Abstract - In this paper we will discuss the learning and curriculum development issues surrounding integrating a design-based software program into engineering classrooms. We are working with a program called CyclePad [1,2] in which students can construct thermodynamic cycles (these are the processes that underlie heating and cooling systems, power plants, and steam engines). CyclePad belongs to an emerging class of educational software called “articulate virtual laboratories (AVLs).” AVLs provide a design space in which users can construct and analyze virtual artifacts. The “articulation” provided by an AVL gives the supports and scaffolding needed to help students with the design process. These supports provide information to the student such as the reasoning which CyclePad uses to arrive at numerical values, the modeling assumptions underlying a design or a list of the user’s design assumptions which are contradictory. Additionally, the program has an economic model to help students understand the real-world costs of building systems. Through using CyclePad students can build and practice their design skills and learn how to reason about thermodynamic processes.

CyclePad has been used at Northwestern University, the US Naval Academy and Oxford University. While there has been some initial successes at those locations, we are seeking to develop a more detailed and robust curriculum to help professors successfully integrate CyclePad into their classrooms. To that end, we are developing curricular activities (problems and exercises) which can be used to integrate CyclePad into the introductory and advanced thermodynamics courses. This paper will discuss the design of the curricular activities and an initial study to determine what students can learn from using CyclePad in a thermodynamics curriculum.

References