The Impact of Game-Based Learning on Immediate Academic Performance

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Abstract

The purpose of this study was to examine whether game-based learning leads to higher immediate test performance compared to non-game-based instruction. Forty participants were initially recruited through Amazon Mechanical Turk, but only thirty-one provided usable data. Participants were randomly assigned to one of two conditions: a game-based learning condition that used a Kahoot interactive quiz or a traditional non-game-based quiz. After completing their respective lessons, all participants took the same posttest to assess short-term recall of U.S. state capitals. An independent samples *t*-test indicated no statistically significant difference in posttest performance between conditions, $t(29) = 1.29$, $p = .21$, Cohen's $d = 0.48$, although the game-based group (M = 11.82, SD = 0.60) scored slightly higher than the non-game group (M = 10.85, SD = 2.43). These findings suggest that while game-based learning may enhance engagement, it does not necessarily result in higher immediate test scores. Future research should replicate this design with a larger sample and explore longer-term retention effects.

Keywords: game-based learning, engagement, retention, educational technology

The Impact of Game-Based Learning on Immediate Academic Performance

Keeping students engaged is one of the most persistent challenges in higher education. When students lose focus, their immediate comprehension and ability to perform well on assessments tend to suffer. One instructional method that has gained attention for addressing this challenge is game-based learning, which integrates interactivity, feedback, and competition into the learning process. Research consistently links student engagement to improved learning outcomes and retention (Clark et al., 2016). Meta-analytic work further shows that digital games and simulations often outperform traditional instruction in terms of both learning performance and motivation (Wouters et al., 2013; Vogel et al., 2006). Still, many studies have focused on long-term retention or broad outcomes, leaving open the question of whether game-based learning provides measurable advantages in immediate test performance. This study will investigate whether students who learn through a game-based method score higher on an immediate post-test than students who learn the same material in a non-game format.

Literature Review

Prior research investigated how game-based learning and gamification influence student outcomes. Studies in this area have examined effects on both performance and engagement, with several meta-analyses showing consistent benefits from instructional games compared to traditional methods. The following section reviews five major studies that highlight what is already known and how these findings inform the current research question.

A Meta-Analysis of the Cognitive and Motivational Effects of Serious Games.

Wouters and colleagues conducted a meta-analysis to determine whether serious games improve learning and motivation compared to traditional instruction. The independent variable was instructional format (serious games vs. conventional methods), and the dependent variables included cognitive outcomes such as test scores and motivational outcomes such as engagement. Their analysis showed that serious games significantly improved both performance and motivation across multiple controlled studies. These findings suggest that game-based learning can be an effective way to enhance student outcomes, justifying further research into immediate performance effects.

Does Gamification Work? – A Literature Review of Empirical Studies on Gamification.

Hamari and colleagues reviewed dozens of empirical studies to evaluate whether gamification features such as points, badges, or leaderboards affect engagement and performance. The independent variables across the studies were the presence or absence of gamification elements, while the dependent variables included measures of motivation, engagement, and learning outcomes. Results showed that gamification often increased engagement, though the effects varied depending on the design and context of the intervention. The review concluded that while gamification has strong potential to improve educational outcomes, its success depends on careful design.

Digital Games, Design, and Learning: A Systematic Review and Meta-Analysis.

Clark and colleagues conducted a systematic review and meta-analysis of digital game-based instruction. The independent variable was the instructional format (games vs. non-game methods), and the dependent variables included both learning outcomes and engagement. Their results indicated small-to-moderate improvements in cognitive performance

and large gains in engagement for game-based instruction compared to traditional methods. This suggests that games not only improve knowledge acquisition but may also motivate students to participate more fully in learning activities.

Computer Gaming and Interactive Simulations for Learning: A Meta-Analysis.

Vogel and colleagues analyzed 32 empirical studies comparing games and simulations with traditional instruction. Their independent variable was instructional format (games/simulations vs. conventional lessons), and their dependent variables included cognitive outcomes such as test scores and attitudinal outcomes such as motivation. Results showed significantly higher performance ($z = 6.05$) and improved attitudes ($z = 13.74$) for game-based methods. These findings highlight the potential of game-based learning to improve both performance and motivation, making it an appropriate method to test for immediate effects.

A Meta-Analytic Examination of the Instructional Effectiveness of Computer-Based Simulation Games.

Sitzmann reviewed 65 studies in a meta-analysis of simulation games for instruction. The independent variable was the use of simulation games, while the dependent variables included declarative knowledge, procedural knowledge, and retention. Results showed that simulation games were 20% more effective for declarative knowledge, 14% more effective for procedural knowledge, and 9% more effective for retention than conventional instruction. These findings reinforce the idea that game-based approaches consistently improve learning outcomes, supporting the rationale for examining whether similar advantages occur in short-term testing situations.

Rationale

Together, this body of literature shows that game-based learning has strong potential to improve both learning performance and student motivation. However, most prior studies emphasized either long-term retention or general performance outcomes, leaving immediate test performance less explored. The present study will address this gap by testing whether a game-based lesson leads to higher immediate post-test scores compared to an equivalent non-game lesson.

