



# Using criterion-referenced assessment to illuminate the digital literacy capability of students with disabilities: A PhD study

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#### Overview

- Background
- Literature review
- Aim of study
  - Research questions
  - Methodology
- Research design
  - Steps in designing the assessment
  - Example of assessment items and sample reports
- Data analysis
- Questions



# Background

- Students with disabilities experience challenges to accessing social, informational, and physical opportunities for learning due to the impact of their impairment/s meeting barriers (Slee, 2014)
- Digital technology use: a compensatory process for students with disabilities to access opportunities for learning (Vygotsky, 1993)
- Digital literacy: a 21<sup>st</sup> century skill for all (Griffin & Care, 2014) but what is it?
- **Teachers** have difficulty teaching students with disabilities (VEOHRC, 2012), and teaching digital literacy (Phillips, 2015)
- Currently, no assessment or learning progression for digital literacy capability exists for students with disabilities



#### Literature review

#### Conceptualising digital literacy

- Multiple constructs, capabilities, terms and little agreement
- Learning to use digital technology and using it to learn can be understood as a literacy
- Sociocultural constructivist framing of digital literacy –
   a human right



# Digital literacy

Interpret and use symbols, text/graphics and digital technology tools & networks

Use digital technology tools and networks in a culturally appropriate manner

Participate in the digital, networked sociocultural environment

Offers ability to access, create, share, and organise social, informational, and communication opportunities

Digital
Literacy for
Students
with
Disabilities

An interactive process of communication and collaboration with others to define and negotiate meaning

Allows for the creation and dissemination of new knowledge and solutions from the interface of networked human beings with digital technology tools



## Literature review cont'd

- Who are students with disabilities?
- How does disability restrict access to opportunities for learning?
- How can digital literacy provide access?
- What are the impacts of **student characteristics** on digital literacy learning?
- What are the impacts of **teacher characteristics** on assessing digital literacy in students with disabilities?
- What challenges does teaching digital literacy present for teachers of students with disabilities?
- How can teachers support digital literacy learning for students?



## Aim of study

 Develop and validate measures to support the teaching and learning of digital literacy capability for students with disabilities

- Investigate constraints on:
  - Digital literacy learning of students with disabilities due to student background characteristics, and
  - Use of the measure by teachers due to teacher background characteristics



## Research questions

- What is digital literacy, and why is it important for students with disabilities?
- To what extent can a measure of digital literacy be developed to describe a **learning progression** of digital literacy for students with disabilities?
- To what extent do teacher characteristics, i.e.,
  - experience in teaching students with disabilities,
  - experience in teaching digital literacy,
  - self-reported digital literacy, and
  - attitudes to digital technology

impact their capacity to **observe, monitor, and report** on student digital literacy learning?

- To what extent do student characteristics, i.e.,
  - type and severity of disability, and
  - access to assistive technologies

impact their digital literacy learning?



## Methodology: Six phases

#### 1. Construct definition - completed

- a. Literature review
- b. Taxonomy identification

#### 2. Draft framework - completed

- a. Workshops with subject matter experts
  - a. Examine Phase I materials
  - b. Draft statements of competencies

#### 3. Judgement of relative difficulty - completed

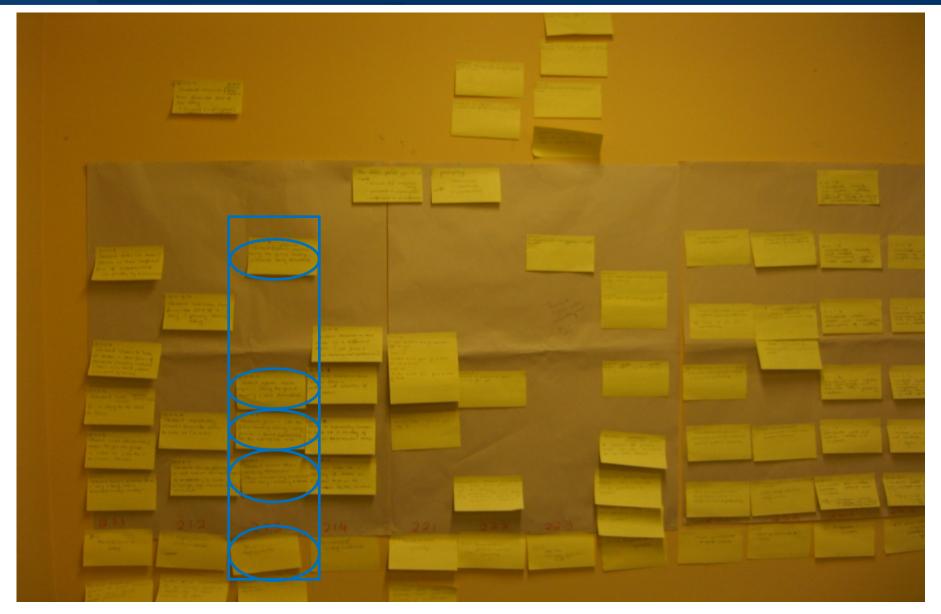
- a. Workshops:
  - a. Pairwise comparisons
  - b. Hypothesised learning progression
  - c. Panelling and piloting



