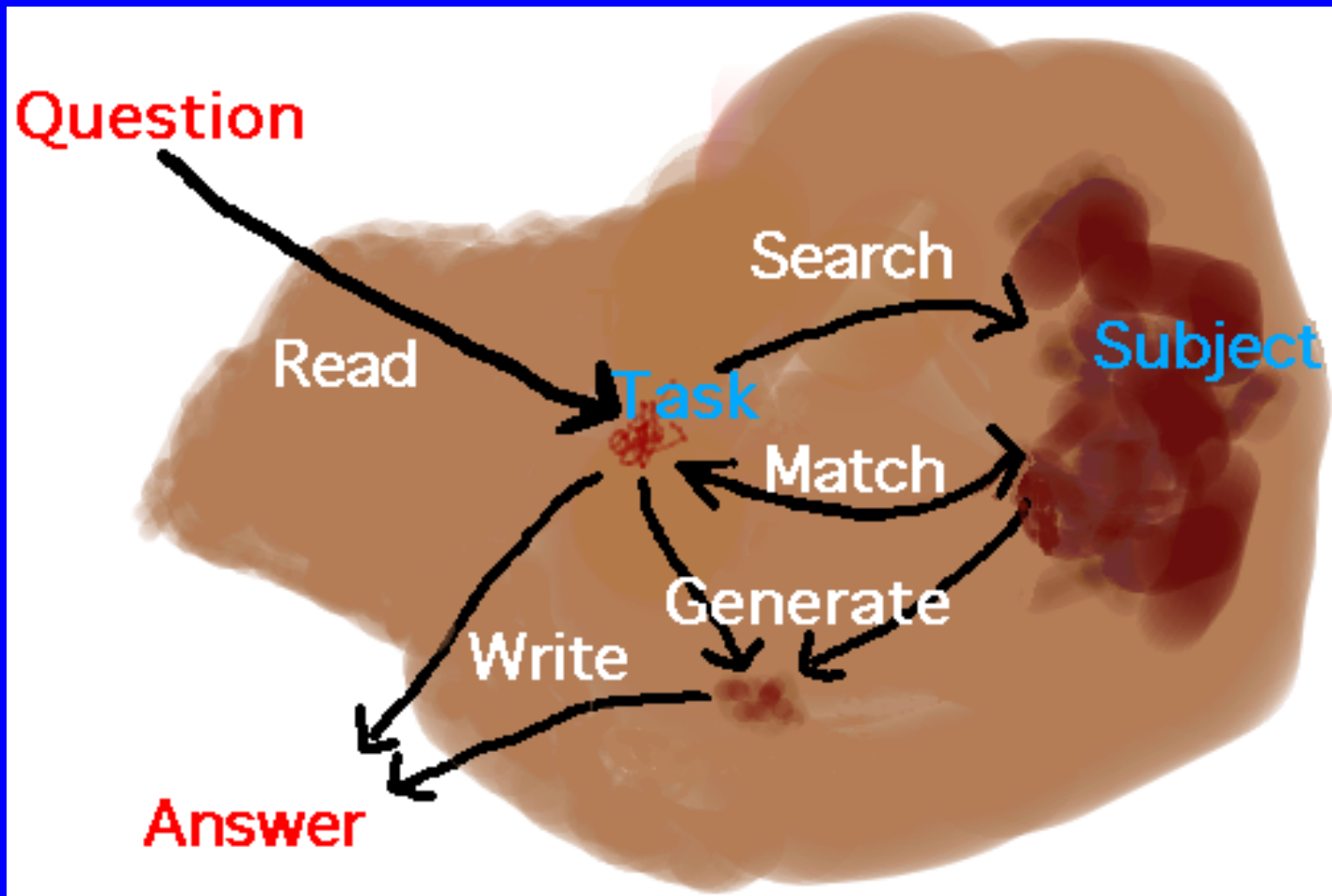
# The four tools

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- 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

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# How students answer questions

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

# The Question Answering Process

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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

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## Stress and:

- capacity
- proceduralisation
- closure and checking



# Tool 2: General SODs and SOEs

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

# Example: Highlighting

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## 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

