

Viewpoint

Testing Educational Digital Games

Diversifying usability studies utilizing rapid application development.

THE DIGITAL GAME industry is a multibillion-dollar global enterprise.¹⁴ Fostered by the development of sophisticated software and hardware as well as an interest in gaming among individuals around the world, the financial impact of digital games is continuously evolving. Accordingly, new streaming platforms are launching, and existing online game systems are expanding to meet the demand.¹⁴ Traditionally referred to as video games, the term digital games is a unifying term encompassing interactive games played on consoles, smartphones, tablets, personal computers, and other devices.² The Entertainment Software Association indicates 214.4 million Americans play digital games.³ National data also suggests 75% of American households have one person that plays digital games.³

In light of the exponential increase in the use of digital games, they have become commonplace in academic settings such as elementary schools, middle schools, high schools, and postsecondary institutions. According to an article published by the American Psychological Association, educational digital games complement a myriad of instructional contexts and have the potential to enhance traditional classroom environments.⁹ Despite needing more research to validate the educational benefits of digital games, the use of educational digital games has increased in recent years.



In a study comprising 488 teachers, more than 50% of the participants used digital games in the classroom.⁵

Benefits of Educational Digital Games

Increasing amounts of scholarship have focused on the extent to which digital games promote educational outcomes. For example, Vanbecelaere et al. exploring the impact of educational digital games on academic achievement, demonstrated that educational digital games could augment students' learning outcomes.¹²

Virvou, Katsionis, and Manos, comparing aspects of an educational digital game, indicated that virtual reality games could promote student achievement.¹³ Another study, which examined qualitative data from students, reinforced the importance of assessing the impact of digital learning experiences to refine gaming software.⁴ In the study, researchers analyzed students' experiences and interactions with an educational digital game designed to teach coding skills. The research suggests educational digital games should incorporate

authentic activities that are consistent with students' expectations about the learning context.

Almeida found that undergraduate students who played an educational digital game, in addition to reading information about the topic, scored higher on a learning assessment than students who did not play the educational digital game.¹ A summary of research about the effects of educational digital games indicates that when games are used to help students learn information, the gameplay should match classroom-based instruction and incorporate assessments of student learning.² Thus, it may be advantageous to align the content, structure, and goals of educational digital games with traditional pedagogical practices.² Moreover, future research investigating educational digital games should explore the extent to which students learn information aligned with the game's instructional model. Studies should also analyze game's impact on students' motivations to learn information related to the game's subject area.

Usability Study Methods

Usability studies incorporate data and theoretical concepts to support the development and testing of software and hardware. Moreover, software testers utilize analytical frameworks to evaluate software applications. To promote a seamless analysis of educational digital games, usability researchers examine aspects of games that influence the playability of games. Therefore, usability studies that focus on educational digital games should combine model-based assessments and human-centered evaluation techniques.

Designing Educational Digital Games

Engineering pedagogical software that students can use to enhance learning outcomes has been an ongoing challenge among researchers and software engineers. The inherent difficulty in designing software to facilitate educational outcomes is that learning styles are divergent among students. Also, to further confound educational software development issues, research suggests that aligning

learning styles to instructional content may not enhance achievement outcomes.¹⁰ Considering the complexity of designing effective educational technologies, it is possible that while some educational digital games may address an element of the course content, they may not provide comprehensive coverage that matches or enhances the course material. In contrast, a student may utilize educational digital games to obtain an overview of a subject, while another student may need educational software that delineates specific concepts about an aspect of the subject.

To design effective educational digital games that consider student diversity, we may need to design inclusive game usability studies. In this regard, an article by Jakob Nielsen gives credence to the notion that game usability studies may be more impactful when the findings from a diverse array of users comprise the player-centered data.⁸ To achieve this goal, extrapolating insights from previously mentioned ideas, usability studies should incorporate research participants from underrepresented populations. Furthermore, integrating this data and diverse sampling procedures in game evaluation processes may also enhance the game's economic impact.

Diversity in Usability Studies

The diversity within the digital game industry continues to be problematic, with approximately 65% of the respondents from the International Game Developers Association's 2019 Developer Satisfaction Survey reporting that equality is an issue in the video game industry.⁶ Moreover, based on 2020 data from the Bureau of Labor Statistics, African Americans constitute approximately 6.2% of software developers, while Hispanics or Latinos comprise 5.9% of software developers.¹¹ Additionally, national data indicates African Americans comprise 12% of software quality assurance analysts and testers, while Hispanics or Latinos account for 9.2% of software quality assurance analysts and testers.¹¹ Given these statistics, it is important to consider the demographic composition associated with usability studies, such as

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the diversity among the individuals who design, test, and evaluate educational digital games.

Rapid Application Development

An effective software process facilitates the creation, testing, and optimization of software via a strategic, measurable, and transparent integration of engineering principles. A fundamental perspective in rapid application development (RAD) is that software development will utilize iterative development phases to minimize production time while pursuing a user-centered design philosophy.⁷ RAD typically incorporates processes that involve defining functional requirements, developing a prototype, evaluating the prototype, implementing improvement processes, modifying requirements, refining the prototype, adjusting software specifications to align with user-centered expectations, and producing the software.⁷ Given its flexibility, a RAD approach may promote equity in usability studies and enable more underrepresented groups to participate in the usability testing phase for educational digital games.

Utilizing a software development process, such as RAD, which promotes adaptations and modifications throughout the educational game development life cycle, may enhance students' learning outcomes. In addition to recruiting more individuals from underrepresented racial groups and women to enter the software engineering and usability testing work-

force, it may also be advantageous to ensure that more educational digital game usability studies incorporate participants from underrepresented groups. Implementing this approach would also involve establishing performance measures to monitor how educational digital games affect learning outcomes among a diverse population of students. This strategy could also integrate the development and utilization of qualitative indicators and quantitative metrics that monitor and manifest diverse students' perspectives in digital game usability studies. Finally, while this column has focused on RAD, it should be noted that additional software process models may also advance diversity within software testing environments. **□**

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