Working together to develop the observation statements and build the hypothesised framework



#### First draft of items





#### **Building a criterion-referenced framework**

Digital literacy: being able to interpret and use CONSTRUCT: The area of inquiry the symbols, text/graphics and tools of digital technologies and networks, and also the ability to do so in a culturally appropriate manner CAPABILITIES: A set of representative abstract skill **Explore** Care for Request Show areas that combine to describe the construct. dig. tech dig. tech to use interest dia. tech in dig tech INDICATORS: Behavioural indicators for each capability. These are observable behaviours that can be used as evidence of a student's capability in terms of the things the student can do, say, make, or write. QUALITY CRITERIA: Observational statements that describe 'how well' each of the behavioural indicators could be demonstrated by the student. These were used to create the observation statements for the assessment materials.



#### Using a matrix format for panelling

| More proficiency |               | Criterion 2,4 | Criterion 3.3 |               | More difficult |
|------------------|---------------|---------------|---------------|---------------|----------------|
| <b></b>          | Criterion 1.3 |               |               | Criterion 4.4 | <b>↑</b>       |
|                  |               | Criterion 2,3 |               | Criterion 4.3 | 1              |
|                  | Criterion 1.2 |               | Criterion 3.2 | Criterion 4.2 | 1 <b>1</b>     |
|                  |               | Criterion 2,2 |               |               | 1 1            |
|                  | Criterion 1.1 |               |               | Criterion 4.1 |                |
| <b>+</b>         |               | Criterion 2,1 | Criterion 3.1 |               | ↓              |
| Less proficiency | Item 1        | Item 2        | Item 3        | Item 4        | Less difficult |



| THE UNIVERSITY OF | Evidence | IIai | Hewo | ΙK |
|-------------------|----------|------|------|----|
| MELBOURNE         |          |      |      |    |
|                   | Taxonomy |      |      |    |

(adapted from Dreyfus & Dreyfus, 1980)

Item 6:

**Exploring digital technology** 

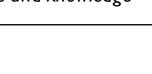
Acting without conscious review of steps/

internalised experience used to guide decisions

prior experience and knowledge

6.4 Examines functions of digital technology by drawing on

Acting on prior experience of success or failure to achieve personally relevant outcomes Following rules to achieve personally relevant



inserting earphone jack into port, pressing buttons)

6.1 Responds to stimuli in the environment (e.g., by

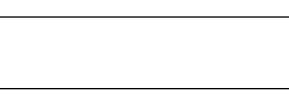
(e.g., by looking at, feeling or listening)

6.2 Interacts with <u>physical features</u> of digital technology

startling, turning head, smiling, becoming still, pausing other



activity)



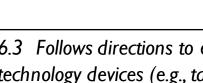
Following rules and taking situational cues into account (contextualised) Following rules and steps (decontextualised,

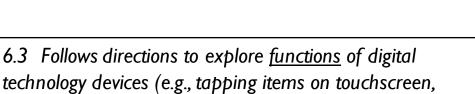
outcomes (registering success or failure)

simple or single step)

Engage with the phenomena

Attend to the phenomena







## Methodology: Six phases cont'd

#### 4. Trial - completed

- a. Data collection from online assessment
- b. Approx. 60 schools, mostly specialist (approx. 900 students)

#### 5. Data analysis - completion in Feb 2017

- a. Coded and calibrated using Rasch item response partial credit modelling
- b. Plotted according to cognitive demand
- c. Item and person fit, reliability and DIF

