Session 2: Introduction to Modern Assessment

Theory: A basis for all assessments (continued)

13:30 till 15:00 Day 1

Presented by Jim Tognolini
Introduction to Modern Assessment Theory: *A basis for all assessments*

During this session we will

- *introduce standards*;
- *introduce standards-referencing and building measurement scales*
- *introduce the writing of assessment frameworks (examples taken from subjects and PISA)*; and,
- *show how to operationalise standards.*
What are standards?

• Standards describe what it is that students should be able to know and do.

• The US New Standards Project defines ‘standards’ as: “what students should know and be able to do”. This definition is also used by the American Foundation of Teachers (see AFT, 1999).

• On the other hand, some states in Australia, use ‘standards’ as a synonym for ‘learning outcomes’ which are described as: “benchmarks or standards against which student achievement can be measured”.
Standards and standards-referenced systems

Standards are generally described as “what it is that students have to know and be able to do”. Commonly a distinction is made between curriculum standards and performance standards.

- **Content standards** (syllabus standards, learning standards, core standards, indicators and outcomes) “are the knowledge, skills and understanding expected to be learned by students as a result of studying a course”; while,

- **Performance standards** (benchmark standards, achievement standards, proficiency standards) are defined as the “levels of achievement of the knowledge, skills and understanding”

In a standards-referenced system the *image* capturing the performance of each student is given meaning by referencing it to *pre-determined standards of performance*. 
What are standards?

**Content Standards:** (Statements of what students should be able to know and do at specified stages (grade levels) along the developmental continuum.)

- Syllabus Standards
- Grade Level Standards
- Core Standards
- Outcomes

Examples of content standards:

1. Understand the meaning of rational numbers; use the point on number line to represent the rational number; compare the rational numbers.

2. According to the actual meaning of the specific problem, inspect whether the solution of the equation is reasonable.
What are standards?

**Performance standards**: (Statements of how well students are expected to be able to know and perform the skills included in the syllabus standards.)

- Achievement standards
- Benchmark Standards
- **Proficiency Standards**
- Reporting Standards
- Accountability/Target Standards

Examples of Performance Standards

**Band 6.** Appreciate literary works and present ideas critically in an exemplary manner.

**Band 1.** Know fundamental skills in listening, reading, speaking and writing.
What are standards?

**General Objectives**: (General statements of what it is students should be able to know and do. They are generally cross-curricula.)

Examples of General Objectives

Knowledge and skills

To experience such processes of abstraction, operation and modeling in the fields of numbers and algebra, to master essential knowledge and basic skills in numbers and algebraic formulae.

Problem Solving

To acquire certain basic methods for analysing and solving a problem, to experience the diversity of problem-solving methods, and to develop the students’ sense of innovation.
Standards

Standards

• should describe performance expectations and proficiency levels in the context of a clear conceptual framework, and are built on sound models of student learning (developmental continuum).

• should be clear, detailed, and complete; reasonable in scope; and both rigorous and well-grounded in the knowledge domain.

• must be elaborated so that curriculum, teaching and assessment are aligned.

• are derived from the curriculum and not developed independently from mandated curriculum requirements.
The basic structure of a standards-referenced system

- Content Standards
- Curriculum
- Examinations and School-based Assessment
- Performance Standards
- Reporting of performance against standards for the purpose of certification
Characteristics of standards-referenced systems

• enable the performance of students to be monitored against pre-determined standards;

• empower students in the teaching and learning process;

• provide all students with a meaningful record of their achievements;

• provide a mechanism to recognise and reward prior achievement at school within broad-based qualifications frameworks; and,

• provide a mechanism to bring together curriculum, pedagogy and assessment in a way that has not been possible in the past.
Quick quiz (True or False or Don’t Know [Need More Information])

1. Standards-referencing is defined as giving meaning to marks by comparing the mark to a group of fellow students.

2. Performance standards describe how well students know and can do their work.

3. Content standards describe what it is that students know and can do.

4. The Bhutanese system is moving towards referencing what it is that students know and can do to standards.

5. Standards vary from school to school and class to class.

6. Standards must be described in order to have curriculum, teaching, learning and assessment all aligned.
Standards and the developmental continuum
Starting with standards
(6 stages across 12 years in school)
Starting with standards
(6 bands across 1 year [e.g. Year 12 in school])

