

## INTISARI

Kemajuan analitik pembelajaran dan penambahan data pendidikan telah mendorong pengembangan sistem pembelajaran adaptif, dengan *Cognitive Diagnostic Computerized Adaptive Testing* (CD-CAT) sebagai salah satu pendekatan utama. CD-CAT memanfaatkan *Cognitive Diagnosis Model* (CDM) untuk memberikan diagnosis mendalam terhadap kemampuan siswa. Namun, tantangan muncul dalam mengelola kompleksitas dan ketidakpastian kebijakan adaptif, terutama ketika jumlah atribut dan item meningkat. Penelitian ini membandingkan empat model diagnosis kognitif GD-DINA, MIRT, MCD, dan KaNCD dalam sistem pengujian adaptif berbasis *Partially Observable Markov Decision Process* (POMDP). Model dievaluasi menggunakan metrik Akurasi, AUC, dan *expected reward* berdasarkan dataset ASSISTments. Hasil penelitian menunjukkan bahwa KaNCD merupakan model CDM dengan kinerja terbaik secara keseluruhan, dengan akurasi tertinggi (0.7503) dan AUC (0.7410), serta performa stabil pada pengujian adaptif berbasis POMDP (*expected reward* = 0.792). GD-DINA memperoleh *reward* tertinggi (0.901) namun dengan akurasi lebih rendah, sedangkan MCD menunjukkan kinerja seimbang dengan akurasi tinggi (0.7464) dan kemampuan adaptasi kebijakan yang kuat (*reward* = 0.873). Temuan ini menegaskan bahwa KaNCD memberikan keseimbangan paling optimal antara akurasi, interpretabilitas, dan efisiensi dalam sistem pengujian adaptif berbasis POMDP.

Kata kunci: diagnosis kognitif model, ujian adaptif berbasis komputer, KaNCD, MCD, POMDP.

## **ABSTRACT**

*Advancements in learning analytics and educational data mining have led to the development of adaptive learning systems, with Cognitive Diagnostic Computerized Adaptive Testing (CD-CAT) being a prominent approach. CD-CAT utilizes Cognitive Diagnosis Models (CDM) to provide detailed insights into student abilities. However, challenges arise in managing the complexity and uncertainty of adaptive policies, especially with increasing attributes and items. This study compares four Cognitive Diagnosis Models GD-DINA, MIRT, MCD, and KaNCD within a Partially Observable Markov Decision Process (POMDP)-based adaptive testing system. The models were evaluated using Accuracy, AUC, and expected reward metrics based on the ASSISTments dataset. Results show that KaNCD is the best-performing CDM overall, achieving the highest diagnostic accuracy (0.7503) and AUC (0.7410), with stable performance in POMDP-based adaptive testing (expected reward = 0.792). GD-DINA obtained the highest expected reward (0.901) but with lower accuracy, while MCD demonstrated balanced performance with high accuracy (0.7464) and strong policy adaptability (reward = 0.873). These findings confirm that KaNCD provides the most optimal balance between accuracy, interpretability, and efficiency for adaptive testing systems based on POMDP.*

*Keywords: cognitive diagnostic model, computerized adaptive testing, KaNCD, MCD, POMDP.*