#### 6. Validation - completion in May 2017

- a. Identification of levels of progressive development
- b. Interpretation by subject matter experts
- c. Comparison of defined levels against hypothesised framework



## ABLES assessments







Select from any of the following assessments

**English, Speaking and Listening** 

**English, Reading and Writing** 

**Personal and Social Capability** 

**Mathematics** 

Movement

**Digital Literacy** 

**Critical and Creative Thinking** 

Main Menu



## Sample question

INSTRUCTIONS: Choose the closest match to this student's typical performance. If the student's performance falls between two levels, select the lower one. Students may demonstrate their skills/understanding with or without the use of assistive technology (e.g., switch, closed captioning) and by using their typical communication mode (e.g., speech, signing, picture exchange, AAC device, etc.)

#### Learning to use digital technology

- Q2. Paying attention to new or unfamiliar digital technology (e.g., computers, tablets, smartphones, program/apps)
- Attends to the use of a new or unfamiliar device or program/app by another (e.g., by watching, reaching towards, becoming still, smiling, pausing other activity, moving into position, or turning towards, etc.)
- Uses a new or unfamiliar device or program/app with direct support or guidance (e.g., following <u>single</u> <u>step instructions</u> to activate unfamiliar icons, or to touch a new device, or to listen to audio instructions from a new app, etc.)
- Maintains attention on a new or unfamiliar device or program/app (e.g., continuing to focus on using new device or program/app when other activities in class could be distracting)
- Is moving towards but has not yet achieved these skills/behaviours



