Can Video Gameplay Improve Undergraduates’ Problem-Solving Skills?

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ABSTRACT

In this study, the authors investigated if two distinct types of video gameplay improved undergraduates’ problem-solving skills. Two groups of student participants were recruited to play either a roleplaying video game (World of Warcraft; experimental group) or a brain-training video game (CogniFit; control group). Participants were measured on their problem-solving skills before and after 20 hours of video gameplay. Two measures were used to assess problem-solving skills for this study, the Tower of Hanoi and The PISA Problem Solving Test. The Tower of Hanoi measured the rule application component of problem-solving skills and the PISA Problem Solving test measured transfer of problem-solving skills from video gameplay to novel scenarios on the test. No significant differences were found between the two groups on either problem-solving measure. Implications for future studies on game-based learning are discussed.

KEYWORDS

Assessment, Brain Training, Cognition, Gameplay, Problem-Solving Skills, Roleplaying, Rule Application, Transfer, Video Games

INTRODUCTION

Video games are played by more than half of the U.S population and the video game industry generated $36 billion in 2018 (ESA, 2018). Given the popularity and success of the video game industry, game-based scholars are exploring how well-designed video games can be used to improve a wide range of knowledge, skills, and abilities referred to as game-based learning (GBL). Proponents of GBL argue that well-designed video games are grounded by active participation and interaction as the focal point of the learner experience and can lead to changes in behavior and cognition (Ifenthaler, Eseryel, & Ge, 2012; Shute et al., 2019). Moreover, well-designed video games immerse players in environments that can provide a framework for learning experiences by promoting engagement and transfer from simulated worlds to the natural world (Dede, 2009).

DOI: 10.4018/IJGBL.2020040102

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Current American students are not receiving adequate exposure to authentic ill-structured problem-solving scenarios in their classrooms, and schools need to address the acquisition of problem-solving skills for students in the 21st century (Shute & Wang, 2016). American students trail their international counterparts in problem-solving skills on the Program for International Student Assessment (PISA) Problem Solving Test. Furthermore, American business leaders complain about recent college graduates’ lack of problem-solving skills. Two surveys conducted by the Association of American Colleges and Universities of business leaders and students indicated that problem-solving skills are increasingly desirable for American employers, but only 38% of employers reported that recently hired American college graduates could analyze and solve complex problems while working (Hart Associates, 2018).

Researchers of video game studies find that gameplay can be positively associated with the improvement of problem-solving skills (Shute, Ventura, & Ke, 2015; Spires et al., 2011). However, current discourse in the field of gameplay and problem-solving skills centers primarily on descriptive research (Eseryel et al., 2014) which can be summarized based on the following premise: video games require players to solve problems, and over time, playing video games will lead to improved problem-solving skills (Hung & Van Eck, 2010). Descriptive research is important to argue that video games support problem-solving skills, but further empirical research is needed to demonstrate whether problem-solving skills are acquired through video gameplay. This research study addressed whether two distinct types of video gameplay empirically affects undergraduates’ problem-solving skills.

### Video Games and Problem-Solving Skills

According to Mayer and Wittrock’s (2006) definition, problem solving includes four central characteristics: (1) occurs internally to the problem solver’s cognitive system; (2) is a process that involves conceptualizing and manipulating knowledge; (3) is goal directed; and (4) is dependent on the knowledge and skills of the problem solver to establish the difficulty in which obstacles must be overcome to reach a solution. Unlike the well-structured problems that students face in formal learning settings, well-designed games provide students with challenging scenarios that promote problem-solving skills by requiring players to generate new knowledge from challenging scenarios within interactive environments, while also providing immersive gameplay that includes ongoing feedback for the players to hone their problem-solving skills over time (Van Eck, Shute, & Rieber, 2017). Rules govern video gameplay mechanics and one component of problem solving is the ability to apply existing rules in the problem space known as rule application (Shute et al., 2015). One example of a rule application is found in the well-researched problem-solving puzzle the Tower of Hanoi (Huyck & Kreivenas, 2018; Schiff & Vakil, 2015; TOH, 2019). The rule application component of problem-solving skill is one of the dependent variables in this study. Rule application refers to the problem-solver’s representation of the problem space through direct action, which is critical to problem solving (Van Eck et al., 2017).

### LITERATURE REVIEW

### Video Gameplay and Transfer

Researchers contend that the hidden power of well-designed video games is their potential to address higher-level learning, like retention, transfer, and problem-solving skills (Gee, 2008; Shute & Wang, 2015). Retention is the ability to remember the presented information and correctly recall it when needed, while transfer is the ability to apply previously learned information in a novel situation (Stiller & Schworm, 2019). Possible outcomes of playing video games may include the improvement of collaborative problem-solving skills, confidence, and leadership skills that are transferable to the workforce environment. Recent research on video game training studies and transfer of cognitive and noncognitive skills indicates that gameplay is positively associated with the improvement of attention,
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