Using a Level Editor's Clickstream Data as a Performance-Based Assessment Tool

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Introduction

Games have great potential to act as assessment tools, particularly for performance-based assessment (Steinkuehler and Squire, 2013). Digital games uniquely enable automated observation of student performance, eliminating the need for video recording or time-intensive observational work. Clickstream data can automate observations if a student's sequence of clicks can be tied to learning claims, for example through an evidence-centered design approach (Shute and Ventura, 2013).

In this study, we will use the clickstream data resulting from a student's use of an in-game level-editor to assess a student's level of persistence and use of the engineering design process (EDP). We will test students both before and after attending an engineering-focused, 12 week after school program. This is particular relevant as the new science standards emphasize understanding the engineering design process in addition to the scientific method (NGSS Lead States, 2013). The level-editor will be used as an assessment tool, to gauge transference of these two skills from a hands-one, engineering learning context to a digital, game-based assessment context. This is an ongoing study, and we will report on the results from the first round of implementation at the GLS poster session.

The program

We will assess learning in a program called "Be an Inventor," run each spring by Iridescent. In this program, 25 students in grades 3-8 attend an after school program. This program runs for 15 weeks, and meets for two three-hour sessions each week. The program itself alternates between directed lesson on certain skills, like techniques for cutting and scoring cardboard with mat knives or how to mix and pour concrete, with open-ended opportunities for students to practice those skills in projects of their own design. In a sense, the activities performed by students in the program are gamefully designed. Throughout the program, students will be instructed and guided in use of the EDP as a tool to help design and improve their projects. Other than that basic structure, each student is given agency to define and build their own, unique set of projects in the program.

One day at the beginning and end of the program will be set aside for an assessment related task. Students will complete a game-based assessment task. Students will be given a chance to play a physics simulation game created by Iridescent. After getting familiar with the game through open gameplay, students will be challenged to make a well-designed level in the game's level editor (Figure 1) using the EDP. Students will also be given a short survey, to rate their comfort with tinkering and playing games, and a student's use of the EDP will be evaluated through the use of a student journal throughout the program.

Assessing learning goals

The learning goals of the Be an Inventor program are to increase creativity, persistence, and curiosity in students, skills which naturally evolve through increasing a student's understanding and use of the EDP. This study will focus on assessing student use of the EDP and persistence. The authors use the model for EDP provided by The Works (http://works.stylefish.com/files/docs/EDP_final_11x17.pdf).

The Gravity Ether contains a clickstream data collection system. System events are recorded as students play through both the game and the level editor. Large scale events are recorded and time stamped, such as when students enter and leave the level edit screen. Smaller events within each screen are also documented, such as what objects students select and where those objects are placed in the editor, or when control mechanisms are turned on and off in the play screen. In this way, the extent to which students build, test, and refine their levels based on testing will be captured by the system, as well as their persistence in continuing through this process multiple times to eventual success. This can be measured on both a large scale (number of switches between the editing and playtesting screen) and on a small scale (editing and testing the same set of features of a level multiple times). As such, we can score both student persistence and use of EDP in designing their levels.

We plan to analyze the data in several ways. First, we will conduct a preliminary exploratory analysis of student play patterns in the game. Next, we will look for increases from the pre to post scores over the course of the program, in both the hands-on task and game-based task. Then, we will look for correlations in scores between the hands-on work as recorded in the journal and game-based task, to determine whether both tasks are accurately

measuring the same skills. In particular, we are concerned that students with more game-playing experience might perform better in the game-based task simply due to their familiarity with the medium, rather than due to gaining the skills in the program. Finally, the students attending the Be an Inventor program are a mix of new and returning students to Iridescent's programs. Each student's attendance is tracked across programs by an attendance tracking software. In this way, we can test whether students do better on the pretest when they have attended more previous Iridescent programs that have reinforced the skills of interest. Thus, some of the variance in student scores can potentially be explained by prior attendance in the Iridescent's programs.

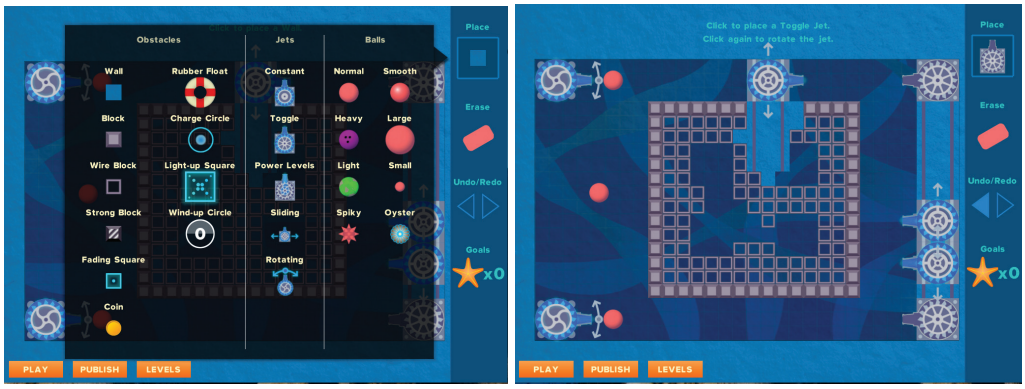

Figure 1: Two screenshots of the game's level editor interface.

References

NGSS Lead States. 2013. Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press.

Shute, V. J. & Ventura, M. (2013). Measuring and supporting learning in games: Stealth assessment. Cambridge, MA: The MIT Press.

Steinkuehler C. and Squire K. (2013) Videogames and Learning. *Cambridge Handbook of the Learning Sciences*, New York: Cambridge University Press.