|                         |             | LITERACY   | s written text.   |                             |  |
|-------------------------|-------------|--|---|-----------------------------|--|
|                         |             | contrategies to confirm or modify und  | erstanding of written<br>spelling patterns and other  |                             |  |
|                         | The studer  | nt is learning to use strategies to confirm or modify of decode or predict unfamiliar words using knowledge of sa sentence), or use partial reading and knowledge of sension. S/he may seek out the meaning of unfamiliar version. S/he may seek out the meaning of unfamiliar version. S/he may seek out the meaning of unfamiliar version.   | imilar materials to support   |                             |  |
| evel Seven              |             |  |   |                             |  |
| earning to apply and    |             |  |   |                             |  |
| earning to appro        | comprehe    | ension. S/he may seek out the student may adapt different material or dictionary). The student may be supported to the student material or dictionary or distinct material or dictionary. The student material or dictionary or distinct material or dictionary or distinct material material or distinct material or distinct material or distinct ma | or writing, dideas. S/he may  |                             |  |
| extend understanding of | WOLLD HISE  | to contain   | -   |                             |  |
| written material        | CHIEF CHIEF | in written work to and relie   | Pathway   | Level                       | Pathway  |
| written material        | combine     | rent tasks, seek ways to make to express and explain order ideas in written work to express and explain order ideas in written work to express and explain information from reading with own ideas and reflection with plot or characteristics and identification with plot or characteristics.  | · aamay   | 20701                       | r dannay   |
|                         | thus sho    | wing understanding and identification that will be wing understanding and identification to break words into components (ble dent is learning to break words into components (ble dent is learning patterns that are common in English. S/he concludes the patterns that are common in the words are common in the words.)   |   |                             |  |
|                         | The stu     | dent is learning to break words into components of the see spelling patterns that are common in English. S/he see spelling patterns that are common in the words all or most of the letter information in the words all or most of the letter information. The studies are seen as the second treatment of the second treatmen |   | $\wedge$                    |  |
| Level Six               | recogni     | se spelling patterns that are information in the wor   |   |                             |  |
|                         | word u      | se spelling patterns that are common in English. Symbols se spelling patterns that are common in English. Symbols se spelling patterns that are common in English. Symbols se spelling patterns that are common in English. Symbols se spelling patterns are spelling to the state of the second  | 7. The student uses a range of strate   | - 1 1                       |  |
| Learning to use         | respon      | ising all or most of the control of  | confirm or modify understanding of te<br>interprets the main ideas and purpose  |                             |  |
| conventions of print    | confid      | ence and control,<br>is in written work.   | and is working towards ordering ideas   |                             |  |
| Contract                | letters     | in writter to use letter-sound relationships   | work.   |                             |  |
|                         | The st      | tudent is learning to use letter-sound relationships, basic rules of grammar, punctuation and spelling orted by pictures to predict the meaning of a senter orted by pictures to predict the meaning of a senter orted by pictures to predict the meaning of a senter or learning words into sounds, identify words that rhy is a senter or letters and symbols.   |   |                             | 6. The student reads and responds to short   |
| Level Five              | some        | basic rules are nredict the meaning to that rhy  |   |                             | texts with familiar ideas and a small amount of  |
| Learning to use         | supp        | basic rules of granting of a school orted by pictures to predict the meaning of a school orted by pictures to predict the meaning of a school orted by pictures to predict the meaning of a school or school o |   |                             | unfamiliar vocabulary. The student makes use<br>of known spelling patterns to attempt the                  |
| Leaning                 | brea        | k simple words into the sounds of letters and symbol e first sound, or use the sounds of letters and symbol e first sound, or use the sounds of letters and symbol e first sound sound symbol e first sound  |   |                             | spelling of unfamiliar words.  |
| relationships between   |             |  | 5. The student matches print and spo  | oken text in                |  |
| letters and sounds      |             |  | the environment, and recognises how   | v sounds                    |  |
| letter.                 |             |  | are represented alphabetically. In wr<br>student uses conventional letters, gro   |                             |  |
| Level Four              | lett        | ters and identify their most seek clarification of work  | letters, and simple punctuation such  |                             |  |
| Level 1 and lette       | rs, on      | e student is learning to the student is learning to the student is beginning to understand how with the student is beginning to understand how with the student is beginning to identify spa   | stops and capital letters.  |                             | A The student course letters of the  |
| Learning to use lette   | w           | ords. The student s/he may be able to lead forms.  |   |                             | <ol> <li>The student names some letters of the<br/>alphabet and identifies their common sounds.</li> </ol> |
| numbers, and pictur     | res to      | insistent meaning their upper and lower couch as t   |   |                             | S/he recognises the connection between print   |
| communicate with        | others re   | ecognise letters in their expension partial cues (such de-<br>neaning of familiar words using partial cues (such de-<br>neaning of familiar words as a familiar or favourite sto<br>word). The student may re-tell a familiar or favourite sto   |   |                             | and the spoken word, and reads some familiar   |
| communicate with        | m           | and) The Students  |   |                             | words and signage using partial cues and<br>illustrations.   |
|                         | v           | to the becoming and the same very  | The student recognises the different control of the student recognises the student reco |                             |  |
| 1.Throp                 |             | The student is becoming aware of print in the transfer of letters and numbers. S/he may recognise some very f to basic needs or familiar people and activities. S/he to basic needs or familiar people and activities. The making choices about materials. The   | between text and pictures, and may s<br>or identify letters and numbers. The s  |                             |  |
| Level Three             | ina         | to basic needs or familiar people and materials. The   | may recognise very familiar words by  |                             |  |
| Learning to recogn      | lise        | to basic needs or familiar people and activities of<br>to basic needs or familiar people and activities. The<br>writing, and be making choices about materials. The<br>writing, and be making choices about materials. The   | link these to basic needs and wants.  |                             |  |
| letters and number      | ers         | writing, and be making choices about materials writing, and be making choices about materials writing, and be making choices about materials text as it is being read. S/he is learning to recognise t text as it is being read. S/he is learning to recognise t may make linear scribbles that include repeated form may make may copy letters or simple words from n   |   |                             | 2. The student is learning to identify objects,  |
| letters are             |             | may make linear sopy letters or simple words it  |   |                             | pictures, shapes and sounds, and may role-play<br>reading, scribble freely, or recognise own name          |
|                         |             | may make linear sopy letters or simple words<br>page. S/he may copy letters or simple words<br>re-tell a familiar story or message. The student may<br>re-tell a familiar story or use these to predict the top  |   |                             | in print.  |
|                         |             | re-tell a familiar story or message. The studenthe top in reading materials, or use these to predict the top in reading materials, as to identify pictures, shapes   |   |                             | -  |
|                         |             | deat is learning to identify the par forms, of   | 1. The student is exploring objects wi  | ithin a                     |  |
| 15.00                   |             | The student is learning to identify pictures, or and writing, label images, draw non linear forms, or and writing, label images, draw non linear forms, or and writing student may recognise his or her own to be student may recognise his order his own to be student may recognise his own to  | familiar environment, and may show i  | interest in                 |  |
| Level Two               | -k-nee      |  | photographs of familiar objects/people  | le.                         |  |
| Exploring pictur        | res, snapes | such as Degitting .  |   |                             |  |
|                         |             | computer keyboo  |   |                             |  |
| and sounds              |             | tent is exploring objects and s/he r   |   |                             |  |
| Level One               |             | The student is exploring objects within a large photographs of familiar objects or people. S/he rephotographs of familiar objects or people. The student books and stories. The student because of objects), or hold and use large   | The student is estima   | ated to be at this location |  |
|                         | the         | and be learning about books and stories. The sur<br>and be learning about books and stories. The sur   | o drawing) perhaps by looking, similar  |                             |  |
|                         |             |  |   |                             |  |



