

Synthesizing Liberal Arts Physics

This paper describes open ended problem assignments designed to move students taking a general education (core) requirement in the natural sciences (in this case “How Things Work” – a qualitative application based physics course) from the typical knowledge, comprehension and application to analysis, synthesis and evaluation. Students do struggle with moving into these higher levels of Bloom. In one assignment students were asked to design a one string ‘banjo’ to play a particular range of notes. From the materials they had it was not difficult to figure out the central equation governing their design, but the students still struggled with the assignment: “I’m trying to do this group problem and I really don’t know where to begin. It seems that every formula has multiple unknowns; how do I decide what mass, length and/or tension to use?” In this problem the students needed to start by deciding how big to make their instrument. They could choose any size they wanted and get a solution to the problem, what they learn to do is to figure out what parameters are important and then select appropriate parameters (they need to decide what’s appropriate) and then move forward. In many cases the process must be iterated. But the key is in the students taking this type of problem and deciding what they need to do and then making appropriate choices when the problem affords them flexibility and then applying the appropriate physics when that is necessary for a complete design. A laboratory assignment has students design airfoils to achieve the maximum lift to drag ratio. The paper describes a low cost set up for experimentally determining this parameter for the students’ projects. The students are then required to evaluate their design and those of the other groups to develop heuristics for designing effective airfoils.