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AI-Based Diagnostic Assessment in Secondary Discrete Mathematics Competitions: Feasibility, Validity, Reliability, and Fairness

Communication Info

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Abstract

Mathematics competitions offer authentic problem-solving situations, but assessment often remains summative (final score), limiting the identification of obstacles (comprehension, modeling, strategy) and individualized remediation. This study aims to examine the feasibility, validity, reliability, and fairness of AI-assisted diagnostic assessment focused on discrete math tasks for secondary education. With an adapted design, students take a semi-open test in interaction with a conversational agent that is supervised and pre-configured for testing mode. The AI produces a diagnosis based on problem-solving processes and strategies and provides targeted feedback. Validity is estimated by double expert annotation and AI-expert agreement; effectiveness by isomorphic pre-test/post-test; reliability by inter-form stability; fairness by comparison between subgroups. The results show significant agreement between AI and experts, measurable gains between pre- and post-testing, satisfactory stability between forms, and overall consistent performance across various grade level, supporting the feasibility of AI-assisted diagnostic assessment in a school setting

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