Knowledge and lower levels of cognition

Performance standards comprising content standards and general objectives

Knowledge and higher levels of cognition

Standards

Band 1  Band 2  Band 3  Band 4  Band 5  Band 6
Starting with standards
(7 marks across a marking rubric for a task)
Content standards and performance standards across 1 year Curriculum

Performance standards comprising content standards and general objectives

Knowledge and lower levels of cognition

Knowledge and higher levels of cognition

Standards

Stage 1
Stage 2
Stage 3
Stage 4
Stage 5
Stage 6

Content Standards

Content Standards

Content Standards

Content Standards
Content standards and performance standards across 1 year

Performance standards comprising content standards and general objectives

Knowledge and higher levels of cognition

Knowledge and lower levels of cognition

Standards

Band 1
Band 2
Band 3
Band 4
Band 5
Band 6

Content Standards

Content Standards

Content Standards

Content Standards
## Performance standards for mathematics

**Example 1**

<table>
<thead>
<tr>
<th>Content Standards</th>
<th>Band 1</th>
<th>Band 2</th>
<th>Band 3</th>
<th>Band 4</th>
<th>Band 5</th>
<th>Band 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not enough information to make a judgement</td>
<td>The student has an elementary knowledge and understanding in few areas of the content and has achieved very limited competence in some of the processes and skills.</td>
<td>The student has a basic knowledge and understanding of the content and has achieved a limited level of competence in the processes and skills.</td>
<td>The student has a sound knowledge and understanding of the main areas of content and has achieved a sound level of competence in the processes and skills.</td>
<td>The student has a thorough knowledge and understanding of the content and has achieved a high level of competence in the processes and skills. In addition, the student is able to <strong>apply this knowledge and these skills to most situations.</strong></td>
<td>The student has an extensive knowledge and understanding of the content and can readily apply this knowledge. In addition, the student has achieved a very high level of competence in the processes and skills and can <strong>apply these skills to new situations to solve problems, reason and demonstrate creativity in doing so.</strong></td>
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</tbody>
</table>
Band 6 Biology Description
Example 2

The typical performance in this band:

**Band 6**
- demonstrates an extensive and detailed knowledge and superior understanding of biological concepts, including complex and abstract ideas
- demonstrates an extensive understanding of the historical development of biological concepts, their applications and implications for society and the environment, and the future directions of biological research
- communicates succinctly, logically and sequentially using a variety of scientific formats, including diagrams, graphs, tables, flow charts and equations relating to biology
- analyses and evaluates data effectively, identifying biological relationships, quantifying explanations and descriptions, synthesising information to draw conclusions
- uses precise biological terms extensively and correctly in a wide range of contexts
- designs valid experimental processes using appropriate technologies and incorporating the thorough knowledge of the use of a control, variables and repetition to solve biological problems
- applies knowledge and information to unfamiliar situations and designs an original solution to a biological problem
Band 5 and 4 Biology Description
Example 2

The typical performance in this band:

**Band 5**
- demonstrates thorough knowledge and understanding of most biological concepts
- demonstrates a thorough understanding of the historical development of biological concepts and their applications and implications for society and the environment
- communicates effectively in a variety of scientific formats including diagrams, graphs, tables, flow charts and equations relating to biology
- explains qualitative and quantitative biological relationships and ideas coherently
- identifies patterns in data to draw conclusions
- uses precise biological terms frequently and correctly in a range of contexts
- identifies the correct application of scientific experimental methodology to solve biological problems

**Band 4**
- demonstrates sound knowledge and clear understanding of some biological concepts
- demonstrates a sound understanding of the historical development of biological concepts and their applications for society and the environment
- communicates using clear written expression and incorporating diagrams of biological structures
- provides qualitative and quantitative descriptions of biological phenomena and explains straightforward biological relationships
- uses general biological terms frequently and correctly in a range of contexts
- identifies the correct components of the experimental scientific method in biology
Performance standards for PISA
Mathematical Literacy
Performance standard descriptions for PISA Mathematical Literacy Levels 5 and 6 (2003-2009)

At **Level 6** students can conceptualise, generalise and utilise information based on their investigations and modelling of complex problem situations. They can link different information sources and representations and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply their insight and understandings along with a mastery of symbolic and formal mathematical operations and relationships to develop new approaches and strategies for attacking novel situations. Students at this level can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments and the appropriateness of these to the original situations.

