

Systemic Assessment: Reflecting on the present – envisaging the future

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Overview

- Philosophical, educational and measurement theory debates
- A study of mathematics assessment
- An elaborated model for assessing the health of the system

Philosophical, educational and measurement theory debates

Philosophical perspectives

- What is “good education”?
 - Standardisation
 - Freedom vs regulation
- Education as a complex construct
 - Qualification
 - Socialisation
 - Individuation
- What role the teacher?

Educational perspectives

- Current scenario
 - Positioning of the teacher – quasi-professional
 - Freedom vs regulation
- Teacher agency and professionalism
 - Inherent creativity of individuals
 - Dynamic competence to address problems
 - Fulfillment
- What role assessment?

Measurement perspectives

- “Data” is always interpreted
- Measurement of what?
 - A clearly articulated construct
 - A unit of measurement
- Validity and reliability
 - Targeting of the instrument
 - Analysis of data
 - Inferences and actions

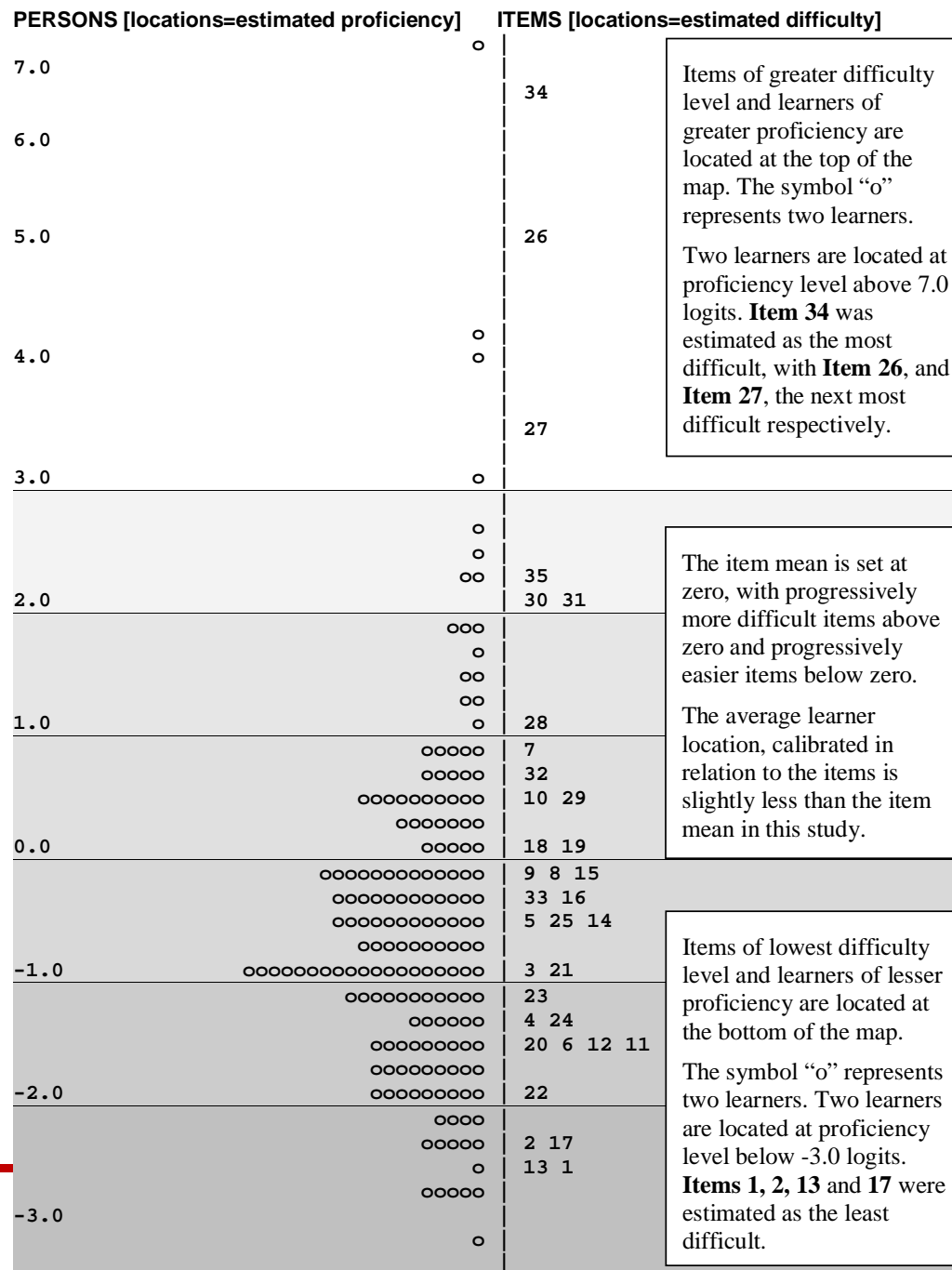
Assessment of a mathematical domain

A framework ensuring meaningful outcomes

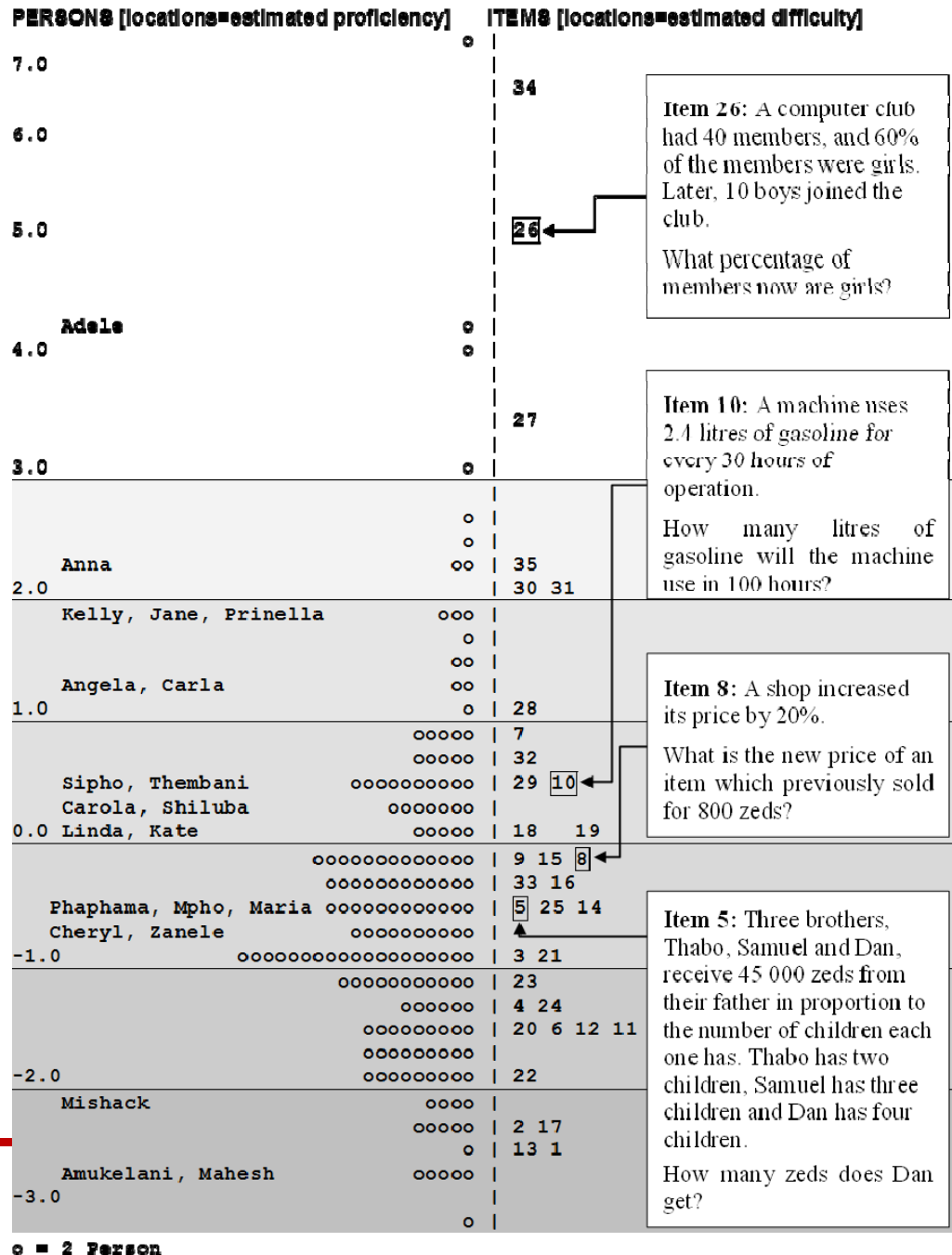
- Nature of mathematics
 - Concepts and operations - a network of related concepts
- Acquisition of mathematical concepts
 - Existing schema – the starting blocks
 - Concepts learned not isolation but in relation
- Approach to teaching and the role of language
- Type and function of assessment

(Long, 2011;2015)