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(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

Kitchen cleaner

3

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

# Outcome Space

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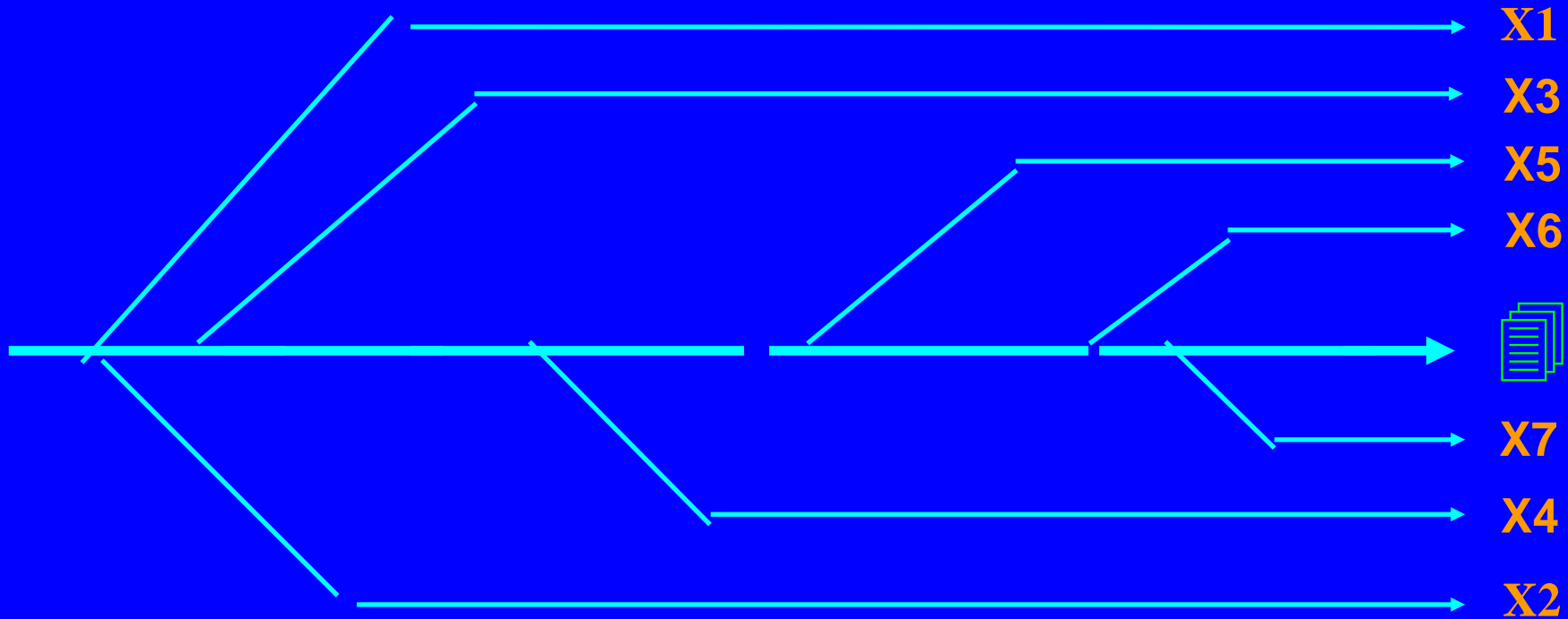
- The range of answers, or of types of answers, to a question or task.
- Qualitative differences
  - A *Writer's expected range*
  - B *Observed range*
- The match between these two 'spaces' is a matter of test validity.

