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Dynamics of How Students Conceptualize the Particle in a Box¹ BENJAMIN W. DREYFUS, ANDREW ELBY, AYUSH GUPTA, University of Maryland, College Park — The "particle in a box" is one of the simple systems that every introductory quantum mechanics student learns to solve exactly, but behind the mathematical simplicity is conceptual complexity. For example, it is not intuitively obvious what are the physical implications of an infinite potential, or why energy eigenstates are not also momentum eigenstates (even though there is zero potential energy at every position where the wavefunction is nonzero).² We use the particle in a box to probe the dynamics of student thinking about quantum systems. By analyzing both spoken language and gestures, we observe students reasoning about quantum "particles" using properties associated with classical particles, with classical waves, and with neither, and switching among these ways of conceptualizing the quantum "particle."

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²See also F.E. Cummings, The particle in a box is not simple, Am. J. Phys. 45, 158 (1977); R.C. Sapp, Ground state of the particle in a box, Am. J. Phys. 50, 1159 (1982); D.S. Rokhsar, Ehrenfest's theorem and the particle-in-a-box, Am. J. Phys. 64, 1416 (1996)

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