At **Level 5** students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations and insight pertaining to these situations. They can reflect on their actions and formulate and communicate their interpretations and reasoning.
Performance scale descriptions for PISA Mathematical Literacy Levels 1 and 2 (2003-2009)

At **Level 2** students can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures, or conventions. They are capable of direct reasoning and making literal interpretations of the results.

At **Level 1** students can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are obvious and follow immediately from the given stimuli.
The teachers and examiners task ...

... is to locate the student on the developmental continuum by constructing items, questions and tasks that give the students the opportunity to demonstrate what it is they know and can do in relation to the indicators which emerge from the standards. The further to the right the student is on the continuum, the more deep is the knowledge that they have in the area of the curriculum.
## Assessment framework

<table>
<thead>
<tr>
<th>Definition of construct</th>
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</thead>
<tbody>
<tr>
<td>Domains/strands</td>
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## Example 1 - Mathematics

<table>
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<tr>
<th>Domains/strands</th>
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<th>Outcomes/content standards</th>
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<tbody>
<tr>
<td><strong>Number</strong></td>
<td>Addition &amp; subtraction</td>
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<td></td>
<td>Multiplication and Division</td>
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<td>Fractions and Decimals</td>
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<td><strong>Measurement</strong></td>
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<td>Early Stage 1 Combines, separates and compares collections of objects, describes using everyday language and records using informal methods</td>
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<td></td>
<td>Multiplication and Division</td>
<td><em>Multiplication and Division</em> Students develop facility with number facts and computation with larger numbers in multiplication and division and an appreciation of the relationship between those facts</td>
<td>Stage 1 Models and uses strategies for multiplication and division</td>
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- **Stage 1**
  - Early Stage 1: Combines, separates and compares collections of objects, describes using everyday language and records using informal methods.
## Example 1 - Mathematics

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|                  | Multiplication and Division | *Multiplication and Division*  
Students develop facility with number facts and computation with larger numbers in multiplication and division and an appreciation of the relationship between those facts | Stage 2 Uses mental and written strategies for multiplication and division | Stage 3 Selects and applies appropriate strategies for multiplication and division |
### Assessment framework

#### Definition of construct

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# Example 2 – Scientific literacy

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<td><strong>Interpreting</strong></td>
<td>Interpreting evidence and drawing conclusions, critiquing the trustworthiness of evidence and claims made by others, and communicating findings</td>
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<td>Using understandings for describing and explaining natural phenomena, making sense of reports, and for decision-making</td>
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The teachers task ...

... is to locate the student on the developmental continuum by constructing items, questions and tasks that give the students the opportunity to demonstrate what it is they know and can do in relation to the content standards. The further to the right the student is on the continuum, the more deep is the knowledge that they have in the area of the curriculum. Once located, teachers and students can provide learning opportunities that enable the student to move to the right on the continuum.
Example developmental continuum for scientific literacy
Starting with standards, then indicators and items.

Band 6 performance standard for Year 12 Biology

Knowledge and lower levels of cognition

Performance standards comprising content standards and general objectives

Band 1  Band 2  Band 3  Band 4  Band 5  Band 5

Content Standards

1  2  3  4  5  6  7  8  9
Content standards, performance standards, general objectives and questions.
Example developmental continuum for scientific literacy

Level 1 - Year 2
Formulating - Domain A

Level 2 - Year 4
Interpreting - Domain B

Level 3 - Year 6
Using - Domain C

Domain A

Domain B

Domain C

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12
Quick quiz (True or False or Don’t Know [Need More Information])

1. Identify corresponding angles, alternate angles and interior angles on the same side is a **Content Standard**.

2. To learn how to think independently, and to understand basic thoughts and ways of thinking in mathematics is a **Performance Standard**.

3. Has extensive knowledge of the English alphabet is a **Performance Standard**.

4. Combines, separates and compares collections of objects, describes using everyday language and records using informal methods is a **Content Standard**.

5. To understand features of mathematics, and to comprehend its values is a **General Objective**.
Quick quiz (True or False or Don’t Know [Need More Information])

6. To build up such scientific attitudes as adhering to the truth, repairing the errors, be precise and realistic is a **Performance Standard**.

7. Counts to 10 without any errors is a **Performance Standard**.

8. Selects and applies appropriate strategies for addition and subtraction with numbers of any size is a **Content Standard**.

9. Actively participates in various teaching activities, and to keep curiosity on and thirst for knowledge of mathematics is a **General Objective**.