

Teaching Physics with Physlet®-Based Ranking Task Exercises

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In this paper, we describe how we use a pedagogical tool, Physlets®, in combination with a complementary pedagogical method, Ranking Task (RT) exercises, to enhance students' interactive engagement in introductory physics.

RTs (see Fig. 1) are one of more than a dozen Tasks Inspired by Physics Education Research (TIPERs) conceived by Curtis Hieggelke, David Maloney, and Thomas O'Kuma.¹ RTs are exercises that require students to compare scenarios with slightly different configurations (such as force applied, mass, or instantaneous velocity) and rank-order another attribute (such as acceleration).²⁻⁵

RTs have a number of pedagogical strengths. Most students, when solving a traditional physics problem, find a formula and simply plug the numbers given into that formula. This approach, which often results in the correct answer, does not require a solid conceptual understanding of the problem. RTs discourage such a plug-and-chug approach because they require students to set up, but not completely solve, a set of similar problems with slightly different configurations. Students must then determine how to efficiently compare different scenarios by ranking different variables and stating whether the rankings of any of these variables are the same. RTs also ask students to give a reason for their rankings. Such reasoning can provide insight into student thinking. In addition, RTs can present students with multiple representations of the same problem by having them rank graphs, vectors, or motion. RTs, then, serve to prepare students for standard textbook problems because "students see that problem

solving has a conceptual basis as they learn that they need a concept first, before doing any calculations."⁶

Physlets, Java applets that simulate physics content, are interactive animations that serve as a foundation for a variety of physics exercises.⁷⁻¹² Physlet-based exercises share many of the same problem-solving attributes as RTs. With the Physlet approach, students are not given much, if any, data; they must determine and measure meaningful quantities for themselves. Students following a standard plug-and-chug approach will find that, without a concept-first approach, they have either no data or too much data (depending on how many measurements were made) to put into an equation. Once students discover that plug-and-chug methods are not effective, they tend to adapt to a more

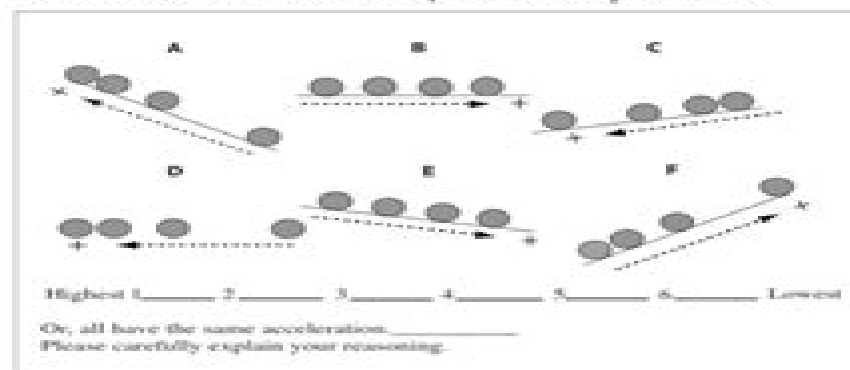


Fig. 1. A Ranking Task on acceleration depicting the motion of six balls using motion diagrams (Ref. 4, Task #5).

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