Based on prior research showing cognitive benefits of game-based learning (Vogel et al., 2006; Wouters et al., 2013; Sitzmann, 2011), it is hypothesized that students in the game-based condition will achieve significantly higher immediate post-test scores than those in the non-game condition.

Methods

This study implemented a randomized posttest-only design to investigate the effect of game-based learning on student performance. Participants were randomly assigned to either a game-based learning condition or a non-game-based learning condition. Immediate test performance was measured using a multiple-choice quiz delivered through Google Forms.

Participants

This study collected data from 31 participants recruited through Amazon Mechanical Turk (MTurk) (N = 31). Eligibility was limited to adults (18 years or older) who are fluent in English. Participants were compensated $1.50 for approximately 15–20 minutes of participation, consistent with MTurk's ethical pay guidelines.

Materials

Demographics survey. A short demographic questionnaire (e.g., age, gender, student status) was included at the beginning of the study.

Learning modules. Participants were randomly assigned to one of two learning conditions:

Game-based condition. Participants completed a 10–12 item lesson using Kahoot!, accessed via a Google Form link. Kahoot! incorporates points, timers, and immediate feedback to create a gamified learning experience.

Non-game condition. Participants completed the same 10–12 item lesson presented directly in Google Forms without game elements (plain multiple-choice format with no points or feedback).

Posttest quiz. An immediate posttest consisting of 10–12 multiple-choice questions covering the lesson content was administered through Google Forms.

Procedure

After providing informed consent, participants completed the demographics survey. They were then randomly assigned by MTurk's study randomizer to one of two Google Form links: (1) game-based lesson with Kahoot! or (2) non-game lesson in Google Forms. Each condition lasted approximately 10 minutes. Immediately after, all participants completed the same posttest quiz in Google Forms. The full study took approximately 15–20 minutes, after which participants were debriefed and compensated via MTurk.

Results

An independent samples *t*-test was conducted to compare posttest scores between participants in Condition A and Condition B. Results indicated that the difference between

conditions was not statistically significant, $t(29) = 1.29$, $p = .21$, Cohen's $d = 0.48$. Participants in Condition A (M = 11.82, SD = 0.60) scored slightly higher than participants in Condition B (M = 10.85, SD = 2.43). See Table 1 for descriptive statistics.

Table 1

Posttest Quiz Performance by Condition

Condition	N	M	SD
Condition A	11	11.82	.60
Condition B	20	10.85	2.43

Note. M = Mean, SD = Standard Deviation.

Discussion

Summary of Findings

The purpose of this study was to examine whether game-based learning led to higher immediate test scores compared to a non-game-based learning condition. Although participants in the game-based condition performed slightly better on the posttest than those in the non-game-based condition, this difference was not statistically significant. These results suggest that, in this sample, completing a short game-based lesson did not significantly enhance immediate quiz performance.

Findings in Context

The findings provide only partial support for the original hypothesis, which predicted that students who engaged in a game-based lesson would achieve higher posttest scores than those

who completed a traditional quiz-style lesson. Prior research has demonstrated that game-based learning can enhance engagement and cognitive outcomes (Vogel et al., 2006; Wouters et al., 2013). However, the present study's non-significant results may reflect situational factors such as the brief exposure time, the simplicity of the content (U.S. state capitals), or variability in participants' motivation.

Implications

Even though the difference was not statistically significant, the medium effect size (d = 0.48) indicates a potentially meaningful pattern that could emerge more clearly in a larger or longer study. These results contribute to the existing literature suggesting that the benefits of game-based learning may depend on implementation quality, content difficulty, and learner engagement. For educators, this finding underscores the importance of thoughtful integration of game-like elements rather than assuming games will automatically improve learning outcomes.

Strengths and Limitations

A key strength of this study was the use of an experimental, between-subjects design that allowed direct comparison between game-based and non-game-based instruction. Additionally, the online format made data collection efficient and accessible. However, limitations include a relatively small sample size, potential variability in participants' attention, and the use of a short-term retention test rather than a delayed assessment. These factors may have reduced the ability to detect a statistically significant effect.

Conclusions and Future Directions

Although the present study did not find a significant difference in posttest performance between conditions, the observed trend aligns with literature suggesting potential benefits of game-based learning. Future research should replicate this design with a larger sample, a more

complex subject area, and a delayed posttest to measure long-term retention. Continued exploration of engagement measures and learning outcomes will help clarify when and how game-based learning can most effectively enhance student performance.

References

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Appendix A

Informed Consent

Title of Research: The Impact of Game-Based Learning on Immediate Academic Performance

Principal Investigator: Marxus Jones, Arizona State University, marxusj@gmail.com

Institutional Contact: For questions about your rights as a participant in this study, you may contact: Arizona State University Institutional Review Board (IRB), Office of Research Integrity and Assurance, Email: research.integrity@asu.edu Phone: (480) 965-6788

1. Introduction and Purpose of the Study:

You are invited to participate in a research study that examines how different learning methods affect student performance. The purpose of this study is to compare whether a game-based lesson improves immediate test scores compared to a traditional lesson.