## Assessment items: Learning to use

- 1. Paying attention to familiar digital technology
- 2. Paying attention to new or unfamiliar digital technology
- 3. Showing interest in digital technology
- 4. Requesting to use digital technology
- 5. Making choices about the use of digital technology
- 6. Controlling own use of digital technology
- 7. Exploring digital technology
- 8. Managing problems with digital technology
- 9. Caring for digital technology devices and peripherals
- 10. Using digital technology symbols
- 11. Applying digital technology terms
- 12. Using digital technology safely

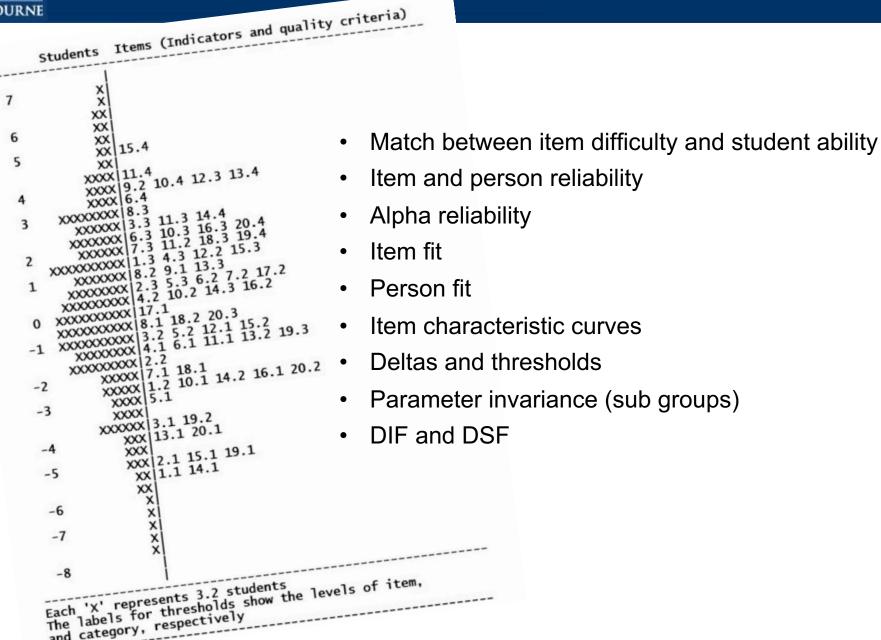


### Assessment items: Using tech to learn

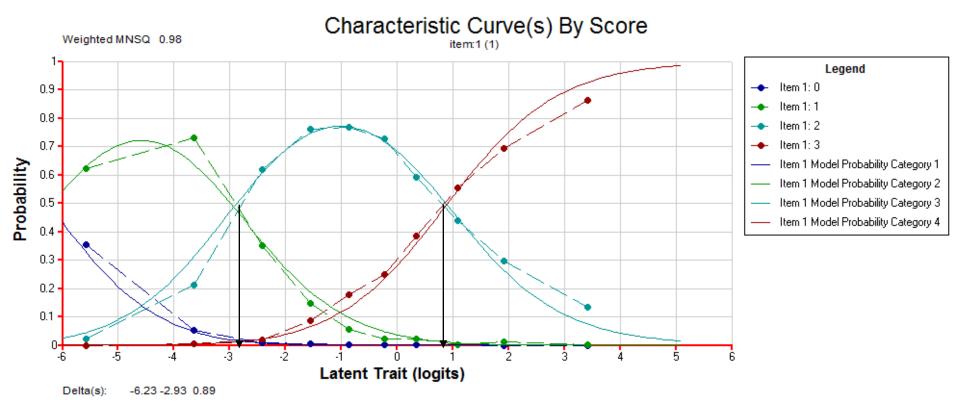
- Responding to information/content presented via digital technology
- 2. Creating content using digital technology
- 3. Finding information/content using digital technology
- 4. Storing content using digital technology
- 5. Sharing content using digital technology



