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The Benefits of Gamification and Game-Based Elements in the Secondary Classroom

## Abstract

Middle school students often struggle with disengagement in the classroom, which affects their motivation and academic performance. To address this issue, the question arises: *In what ways can secondary students benefit from gamification and game-based elements in the classroom?*

This research review examines how integrating gamification and game-based learning strategies into daily lessons can enhance student engagement, problem-solving skills, and academic achievement. Research indicates that gamification fosters creativity, collaboration, and self-regulation, while game-based learning environments support practical problem-solving. Studies have also demonstrated that these methods improve students' mathematical precision, critical thinking, and teamwork. Additionally, game-based learning has been linked to higher test scores and better retention compared to traditional teaching approaches. These findings suggest that gamification and game-based learning not only engage students but also lead to measurable academic gains, making them valuable tools for enhancing secondary education. **By adopting these methods, teachers can motivate students while fostering deeper learning and stronger critical thinking and problem-solving skills.** To translate our research findings into a vision for change, we have designed a Professional Development Workshop that will not only educate participants on the latest research but also offer hands-on learning opportunities, equipping them to effectively implement gamification strategies in their classrooms.

## Visual Map

<b>Research Question:</b> <i>In what ways can secondary students benefit from gamification and game-based elements in the classroom?</i>	
<b>Thesis Statement:</b> <i>Teachers can promote deeper learning and engagement for secondary students by incorporating gamification strategies and game-based elements into instruction to motivate students and enhance problem-solving skills.</i>	
<b>Theme 1:</b> <b>Increased Engagement and Motivation</b>	
<p>Gamification and game-based learning provides enhanced creativity and collaboration with support for self-regulation which increases engagement and motivation.</p>	<p>Gamification and game-based approaches in education significantly enhances student engagement and motivation, as proven by studies showcasing increased interest through interactive and story-driven methods.</p>
<ul style="list-style-type: none"> <li>● Gamification in collaborative digital storytelling, fosters creativity and socialization, motivating students to engage more deeply with tasks (Bal, 2019).</li> <li>● Designing games or escape rooms promotes teamwork and problem-solving, with students expressing pride in their collaborative achievements (Stohlmann, 2023)</li> <li>● Collaborative play during Kahoot sessions fosters teamwork and shared strategies, as students discuss and debate answers to improve their collective understanding (Ur Rahim et al., 2024).</li> <li>● Game-based learning environments encourage self-directed learning and persistence, although scaffolding and structured support are essential to address variability in student interaction (Ke, Dai, &amp; West, 2024).</li> <li>● Gamification elements, such as role-playing and defined responsibilities in writing tasks, empower students to take ownership of their learning (Bal, 2019).</li> </ul>	<ul style="list-style-type: none"> <li>● A comprehensive review of how game-based approaches have been developed and integrated into the STEM classroom showcased that integrating games increased student motivation, engagement, and scientific inquiry of the students (Fante, Ravicchio, &amp; Manganello, 2024).</li> <li>● Results of the BIG GAME project, which is a story-driven investigative exploration approach to engage students, indicate enhanced engagement and motivation of students (Tramonti et al., 2024).</li> <li>● Game-based learning application positively influences student engagement in science, while traditional or conventional teaching methods lead to disengagement (Khan, Ahmad, &amp; Malik, 2017).</li> <li>● While exploring shallow (simple) and deep (in-depth) gamification styles with second-grade students, deep gamification showed higher motivation levels with the students (del Olmo-Muñoz et al., 2023).</li> </ul>

<b>Theme 2:</b> Increased Problem-Solving Skills	
<p>Gamification and game-based learning promote problem solving through strategy development and real-world applications.</p>	<p>Gamification and game-based learning through the implementation of programs like the BIG GAME project and knowledge check strategy enhances problem-solving and critical thinking skills.</p>
<ul style="list-style-type: none"> <li>● Game-based learning environments like <i>eRebuild</i> encourage students to refine their mathematical precision and iterative problem-solving approaches. Students demonstrated improved performance in tasks requiring spatial and numerical reasoning over time, transitioning from trial-and-error strategies to systematic problem-solving (Ke, Dai, &amp; West, 2024).</li> <li>● Contextual games such as Minecraft for geometry and ratios or probability-based escape rooms enhance students' abilities to apply mathematical concepts to practical scenarios, fostering deeper understanding and strategic thinking (Stohlmann, 2023).</li> <li>● By employing Krulik and Rudnick's heuristic problem-solving steps, GEMAS challenges students to plan, execute, and verify their solutions, fostering structured and strategic approaches to math problems (Lukman et al., 2023).</li> </ul>	<ul style="list-style-type: none"> <li>● Using the BIG GAME project, students developed their critical skills of problem-solving, teamwork, and scientific reasoning. Students apply their knowledge to real-world scenarios where they increase their problem-solving skills. Peer assessment also promoted critical thinking amongst the students (Tramonti et al., 2024).</li> <li>● The knowledge check (check-ins during learning games) strategy enhances problem-solving awareness amongst seventh-grade chemistry students using game-based learning. While gaming, students were required to answer factual and conceptual questions (Chen, Hwang, &amp; Chen, 2024).</li> <li>● By exploring and comparing shallow (simple) and deep (in-depth) gamification techniques, it was found that both techniques improved computational thinking skills. Instruction with both types of gamifications showed improvement for the second-grade students for problem-solving skills (del Olmo-Muñoz et al., 2023).</li> </ul>