2. Description of the Research:

If you agree to participate, you will complete a short online lesson followed by a quiz. Depending on your assignment, you will either complete the lesson through a game-based platform (Kahoot!) or a non-game quiz format (Google Forms). You will then complete a short multiple-choice posttest. The study should take approximately 15–20 minutes.

3. Subject Participation:

About 40 participants will be recruited through Amazon Mechanical Turk (MTurk). Participants must be at least 18 years old and fluent in English. You will be randomly assigned to

one of two groups (game-based or non-game). Your participation will involve completing one lesson and one posttest quiz in a single session lasting about 15–20 minutes.

4. Potential Risks and Discomforts:

   There are no known risks beyond those associated with everyday computer use.

5. Potential Benefits:

   Although there are no direct benefits to you, this research may help educators better understand how game-based learning influences student performance.

6. Confidentiality:

   Your responses are anonymous. No identifying information will be collected.

7. Voluntary Participation:

   Your participation is voluntary. You may withdraw at any time without penalty.

8. Compensation:

   You will receive $1.50 through MTurk for completing this study.

By clicking “I agree” below, you confirm that you are at least 18 years old and consent to participate.

Appendix B

Demographics Sheet

Please answer the following questions. Your responses are anonymous and will only be used for research purposes.

1. Age: ____
2. Gender:
    - ☐ Male
    - ☐ Female
    - ☐ Non-binary / Other
    - ☐ Prefer not to say
3. Education level:
    - ☐ High school diploma or equivalent
    - ☐ Some college
    - ☐ Associate's degree
    - ☐ Bachelor's degree
    - ☐ Graduate degree
    - ☐ Other: _____
4. Are you currently a student?
    - ☐ Yes
    - ☐ No
5. Primary language: _____

Appendix C

Order of Conditions

This study uses a between-subjects design. Participants will be randomly assigned to one of two conditions using Amazon Mechanical Turk's task distribution system. Each participant will only complete one version of the lesson.

Condition A (Game-based lesson): Participants will complete a 10–12 item lesson in Kahoot! with points, timers, and immediate feedback. They will then complete a posttest quiz in Google Forms.

Condition B (Non-game lesson): Participants will complete the same 10–12 item lesson in Google Forms, presented in a standard multiple-choice format without game features. They will then complete the same posttest quiz in Google Forms.

Randomization will occur automatically when participants accept the HIT in MTurk. Approximately half of the participants will be routed to Condition A and half to Condition B.

Appendix D

Instructions, Materials, and Script

1. Instructions to Participants (presented at the start of the Google Form):

You will complete a short lesson on U.S. State Capitals. Depending on your group, the lesson will be presented either as a game-based quiz (Kahoot!) or as a traditional quiz (Google Forms). Both lessons cover the same content. Please complete the lesson carefully, as you will take a quiz immediately after. The study will take about 15–20 minutes.

2. Materials:

Game-based lesson (Condition A): Participants will complete a 10–12 item Kahoot! quiz. This version will include game-based features such as points, timers, and immediate feedback.

Non-game lesson (Condition B): Participants will complete the same 10–12 item lesson using Google Forms in a standard multiple-choice format. This version will not include game-based features such as points or feedback.

Posttest quiz: All participants, regardless of condition, will complete an immediate posttest consisting of 10–12 multiple-choice questions in Google Forms. The posttest will cover the content from the lesson and serve as the dependent measure of performance.

3. Script for Researcher (for setup and debriefing in MTurk):

Study description (MTurk HIT): *"*This is a 15–20 minute study on how different lesson formats affect learning. You will complete one short lesson and then answer a brief multiple-choice quiz. Compensation is $1.50.*"*

Condition links: Participants will be automatically routed by MTurk to either the Kahoot! lesson (Condition A) or the Google Forms lesson (Condition B). Both versions end with the same posttest quiz in Google Forms.

Debrief: After completing the posttest, participants will see the debriefing statement (Appendix E).

Appendix E

Debrief Form

Title of Research: The Impact of Game-Based Learning on Immediate Academic Performance

1. Purpose of the Study

The purpose of this research is to examine whether game-based learning produces higher immediate test performance compared to traditional non-game lessons.

2. Description of the Research

Participants were randomly assigned to one of two conditions. In the game-based condition, participants completed a lesson using Kahoot! with features such as points, timers, and immediate feedback. In the non-game condition, participants completed the same lesson in Google Forms without game features. All participants then completed a posttest quiz.

3. Hypothesis

We predict that participants in the game-based condition will perform better on the immediate posttest than participants in the non-game condition.

4. Confidentiality

All responses are anonymous and no identifying information was collected.

5. Contact Information

If you have any questions about this study, please contact: Marxus Jones, Arizona State University, marxusj@gmail.com

For questions about your rights as a research participant, you may contact: Arizona State University Institutional Review Board (IRB), Office of Research Integrity and Assurance, Email: research.integrity@asu.edu Phone: (480) 965-6788