

ANALYSIS ON MATHEMATICS READING ASSESSMENT CALIBRATION AND STUDNETS' PERFORMANCE BASED ON MULTIDIMENSIONAL IRT

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The purpose of this study aims to calibrate mathematics reading assessment based on multidimensional item response theory (IRT) and analyze students' performance. The mathematics reading assessment is statistics texts and the sample is 789 sixth graders. Mathematics reading includes three dimensions which are based on the content area reading components provided by M. C. McKenna and R. D. Robinson. This study calibrates the assessment by multidimensional item response theory (IRT). Item fit indicators show this assessment conforms to the assumption of three dimensions on mathematics reading. Cluster analysis of k-means shows that are five clusters based on the three latent traits of mathematics reading. Each cluster shows its cognitive characteristics on mathematics reading. This study could also provide references for the issue of mathematics reading.

MAIN SECTION (USING CAPITALIZED 11 POINT TIMES NEW ROMAN BOLDFACE FONT)

This researcher develops mathematics reading assessment and validates its dimension with multidimensional item response theory (IRT). All students are classified into proper clusters so as to reveal cognitive characteristics of mathematics reading. This study constructs mathematics reading in terms of three dimensions, which are general reading comprehension, prior knowledge of mathematics, and specific skills of mathematics (Mckenna & Robinson, 2002). The multidimensional item response theory (IRT), which is proposed by Reckase (2009), is presented as $p_{ji} = \frac{1}{1+\exp[-(\theta_1+\theta_2\dots+\theta_k-b_i)]}$, where p_{ji} is the probability of person j responding on item i correctly, $\theta_1, \theta_2 \dots, \theta_k$ represent k latent traits, b_i is the overall difficulty parameter of item i .

For each dimension, there is one short article and 5 items. The sample is 789 sixth graders from 13 elementary schools in Taiwan. The EAP reliability of the three dimensions are 0.707 0.798 0.737 and they are acceptable. Item parameters and item difficulties are also reasonable. The correlation coefficients among three dimensions are significantly correlated. Results of k-means based on the three latent traits show that the proper number of cluster is 5. Table 1 displays the cluster center and number of students in each cluster. Cluster analysis indicates there exists features of latent traits with respect to each cluster.

Table 1: Cluster center and number of students for each cluster

Dimensions(latent traits)	Cluster center				
	I	II	III	IV	V
General reading comprehension	.202	-.112	1.068	1.731	-3.278
Prior knowledge of mathematics	-3.078	.528	1.974	4.348	-3.333
Mathematics-specific literacy skills	-2.365	1.749	-.545	3.445	-2.054
Number (%)	183 (23%)	191(24%)	161(20%)	128(17%)	126(16%)

References

- Mckenna, M. C., & Robinson, R. D. (2002). Teaching through text-reading and writing in the content area. Boston: Allyn & Bacon.
- Reckase, M. D. (2009). Multidimensional item response theory. New York, NY: Springer.