Indonesian Year 9 and Year 12 Students' Statistical Literacy: Levels, Challenges and Understandings

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Abstract

In the information age, heightened during the COVID-19 pandemic, the capability to interpret and critically engage with data-driven information become an essential skill. This study aimed to address this crucial issue by focusing on the statistical literacy (SL) of Indonesian students, a population often underrepresented in research. Notably, the Programme for International Student Assessment (PISA) 2003 and 2012 tests have shown that Indonesia was among the underperforming developing countries in the uncertainty and data subscale. This study is timely given that there was no recent PISA data available when this study began, and the most recent PISA data—which similarly showed Indonesian students' underperformance—was only recently released in 2023. In addition, there is a concern that Indonesian students' underachievement in SL has not improved substantially in their final years of formal education.

The study introduced a novel framework for SL assessment that is innovative in its comprehensive approach. This framework aimed to gauge not only the SL levels of Indonesian Year 9 and Year 12 students, but also to identify the specific challenges they faced and understandings they demonstrated. SL was determined through four complex response skills—interpreting, communicating, evaluating and decision-making—all of which were founded on three interrelated knowledge components: text and context, representation and statistical-mathematical knowledge. The framework incorporated a six-level hierarchy for each component. The lower three levels—idiosyncratic, informal and inconsistent—served to highlight the challenges students encountered, while the upper three levels—consistent non-critical, critical and critical mathematical—shed light on students' understandings.

To ensure a robust and diversified sample, the study adopted a stratified purposive and convenience sampling strategy, 96 students were drawn from 16 schools. The stratification included the students' grade levels, gender, school type, school status and city of origin. The study was a cross-sectional study and employed an explanatory sequential design, starting with a quantitative component and subsequently delving into qualitative component. A test was administered, and a follow-up interview was undertaken to clarify students' thought processes during the test. In the quantitative component, analyses included double coding of students' written responses, descriptive statistics and the application of the Mann-Whitney U test for non-parametric data. For the qualitative component, the study employed the four stages of the Constant Comparison Method (CCM) to gain nuanced insights into the students' written responses and subsequent interviews.

The results revealed that Year 12 students displayed statistically significant higher levels of SL and skills, except in interpreting. Furthermore, the study found no significant gender-based or other demographic-based differences in SL and skill levels. Qualitatively, the challenges and understandings in the four skill areas were closely linked to the students' appreciation of the three foundational knowledge components. The level of sophistication in one component appeared to influence the level of sophistication in the others. Most students in the lower group encountered challenges with contextual-graphical interrelationships, while students' critical understandings of the context improved their ability to comprehend data presented in graphs and tables, and vice versa.

In summary, this study contributed a groundbreaking framework for the assessment of SL, one that has the potential to be broadly applied by educators for both evaluative and pedagogical purposes. The framework filled a significant research gap and had far-reaching implications for educational strategies and curriculum development aimed at promoting SL.