

# The Gravity Ether: A Physics Simulation Game With Level Editor

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## Description of Game

We will present the *The Gravity Ether*, the second in a planned six-game series of physics simulation games designed to help middle school students develop an intuitive understanding of complex physics concepts through experiential play (Figure 1). *The Gravity Ether* explores concepts related to forces in space, like the relation between force and distance or the speed and radius of orbits. Players can only interact with the objects in the game (namely, planets) indirectly by adding and removing black holes to create gravitational fields. Thus, becoming better at controlling objects in the game is directly related to more thoroughly understanding the nature of gravitational forces. By more accurately being able to control the motion of planets, players can accomplish simple level objectives like breaking blocks and collecting coins. *The Gravity Ether* integrates physics learning directly with gameplay, with levels and goals that are designed to highlight core concepts. With an appealing sandbox and a safe environment for experimentation, the game provide students an open and undirected opportunity to observe and interact with complex forces that are difficult to demonstrate in the traditional science classroom.

The games breaks up the more free-form, open sandbox levels with a few very directed and constrained “challenge levels.” These levels are focused on a particular concept, and typically only have a few ways that they can be solved. They act as a very explicit test of a particular concept, drawing a player’s attention to aspects of the simulation that they previously may have taken for granted, like how planets of different sizes generate different gravitational forces. This both allows students to notice and reflect upon physics concepts in the game, as well as very explicitly testing their understanding of those concepts in a puzzle-like task.

Students can create their own content in the game using a robust and intuitive level editor (Figure 1), and then publish that content for anyone to access and play. This promotes engagement and teaches students through the active process of creation. We consider the level editor to be the most valuable learning component to the game. By forcing students to balance competing design elements and work within the simulation’s constraints, they will be asked to engage in systems thinking, problem solving and demonstrate a deep understanding of the physics concepts involved in the game. The level editor also increases the game’s potential for innovative use in the classroom: student-created levels can be used in science classrooms as a vehicle for synthesis and analysis of a complex topic. This can support project-based learning, and the delivery of complex projects rather than standardized test questions as a demonstration of understanding.

*The Gravity Ether* also has embedded assessment capabilities; as players go through the game, the game will collect data about play performance (e.g., what level components they create and test, how they redesign levels, etc.). Educators can access data from their student’s gameplay through a web interface (Figure 2). We plan to use this data for assessment purposes, and we are looking forward to discussing possibilities for how to analyze this data or how best to present this data back to students for feedback with GLS attendees. In particular, we are interested in using the game to assess skills like persistence, creativity, and problem solving, as well as the more obvious content knowledge around gravitational forces.

*The Gravity Ether* is designed to reflect Iridescent’s overall learning philosophies, including learning by doing, learning in a goal- and task-oriented environment, using open-ended challenges, creating a safe environment for failure and encouraging performance before competence. Tools with these attributes can promote self-directed learning and scaffold more innovative and student-oriented classroom practices. These games were in part designed as a vehicle to bring our learning philosophy into classrooms and other educational environments.

## Additional links

*The Gravity Ether* is freely available as a desktop download from Iridescent’s website, at <http://iridescentlearning.org/ethers/gravity/>. It can also be downloaded for free from the App store for iPhones or iPads at <https://itunes.apple.com/us/app/the-gravity-ether/id721028894?mt=8>.

For a demo video of *The Gravity Ether*:

<http://www.youtube.com/watch?v=l0DIU1hmZiw&feature=youtu.be>

For a video showing how students create levels for a similar game in the series, *The Fluid Ether*:

<http://www.youtube.com/watch?v=DcJJ2t9S1Z0>.

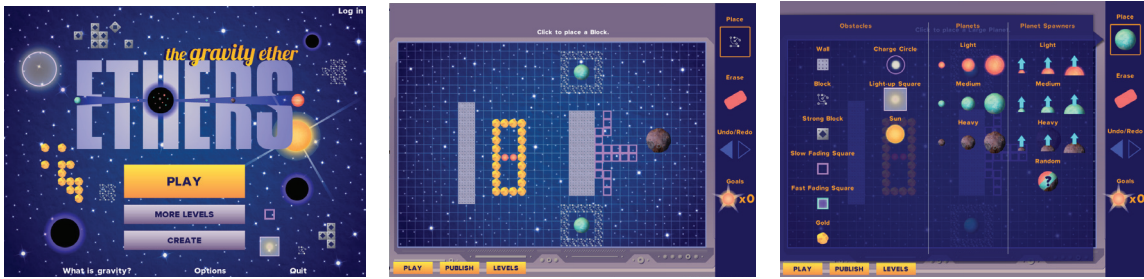


Figure 1: The Gravity Ether screenshots.

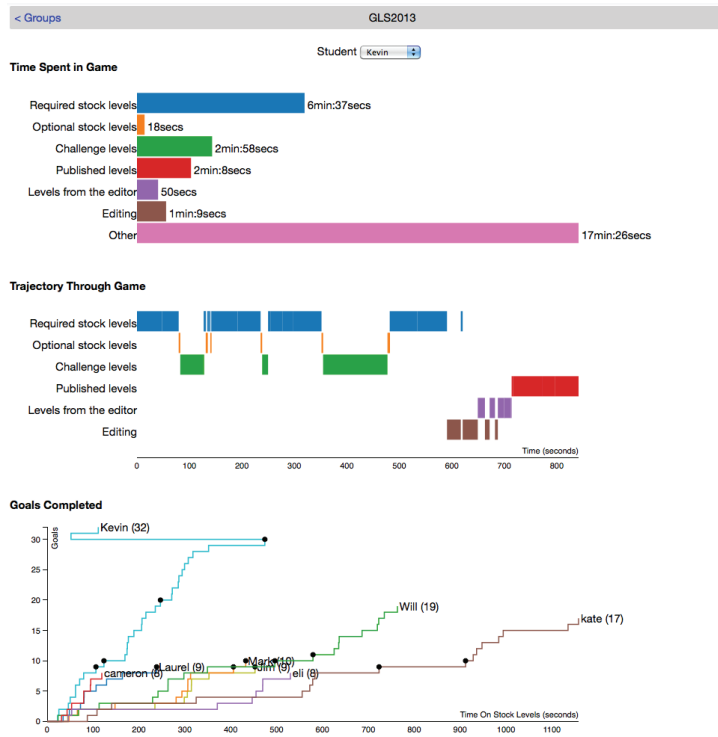


Figure 2: Screenshots of the educator interface, showing gameplay data.

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