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Precision or illusion? navigating the algorithmic mirage of confidently inconsistent ai in the validation of a data collection instrument

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Abstract. The development and validation of instruments for the collection of educational data, including psychometric assessments, require a high degree of methodological precision and replicable findings. Given the increasing prevalence of artificial intelligence-based tools, researchers have examined their applicability in various analytical methodologies, such as factor analysis, reliability evaluation, and construct validation. This work critically reflects on the integration of generative AI into the validation process of the GreenComp-Based Questionnaire (GCQuest), which is an instrument designed to assess sustainability competences. It focuses on the inconsistencies that were identified when using tools such as Julius and PowerDrill.ai for statistical validation. Despite working with an identical dataset, results varied across sessions due to subtle changes in prompt phrasing and model interpretation. These inconsistencies highlight the stochastic and opaque nature of large language models, which poses risks to reproducibility and research integrity (Megahed et al., 2023). Systematic logging of multiple interactions revealed that, although the outputs appeared robust, they diverged unpredictably. This raises concerns about the reliability of AI-generated results in high-stakes educational research. According to the literature, these findings emphasize the importance of human oversight, ethical safeguards, and robust methodological controls when incorporating AI into research workflows (Bulut et al., 2024; Riordan et al., 2024). As Burleigh and Wilson (2024) argue, replacing human reasoning with unverified AI outputs can undermine both the epistemic and ethical foundations of research. This paper therefore advocates for a human-centred and cautious approach to the development of AI-supported instruments, including training in prompt engineering, triangulation with traditional methods, and the application of ethical frameworks, to ensure the trustworthy and replicable use of AI in education.

Keywords: *Artificial Intelligence, Educational Research, Instrument development, GCQuest, Psychometric validation, Prompt engineering*

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