We have developed a systematically extensible model to describe electron dynamics at the interface between materials, such as between a bulk semiconductor and a monolayer of quantum dots attached thereto. We use a model Hamiltonian method and propagation of the Schrödinger equation in time to model electron dynamics at this interface. Features of the model include the ability to flexibly accommodate differing band/electronic structures and coupling constants between parts of the system being described. Preliminary results from the model include the fact that there exist coupling (binding) strengths for molecular linkers which optimize the yield of electron transfer from a photoexcited bulk semiconductor to a quantized semiconductor.