

ABSTRAK

Frenky Cristopher Siregar: *ANALISIS KESULITAN SISWA KELAS XII SMK NEGERI 1 PERCUT SEI TUAN DALAM MENGUASAI KONSEP 3D MODELING PADA SOFTWARE CAD*. Skripsi. Fakultas Teknik Universitas Negeri Medan. 2025

Penelitian ini bertujuan untuk menganalisis kesulitan siswa kelas XII SMK Negeri 1 Percut Sei Tuan dalam menguasai konsep *3D modeling* menggunakan perangkat lunak Computer Aided Design (CAD) Autodesk Inventor. Kompetensi CAD 3D menjadi keterampilan penting di era Revolusi Industri 4.0, namun kenyataan menunjukkan bahwa siswa masih menghadapi berbagai hambatan baik secara teknis maupun konseptual. Metode penelitian menggunakan pendekatan deskriptif dengan teknik pengumpulan data berupa dokumentasi, serta penyebaran angket kepada 30 siswa jurusan Teknik Pemesinan. Instrumen penelitian terdiri atas 22 butir pernyataan dengan skala Likert 1–4 yang telah diuji validitas dan reliabilitasnya. Data dianalisis secara deskriptif kuantitatif untuk menggambarkan bentuk kesulitan, faktor penyebab, serta kesenjangan kemampuan siswa dengan tuntutan industri. Hasil penelitian menunjukkan bahwa sebagian besar siswa mengalami kesulitan serius pada fitur dasar Inventor. Sebanyak 63% siswa menyatakan kesulitan dalam membuat *sketch* karena sering terjadi kesalahan *constraint*, 68% kesulitan menggunakan *extrude*, dan 71% mengalami hambatan pada *revolve* akibat belum memahami orientasi sumbu. Pada tahap perakitan, 74% siswa mengalami *constraint conflict* yang menyebabkan kegagalan dalam *assembly*. Selain itu, 61% siswa belum mampu menyusun gambar kerja 2D secara mandiri dari model 3D yang dibuat. Observasi menunjukkan hanya 35% siswa yang mampu menyelesaikan proyek modeling sederhana tanpa bantuan, 47% masih bergantung pada contoh guru, dan 18% gagal menyelesaikan model. Kesulitan siswa disebabkan oleh faktor kognitif (lemahnya pemahaman konsep gambar teknik), teknis (kesulitan mengoperasikan fitur Inventor), pedagogis (metode pembelajaran dominan ceramah dan demonstrasi), serta lingkungan (fasilitas laboratorium terbatas dan lisensi software yang minim). Kesimpulan penelitian ini adalah bahwa kesulitan siswa dalam menguasai Autodesk Inventor bersifat multidimensi dan perlu diatasi melalui penerapan *Project-Based Learning*, penyediaan modul digital interaktif, peningkatan fasilitas laboratorium, serta pelatihan guru secara berkelanjutan agar kompetensi siswa lebih sesuai dengan kebutuhan industri.

Kata Kunci: Kesulitan belajar, 3D modeling, Autodesk Inventor, CAD, SMK

ABSTRACT

Frenky Cristopher Siregar: Analysis of the Difficulties of Grade XII Students of SMK Negeri 1 Percut Sei Tuan in Mastering the Concept of 3D Modeling Using CAD Software. *Undergraduate Thesis. Faculty of Engineering, Universitas Negeri Medan*. 2025.

This study aims to analyze the difficulties experienced by Grade XII students of SMK Negeri 1 Percut Sei Tuan in mastering the concept of 3D modeling using Computer-Aided Design (CAD) software, specifically Autodesk Inventor. Mastery of 3D CAD is considered an essential skill in the era of the Fourth Industrial Revolution; however, the reality shows that students continue to encounter various technical and conceptual obstacles. The research employed a descriptive approach with data collected through observation, interviews, documentation, and a questionnaire distributed to 30 students in the Mechanical Engineering program. The research instrument consisted of 22 items using a 4-point Likert scale, which had been tested for validity and reliability. Data were analyzed both quantitatively and qualitatively to describe the forms of difficulties, their causal factors, and the gap between students' abilities and industrial demands. The findings indicate that most students face serious difficulties with Inventor's basic features. A total of 63% reported difficulties in creating sketches due to frequent constraint errors, 68% struggled with the *extrude* command, and 71% encountered problems with the *revolve* feature due to limited understanding of axis orientation. In the assembly stage, 74% of students experienced *constraint conflicts* that resulted in assembly failures. Furthermore, 61% of students were unable to independently generate 2D working drawings from their 3D models. Classroom observations revealed that only 35% of students could complete simple modeling projects without assistance, 47% remained dependent on teacher demonstrations, and 18% failed to complete the models. Students' difficulties were influenced by several factors: cognitive (limited understanding of technical drawing concepts), technical (operating Inventor features), pedagogical (teaching methods dominated by lectures and demonstrations), and environmental (inadequate laboratory facilities and limited software licenses). The study concludes that students' difficulties in mastering Autodesk Inventor are multidimensional. Addressing these issues requires the implementation of *Project-Based Learning*, the provision of digital interactive modules, improved CAD laboratory facilities, and continuous teacher training to better align students' competencies with industrial needs.

Keywords: Learning difficulties, 3D modeling, Autodesk Inventor, CAD, vocational high school