Dana Farina WEIHER, Lüneburg

Measurement Estimation Accuracy: A Comparison of Different Approaches

To determine the accuracy of an estimate, it is common to calculate the *percentage deviation* (D_{perc}) from the real value (Joram et al., 2005). Using data from 615 students (5th and 6th grade) from a written estimation test for length, area, capacity and volume, disadvantages of D_{perc} were observed: The scale is closed to underestimations, which causes high skewness and high number of outliers (for overestimations). Internal consistency and discrimination power is rather low. Therefore, two alternatives were investigated: *Dividing by the smaller* value (estimated or real value, D_{min}) proposed by Lörcher (2000), and *logarithmic error score* (D_{log}), adapted from Clayton (1996).

Approach	Formula	Interpretation
D_{perc}	$\mathrm{D}_{perc} = \frac{e-r}{r}$	$-1 < D_{\mathrm{perc}} < \infty$ 0 = exact estimation
D_{log}	$D_{\log} = log_{10}\frac{e}{r}$	$-\infty < D_{\log} < \infty$ -1 or 1: deviation of one order of magnitude (factor 10 of r)
D_{min}	$D_{\min} = \frac{e-r}{\min(e,\ r)}$	$-\infty < D_{\min} < \infty$ equally good: e half of r, e twice of r

Tab. 1: Different Approaches for calculating the estimation accuracy (e = estimated value, r = real value).

Results from testbook A (310 students) shows highest internal consistency for D_{log} (r = .541), followed by D_{min} (r = .611) and D_{perc} (r = .541). The same order was observed for discrimination power. The advantage of D_{log} is the open scale for over- and underestimation, which prevents incorrect accuracy when underestimating and reduce outliers without glossing over them. Test quality (internal consistency and discrimination power) seems to be higher.

Literatur

Clayton, J. (1996): A Criterion for Estimation Tasks. *International Journal of Mathematical Educationin Science and Technology*, *27*(1), 87–102. https://doi.org/10.1080/0020739960270111

Joram, E., Gabriele, A. J., Bertheau, M., Gelman, R. & Subrahmanyam, K. (2005). Children's use of the reference point strategy for measurement estimation. *Journal for Research in Mathematics Education, 36*(1), 4–23. https://doi.org/10.2307/30034918.

Lörcher, G. A. (2000). Zur Entwicklung der Zahlvorstellung. In M. Neubrand (Ed.), Beiträge zum Mathematikunterricht 2000 (pp. 402–404). Franzbecker (in German).

In: IDMI-Primar Goethe-Universität Frankfurt (Hrsg.),
Beiträge zum Mathematikunterricht 2022.
*56. Jahrestagung der Gesellschaft für Didaktik der Mathematik.*WTM.
https://doi.org/10.37626/GA9783959872089.0