## Progressions based on theory, practice and data

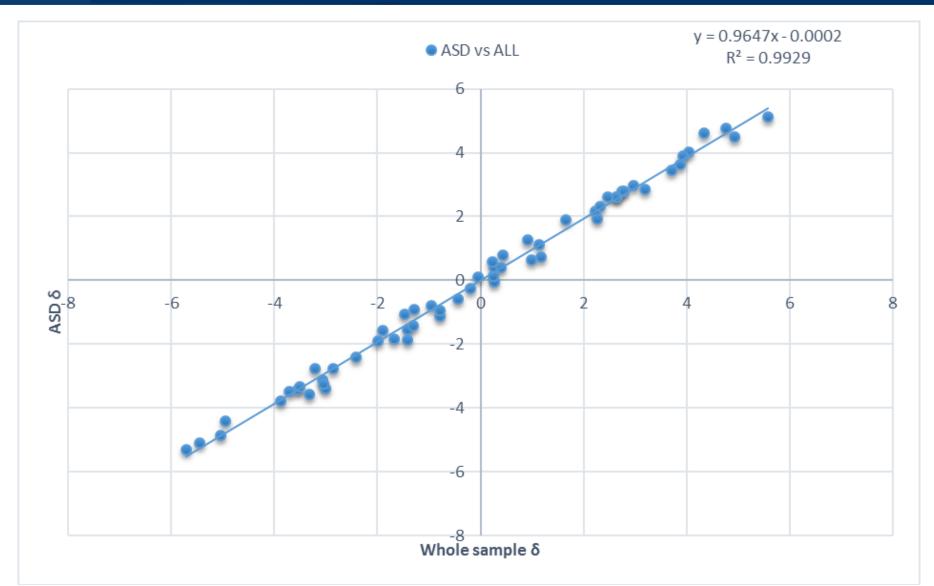








#### Parameter invariance (Numeracy)

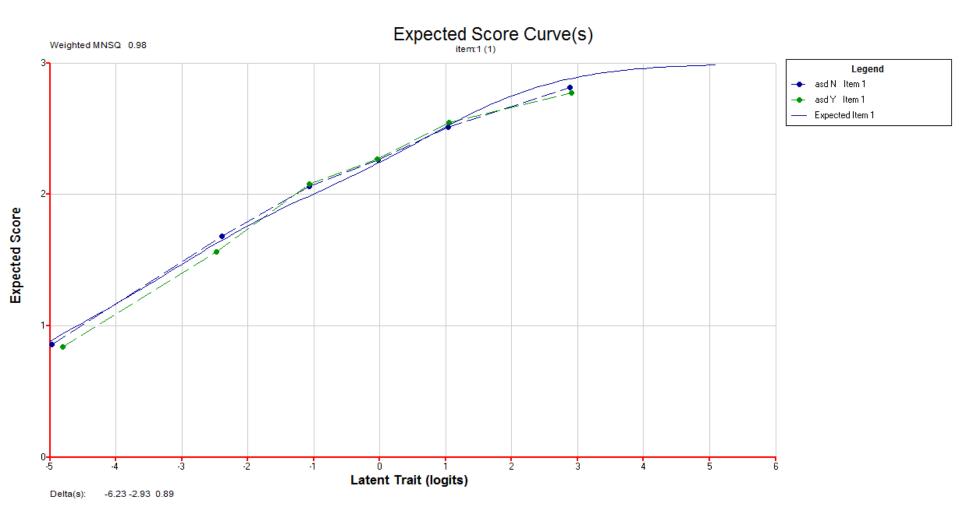




#### **Example summary of DIF analysis (Numeracy)**

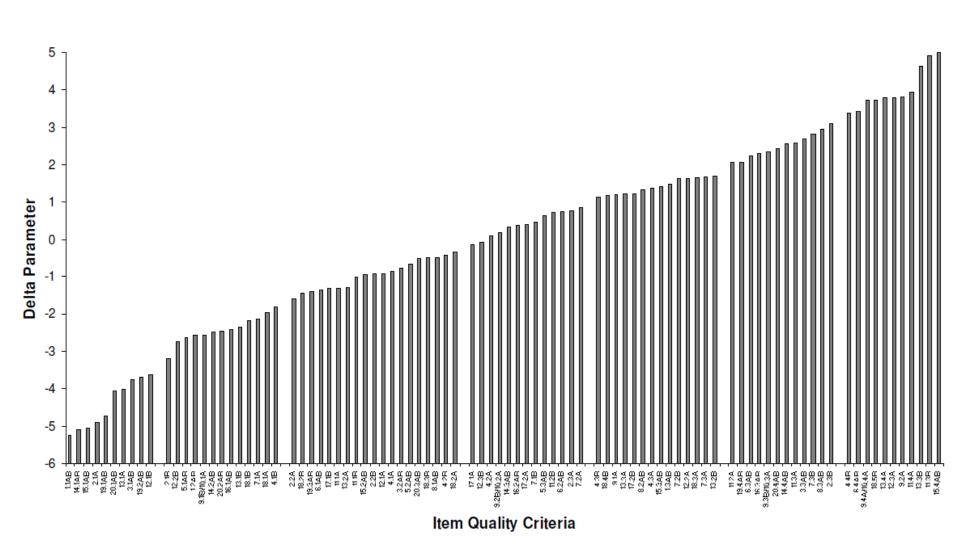
| Item   | Grouping<br>variable | DIF<br>description   | Skill assessed   | Criterion  | DIF explanation  |
|--------|----------------------|--|--|--|--|
| Item 3 | Vision<br>impairment | Small, uniform - item more difficult for students with vision impairment | Recognising<br>quantities of<br>1-3 without<br>counting<br>(e.g., using<br>words, signs<br>or symbols) | Reacts to (e.g., looks, listens, turns towards) a representation of 1-3 objects                      | Vision is largely relied<br>upon to subitise.<br>Although haptic (tactile)<br>subitising exists (Plaisier,<br>Bergmann & Kappers,<br>2009) it is not well<br>described in the criterion. |
| Item 5 | ASD                  | Small, uniform<br>-item easier for<br>students with<br>ASD               |  | ALL  | Ability to work with<br>number symbols is<br>commonly a preserved<br>strength in students with<br>ASD (Hiniker,<br>Rosenberg-Lee &<br>Menon, 2015).                                      |
| Item 8 | ASD                  | Small, uniform - item more difficult for students with ASD               | Describing changes in quantity   | Responds (e.g., looks, gestures, smiles, protests) when an object is added or removed from the group | Impaired verbal<br>communication is<br>commonly identified in<br>lower functioning<br>students with ASD<br>(Baron-Cohen, Leslie &<br>Frith, 1985).                                       |