<b>Theme 3:</b> Increased Academic Progress	
<p>Gamification and game-based learning promote increased academic progress on test scores and exam performance.</p>	<p>Gamification and game-based learning significantly increases academic progress and student achievement as shown on assessment scores.</p>
<ul style="list-style-type: none"> <li>● Incorporating game elements like badges and leaderboards into learning platforms, resulted in higher exam scores compared to traditional instruction methods. (Turan et al., 2016).</li> <li>● Middle school students participating in technology-integrated conceptual games, such as <i>Hit the Target</i>, showed measurable gains on state mathematics assessments. These games emphasized conceptual understanding, contributing to higher academic achievement (Stohlmann, 2023).</li> <li>● Students reported better retention and understanding of mathematical concepts after using Kahoot, which was reflected in improved performance on math tests (Ur Rahim et al., 2024).</li> <li>● Students who participated in GEMAS sessions demonstrated significant improvements in post-test scores compared to pre-tests, highlighting the game's effectiveness in enhancing academic performance (Lukman et al., 2023).</li> </ul>	<ul style="list-style-type: none"> <li>● Game-based learning (GBL) enhances student achievement and academic progress as evidenced by evolving pedagogical approaches and improved scores on post-assessments (Fante, Ravicchio, &amp; Manganello, 2024).</li> <li>● Three teaching methods were compared: all traditional, traditional with DGBL (digital game-based learning) practice, and all DGBL. Higher academic achievements were noted with the traditional plus DGBL practice method (Amzalag, Kadusi, &amp; Peretz, 2024).</li> <li>● The use of knowledge checks in addition to game-based learning showcased higher academic progress amongst the students. The strategy showed a deeper comprehension and critical thinking of the students (Chen, Hwang, &amp; Chen, 2024).</li> <li>● Pre-existing knowledge was measured using quantitative methods along with post-assessment data to measure success of both gender groups. Girls showed significant academic gains compared to boys (Khan, Ahmad, &amp; Malik, 2017).</li> </ul>

## Literature Review

### Introduction

As middle school math and science teachers in Baltimore County Public Schools, we face the ongoing challenge of fostering consistent academic engagement and progress amongst students in both in-person and online learning environments. Traditional methods often struggle to fully engage learners, particularly in virtual environments where distractions are prevalent and opportunities for hands-on collaboration are limited. The lack of engagement affects not only individual student success but also the broader school community, where student performance directly influences schoolwide goals for equity and academic excellence.

One potential solution to this challenge is gamification—the application of game-based elements such as points, badges, and leaderboards in non-game contexts to motivate and engage learners. By integrating gamification strategies alongside game-based learning, teachers can create dynamic, interactive environments that captivate students and enhance their problem-solving skills. These approaches have shown promise in transforming student engagement with curriculum content, fostering deeper learning and improving academic achievement. Teachers can inspire deeper learning and engagement by incorporating these strategies into instruction, motivating students and strengthening their problem-solving skills.

### Theme 1: Increased Engagement and Motivation

Research has shown that gamification and game-based learning are powerful strategies for enhancing student motivation and engagement. For example, studies in writing education highlight how collaborative digital storytelling encourages creative expression and social interaction, which motivates students to actively participate in writing tasks (Bal, 2019).

Similarly, tools like Kahoot promote collaborative play, allowing students to debate answers, deepen understanding, and build a sense of shared purpose (Ur Rahim et al., 2024). These interactive experiences create student-centered environments where engagement thrives.