Person-Item Map



Person-Item Map



	MCF concepts	Errors	LQ (-1.9)	MLQ (-1.1)	MHQ (0)	HQ (1.1)
Level 1 [-3,2]	<ul style="list-style-type: none"> Part-whole of discrete and continuous quantities Both fraction and ratio meaning of fraction notation Multiplicative relationship between sets of ratios 	<ul style="list-style-type: none"> Confusion between fraction measure and ratio meaning and with fraction notation 	53%	88%	93%	94%
Level 2 [-2,1]	<ul style="list-style-type: none"> Fraction equivalence Part-part and part-whole ratios Percent concept and notation Connect probability with fraction measure Covariant relationships Comparative relationships 	<ul style="list-style-type: none"> Natural number confusion Just add the percent sign % Language difficulty Ignoring part of the problem 	37%	61%	79%	91%
Level 3 [-1,0]	<ul style="list-style-type: none"> Rational number, operator subconstruct Identification of ratio Multiplicative comparison (operator construct) Percentage increase (operator subconstruct) Applying ratio operator construct to find the sample Multiplicative comparison 	<ul style="list-style-type: none"> Confusion with operator construct Confusion of additive and multiplicative relationship Ignoring part of the problem 	16%	35%	57%	78%
Level 4 [0, 1]	<ul style="list-style-type: none"> Fraction measures, addition (subtraction), multiplication (division) Ratio and rate concepts Multiplication (division) of decimals Probability and statistics concepts, "sample", "random" 	<ul style="list-style-type: none"> Consider only the numerator Additive reasoning Lack of fluency with multiplication and division Confusion with terminology 	14%	22%	28%	58%
Level 5 to 7 (> 1)	<ul style="list-style-type: none"> Rate and ratio Percent, identifying referents Covariant relationships Reasoning with unknowns 2 step problems 	<ul style="list-style-type: none"> Confusion with percent language and referents 	0%	3%	9%	29%

Levels	High (L 5,6,7)	Middle high (L4)	Middle low (L3)	Low (L1, 2)
Add and subtract	Fluency with addition and subtraction	Fluency with addition and subtraction	(Mistakes, use of addition where multiplication more efficient)	(Use of addition where multiplication more efficient)
Multiply and divide	Fluency with multiplication and division, proportional sharing (Confusing multiplication and division in proportional shares)	Some fluency with multiplication and division, sharing (Lack of fluency with multiplication and division; Abandon sense making Applying incorrect algorithm)	Some fluency with multiplication and division, sharing (Confusing multiplication and division; Incorrect conception of proportional sharing)	Some fluency with multiplication and division (Misreading of the problem)
Fractions, decimals, operation	Conversions, operations with decimal fractions Conversions of measurement units	Conversions from fraction to percent Multiplying decimal fractions	Fluency of operations with decimal fractions	Conversions from percent to decimals
Percent, concept, operations	Percent change - percent increase Percent - fraction type Converting ratio relationship to a percentage	Finding percent increase (finding percent decrease) Percent, fraction type (Mixing objects, adding percents and quantities)	(Confusing percent with amount, rather than ratio. Difficulty changing referent when converting ratio to percent)	
Using ratio and rate concepts	Using ratio understanding to find proportions, finding unit rate	Reasoning with ratio and rates (Lack of fluency, multiplication and division)		
Identify variables and relationships	Identifying variables and relationships Identifying scalar and function operators	Identifying variables and relationships (Confuses relationships incorrect use of algorithms)	(Incorrect identification of relationships, working back from the answer)	(Incorrect identification of relationships; working backwards from the answer)
Algorithms, symbolic notation	Fluency with algorithms (Applying algorithms in conceptually clumsy ways, using inappropriate algorithms Misuse of equals sign)	(Incorrect use of algorithms, Mistakes with cancelling, when applying algorithms)	(Rote use of algorithm, sometimes correct)	(Rote use of algorithms)

Description of concepts and skills in bold, (errors enclosed in brackets)

A MODEL FOR SYSTEMIC ASSESSMENT

Rationale for the model

- Problem
 - Lack of expected progress despite the high goals of the No Child Left Behind project
 - No direct relevance to teaching and learning
 - Assessment of, for and as learning
 - Monitoring
 - Classroom-based formative assessment
 - Professional development
 - Cognitive developmental model underlying all three components
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Monitoring component

- Theoretical development of the construct
 - Example multiplicative conceptual field
- Balanced multiple level competence
 - To include complex reasoning
- Broad range of curriculum elements
 - Little predictability between cycles
- Broad-based construction and review of items
 - Relevant to classroom teaching and learning

Classroom-based assessment

- Intermittent markers of progress
 - Insight into difficulty levels required
 - Critique expected
 - Professional development – item construction
- Formative assessment design
 - Results feed into teaching and learning
 - Learner autonomy - detailed memoranda
- Links to Olympiad style questions

Professional development

- **Autonomy**
 - Voluntary engagement
- **Authority**
 - Teacher's authority in the classroom
 - Needs of the teacher and learner cohort
- **Professional learning community**
- **Aligned with a career trajectory**

Conclusion

- Good education
 - Qualification, socialisation and individuation
- Professionalism and agency of the teacher
- Assessment reflecting quality education goals
- Integrated and balanced system
 - No need to over test
 - Teaching to the test?
 - Assessing what is worth teaching!

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Thank you for your attention

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