Strickland, Woods & Pavlovic, in press





#### Setting cut scores and defining levels





#### **Setting cut scores and defining levels**

| Criterion | δ     | Description   | Derived Standard  |  |  |
|-----------|-------|---|---|--|--|
| 1.1AB     | -5.24 | Looks at, touches or pats photographs of familiar objects.                          |   |  |  |
| 14.1AB    | -5.09 | Responds to photographs of familiar objects/people (e.g., smiling, touching).       |   |  |  |
| 15.1AB    | -5.04 | Makes choices between objects (or photographs of objects).                          | Students are beginning to<br>explore objects within a<br>familiar environment and   |  |  |
| 2.1A      | -4.88 | Remains present while a story or other reading material is being read or shown.     | may be responsive to<br>photographs of familiar<br>objects or people. They are<br>learning about books and<br>stories, and may accept |  |  |
| 19.1AB    | -4.74 | Picks up and holds objects.   |   |  |  |
| 20.1AB    | -4.03 | Taps an object with a finger.   |   |  |  |
| 13.1A     | -4.01 | Accepts materials for drawing or writing.   | materials for drawing or  |  |  |
| 3.1AB     | -3.76 | Shows enjoyment of being read to (e.g., by smiling, looking, relaxing).             | remain present during the reading of a story.   |  |  |
| 19.2AB    | -3,68 | Holds and uses large crayons and pencils, perhaps with a fist-like or similar grip. |   |  |  |
| 12.1B     | -3.62 | Remains present during drawing or writing activities.                               |   |  |  |



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