Game-based learning also supports self-directed learning and persistence, particularly when scaffolding is effectively implemented to address diverse student needs (Ke, Dai, & West, 2024). Strategies such as role-playing with specific responsibilities empower students to take ownership of their learning, further boosting motivation (Bal, 2019). These methods illustrate how gamification can transform traditional instruction into immersive and engaging experiences that promote deeper learning.

In STEM education, game-based approaches have proven particularly effective in enhancing student interest and motivation. Interactive and story-driven investigative methods have been shown to increase engagement with STEM topics, promoting both scientific inquiry and sustained motivation (Fante, Ravicchio, & Manganello, 2024). For instance, the BIG GAME project, which employs story-driven investigative exploration, revealed significantly higher levels of student engagement compared to traditional teaching methods (Tramonti et al., 2024). These findings emphasize the transformative potential of game-based learning in creating active and engaging educational environments, especially in contrast to the disengagement often associated with conventional approaches (Khan, Ahmad, & Malik, 2017).

The depth of gamification also plays a critical role in fostering student engagement. Recent research comparing shallow and deep gamification styles among students found that deep gamification, which integrates game-based learning comprehensively into the lesson, significantly enhances motivation levels (del Olmo-Muñoz et al., 2023). By incorporating more

complex and immersive game elements, educators can further amplify the motivational and engagement benefits of gamified instruction. Collectively, the research demonstrates that gamification and game-based learning are effective pedagogical tools that increase engagement in the classroom.

### **Theme 2: Increased Problem-Solving Skills**

Gamification and game-based learning have been shown to enhance problem-solving skills by fostering strategic thinking and helping students apply concepts to real-world scenarios. Programs such as eRebuild support the development of mathematical precision and help students transition from trial-and-error to systematic problem-solving, strengthening both spatial and numerical reasoning (Ke, Dai, & West, 2024). In addition, GEMAS, an interactive math learning game software, incorporates structured problem-solving steps, guiding students through planning, execution, and verification, which cultivates disciplined and methodical thinking (Lukman et al., 2023). These examples highlight how gamified learning environments create engaging and systematic frameworks that nurture robust problem-solving abilities.

Similarly, the BIG GAME project and the knowledge check strategy further demonstrate gamification's potential to build critical thinking and problem-solving skills. The BIG GAME project fosters teamwork and scientific reasoning while enhancing students' abilities to tackle complex problems (Tramonti et al., 2024). The knowledge check strategy, which involves targeted questions during gameplay, has proven particularly effective for seventh-grade chemistry students. By blending factual and conceptual challenges, this approach strengthens content understanding and sharpens critical thinking (Chen, Hwang, & Chen, 2024). Research comparing shallow gamification techniques, such as simple digital review games, with deep

gamification, such as fully immersive digital lessons, also demonstrates the effectiveness of gamified methods in improving computational and problem-solving skills, even among younger learners (del Olmo-Muñoz et al., 2023).

Overall, these studies reveal how gamification leverages structured strategies and dynamic engagement to foster higher-order thinking. By combining interactive activities with thoughtful problem-solving frameworks, gamified approaches not only motivate students but also equip them with the skills needed to address challenges strategically and effectively. This innovative approach encourages collaboration amongst students, enabling them to share perspectives and solutions to various problems.

### **Theme 3: Increased Academic Progress**

Gamification and game-based learning strategies have been shown to significantly enhance academic progress by improving test performance, comprehension, and overall achievement. Integrating game elements such as badges and leaderboards into learning platforms has led to measurable improvements in exam scores compared to traditional teaching methods (Turan et al., 2016). For instance, middle school students who used conceptual games like *Hit the Target* demonstrated substantial gains on state mathematics assessments by reinforcing conceptual understanding through interactive gameplay (Stohlmann, 2023).

In addition to test performance, gamified tools such as Kahoot have been proven to enhance retention and comprehension of complex concepts, contributing to improved academic performance (Ur Rahim et al., 2024). Similarly, GEMAS sessions—a structured approach to game-based activities—have shown notable improvements in post-test scores, highlighting the value of gamification in advancing students' understanding of subject material (Lukman et al.,

2023). A study analyzing traditional instruction with traditional practice, digital game-based learning (DGBL) integrated practice, and full DGBL instruction found that combining traditional methods with DGBL practice yielded the highest academic performance gains (Amzalag, Kadusi, & Peretz, 2024).

Further research has shown that gamification can address diverse learning needs and promote equitable learning opportunities. Quantitative studies using pre- and post-assessments found that girls demonstrated greater academic improvement than boys, showcasing the potential of game-based learning to support gender equity in education (Khan, Ahmad, & Malik, 2017). These insights emphasize the importance of tailoring gamified approaches to meet varied learning needs and ensure that all students can benefit from this innovative pedagogical strategy. Overall, gamification and game-based learning are transformative tools in education, not only engaging students but also driving measurable academic progress.