# Tool 3: The Outcome Space Generator

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Outcome  
Space

Read Search Match Generate Write



# The Outcome Space Generator

## Example

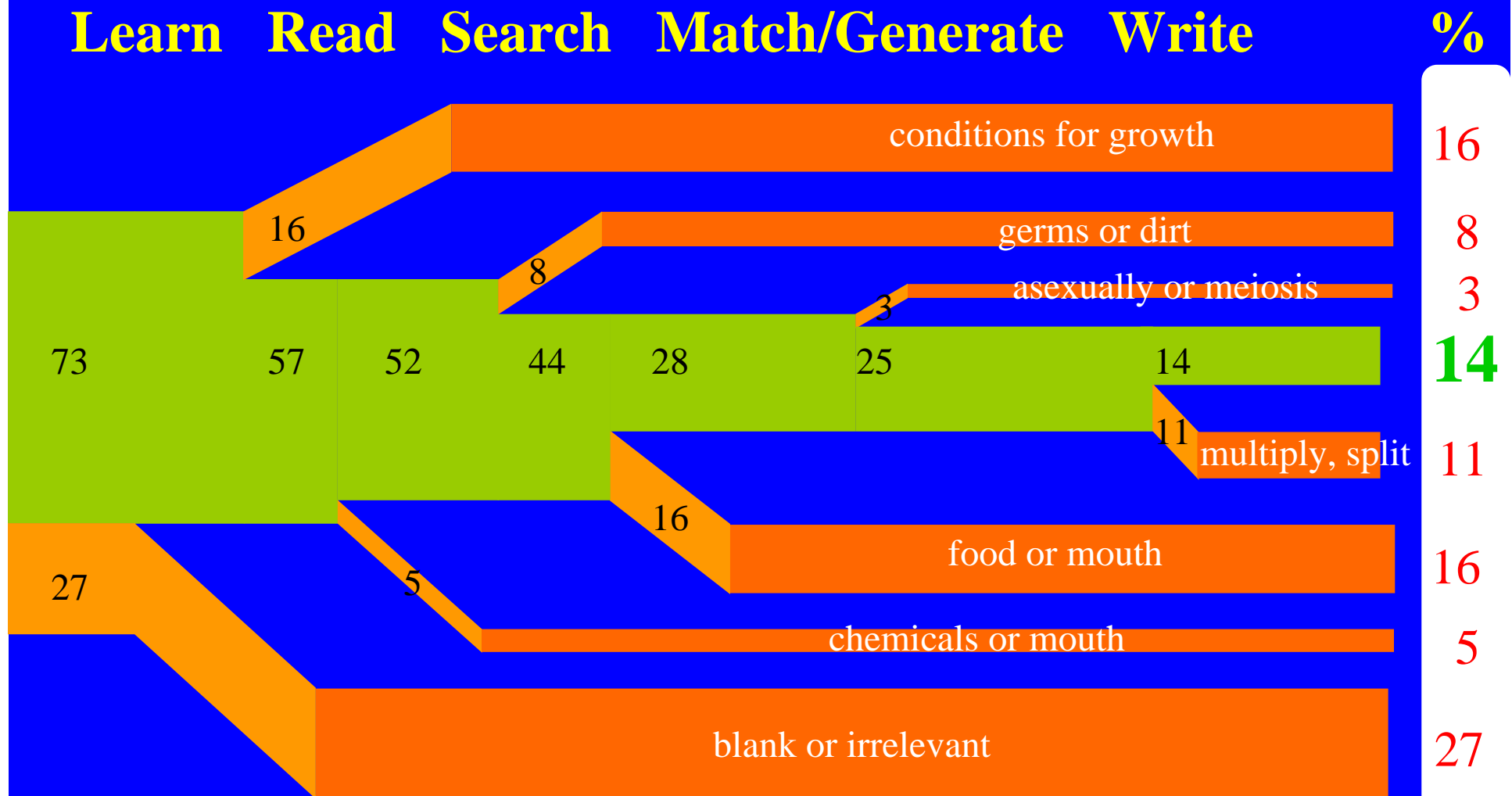
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Joy uses a new toothpaste.

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

(a) (i) How do bacteria reproduce?

# The Outcome Space Generator Example



# Tool 4: Five-dimension Scale of Cognitive Demands

	1	2	3	4	5
<p><b>Complexity</b> 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><b>Resources</b> 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><b>Abstractness</b> 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><b>Task Strategy</b> 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><b>Response Strategy</b> The extent to which students have to organise their response</p>	<--	<p>Organisation of response not required</p>	<-->	<p>Must organise how to communicate response</p>	-->



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