In this paper, we will present an analysis of the manner in which students interact with an infinitely explorable online learning system. The Sigma Grading System (SGS), www.sigma-gs.com/SGS, provides students engineering problems in statics, fluids, mechanics of materials, and physics which can be infinitely explored. Traditional online systems use a hint based system. If a student has trouble, such systems let them ask for a hint and proceed. Instead, SGS provides the ability for the student to test intermediate steps. If a student cannot determine the value of the sine of an angle, they can first check if the angle they are using is correct. In this way, a student is free to test any and all possible intermediate steps in a problem. We will show how students evolve to take advantage of this promoting creative thinking and less reliance on formulaic learning. Specifically, as students gain confidence in their answer entry they transition from a guess / check pattern to a more structured search of intermediate steps. This analysis is made possible due to the fact that SGS maintains a log of student entries for each problem. The analysis also gives insight into the way students approach problems. I will show that such a system can be used to automatically identify specific deficiencies in a student’s understanding. The SGS system allows students the ability to interact both graphically, and through equations with a problem. Students can explore a three dimensional problem determining its connectivity, three dimensional structure, and stresses. The system automatically grades problems and identifies student weakness. In fact, the system can evaluate any and all possible intermediate steps and extraneous characteristics of a system.

Figure: The system allows students to enter intermediate steps and obtain feedback. In addition, students use vector notation and notation common within engineering textbooks within the software.

Keywords: Mechanics, Statics, online learning environments, scaffolding, active learning.

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