

**PENGEMBANGAN INSTRUMEN ASESMEN PILIHAN GANDA EMPAT-
TINGKAT UNTUK MENDIAGNOSIS KEMAMPUAN MULTI-
REPRESENTASI MAHASISWA CALON GURU
PADA KONSEP MEKANIKA**

DISERTASI

**Diajukan untuk Memenuhi Sebagian Syarat Memenuhi Gelar
Doktor Pendidikan Ilmu Pengetahuan Alam**



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**PENGEMBANGAN INSTRUMEN ASESMEN PILIHAN GANDA-EMPAT TINGKAT
UNTUK MENDIAGNOSIS KEMAMPUAN
MULTI-REPRESENTASI MAHASISWA
CALON GURU PADA KONSEP
MEKANIKA**

ABSTRAK

Asesmen diagnostik bertujuan mengidentifikasi kekuatan dan kelemahan kemampuan mahasiswa. Apabila keunggulan dan kelemahan mahasiswa terdiagnostik dengan baik, dosen dapat merencanakan proses pembelajaran lebih baik. Tes pilihan ganda empat-tingkat merupakan salah satu format instrumen asesmen diagnostik. Pemilihan jenis asesmen berkaitan erat dengan karakteristik konsep fisika yang bersifat abstrak. Konsep fisika akan lebih mudah dipahami mahasiswa apabila digambarkan dalam multi-representasi (representasi verbal, matematis, gambar, dan grafik). Asesmen diagnostik belum maksimal diterapkan dalam penilaian berbasis kelas. Berdasarkan kesenjangan penelitian tersebut, tujuan penelitian ini antara lain: 1) mengembangkan *framework* tahapan-tahapan mengkonstruksi instrumen asesmen pilihan ganda empat-tingkat untuk mendiagnosis kemampuan multi-representasi mahasiswa pada konsep-konsep mekanika, 2) mendapatkan gambaran karakteristik instrumen asesmen pilihan ganda empat-tingkat untuk mendiagnosis kemampuan multi-representasi dengan pendekatan *Item Response Theory* (IRT) model Rasch meliputi parameter analisis item, analisis kemampuan *testee*, dan *Differential Function Item* (DIF), 3) mendapatkan gambaran diagnostik kemampuan multi-representasi mahasiswa pada konsep-konsep mekanika. Penelitian ini menggunakan *mixed methods model exploratory design* dengan model pengembangan tes. Subyek utama penelitian ini meliputi 174 calon guru fisika. Karakteristik item tes dianalisis dengan IRT model Rasch. Tahapan pengembangan instrumen diagnostik pilihan ganda empat-tingkat meliputi analisis konsep mekanika, indentifikasi konsepsi mekanika, mengembangkan instrumen diagnostik multi-representasi, mengadministrasi skor tes. Instrumen asesmen pilihan ganda empat-tingkat untuk mendiagnostik kemampuan multi-representasi telah memenuhi kaidah analisis butir soal model Rasch meliputi parameter item tes, person tes dan item bias (DIF). Indikator reliabilitas pada ujicoba skala besar meliputi *person item reliability* adalah 0,97 pada kategori istimewa, nilai *item reliability* 0,94 pada kategori bagus sekali, dan nilai Cronbach Alpha (KR-20) 0,95 pada kategori bagus sekali. Profil diagnostik kemampuan representasi mahasiswa didominasi representasi matematis 53,66%, representasi gambar 53,03%, representasi verbal 52,78%, dan representasi grafik 52,32%. Kemampuan multi representasi verbal, gambar, matematis, grafik termasuk pada kategori cukup.

Kata kunci: asesmen diagnostik, instrumen diagnostik, pilihan ganda empat-tingkat, multi-representasi

THE DEVELOPMENT OF FOUR-TIER MULTIPLE-CHOICE ASSESSMENT INSTRUMENTS TO DIAGNOSE MULTI-REPRESENTATION ABILITY OF TEACHER PROSPECTIVE STUDENTS IN MECHANICAL CONCEPTS

ABSTRACT

A diagnostic assessment aimed to identify the strengths and weaknesses of student abilities. If students' strengths and weaknesses were properly diagnosed, the lecturer could plan the learning process better. The four-tier multiple-choice test was a form of the diagnostic assessment instrument. The choice of assessment type was closely related to the characteristics of abstract physics concepts. The concept of physics would be easier for students to understand if it was described in multi-representations (verbal, mathematical representations, pictures, and graphics). The diagnostic assessment has not been maximally applied in class-based assessment. Recognizing this research gap, this study's objectives included: 1) developing a framework for constructing a four-tier multiple-choice assessment instrument to diagnose students' multi-representational abilities on mechanical concepts; 2) obtaining an overview of the characteristics of a four-tier multiple-choice assessment instrument, the level for diagnosing multi-representation ability with the Rasch Model Item Response Theory (IRT) approach includes item analysis parameters, testee ability analysis, and Differential Function Item (DIF); 3) getting a diagnostic picture of students' multi-representation ability on mechanical concepts. This research used a mixed-methods model exploratory design with a test development model. The main subjects of this study included 174 prospective physics teachers. The characteristics of the test items were analyzed using the Rasch IRT model. The stages of developing a four-tier multiple-choice diagnostic instrument included analysis of mechanical concepts, identification of mechanical conceptions, developing multi-representational diagnostic instruments, administering test scores. The four-tier multiple-choice assessment instrument for diagnosing multi-representation ability has met the rules of item analysis of the Rasch model, including the test item's parameters, test person and item bias (DIF). Indicators of reliability in large-scale trials included person item reliability was 0,97 in the special category, item reliability value was 0,94 in the excellent category, and Cronbach Alpha value (KR-20) was 0,95 in the excellent category. The diagnostic profile of student representation ability was dominated by mathematical representation 53,66%, image representation 53,03%, visual representation 52,78%, and graphical representation 52,32%. The ability of multiple verbal, image, mathematical, graphic representations was included in the sufficient category.

Keywords: diagnostic assessment, diagnostic instrument, four-tier multiple-choices, multi-representation

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PENGEMBANGAN INSTRUMEN ASESMEN PILIHAN GANDA EMPAT-TINGKAT UNTUK MENDIAGNOSIS KEMAMPUAN MULTI-REPRESENTASI CALON GURU PADA KONSEP MEKANIKA

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PENGEMBANGAN INSTRUMEN ASESMEN PILIHAN GANDA EMPAT-TINGKAT UNTUK MENDIAGNOSIS KEMAMPUAN MULTI-REPRESENTASI CALON GURU PADA KONSEP MEKANIKA

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