## **Vision for Change**

### **Professional Development Program: Gamification and Game-Based Learning for**

#### **Secondary Education**

Engaging students and fostering motivation for learning poses a significant challenge for educators in today's educational settings. The professional development program described here aims to equip teachers with innovative strategies to enhance student engagement and promote academic success. Participants will dive into the research-based benefits of gamification and explore how these approaches can increase student motivation, problem-solving skills, and academic progress. Through hands-on experiences with popular digital tools, educators will collaborate to design and implement gamified lessons that address diverse learning needs.

#### **Summary of Learning Objectives**

Participants will:

1. Understand the research-based benefits of gamification and game-based learning, including increased engagement, problem-solving skills, and academic progress.
2. Explore strategies to integrate gamification into their instructional practices effectively.
3. Develop skills in using digital tools and platforms such as Kahoot, Minecraft, and GEMAS for classroom implementation.
4. Collaborate with colleagues to design and implement gamified learning activities tailored to their content areas.
5. Reflect on how gamification can be used to address diverse learning needs and foster student achievement.

### Sample Schedule for One Workshop

<b>Time</b>	<b>Activity</b>	<b>Description</b>
9:00 – 9:15 AM	<b>Welcome and Icebreaker</b>	Participants introduce themselves and engage in a gamified icebreaker using Kahoot to demonstrate its potential for community-building.
9:15 – 10:00 AM	<b>Research Overview</b>	Facilitator presents a lecture summarizing the research findings on gamification and game-based learning, focusing on benefits and practical examples.
10:00 – 10:45 AM	<b>Exploring Tools: Hands-On Activity</b>	Participants explore digital tools like Kahoot, Minecraft, or GEMAS in small groups, completing pre-designed challenges.
10:45 – 11:00 AM	<b>Break</b>	Refreshment break to network and recharge.
11:00 – 11:45 AM	<b>Collaborative Design: Gamified Lessons</b>	Teachers collaborate in groups to design a gamified activity for their subject area using templates and shared tools.
11:45 – 12:00 PM	<b>Reflection and Next Steps</b>	Participants share key takeaways and plan for implementing gamified strategies in their classrooms.

## **Overview of Four-Workshop Series**

### **Workshop 1: Introduction to Gamification in Education**

- Focus: Understanding the research and theoretical framework for gamification.
- Activities: Lecture, exploration of tools, and collaborative planning.

### **Workshop 2: Gamification Design Strategies**

- Focus: Designing gamified activities and assessments for specific content areas.
- Activities: Hands-on design sessions and peer feedback.

### **Workshop 3: Implementing Gamified Lessons**

- Focus: Best practices for implementation and managing classroom dynamics.
- Activities: Role-playing scenarios and practice sessions using designed activities.

### **Workshop 4: Reflection on Gamification**

- Focus: Analyzing student outcomes and planning for long-term integration.
- Activities: Sharing success stories, troubleshooting challenges, and brainstorming

## **Lesson Plan: Workshop 1 – Introduction to Gamification in Education**

### **Objective:**

Participants will explore the benefits of gamification, analyze research findings, and experience gamification tools to prepare for implementing gamified strategies in their classrooms.

### **Materials Needed:**

- Projector and computer
- Participant handouts summarizing research
- Devices for participants (laptops or tablets)
- Access to Kahoot, Minecraft, and GEMAS

### **Workshop Sequence:**

#### **1. Welcome and Icebreaker (15 minutes)**

- Activity: Participants engage in a live Kahoot quiz focused on fun educational trivia. Goal: Demonstrate engagement potential and build rapport.

#### **2. Research Overview (45 minutes)**

- Lecture: Facilitator presents key research findings on gamification, emphasizing increased engagement, problem-solving, and academic performance.
- Visual aids: Graphs and videos showcasing real-world classroom examples.
- Discussion: Participants reflect on challenges and opportunities in their current practices.

#### **3. Exploring Tools: Hands-On Activity (45 minutes)**

- Activity: Participants rotate through stations to try out Kahoot, Minecraft, and GEMAS.
- Task: Complete a pre-designed mini lesson at each station to experience how these tools can enhance learning.
- Support: The facilitator and assistants provide guidance and answer questions.

#### **4. Collaborative Design: Gamified Lessons (45 minutes)**

- Activity: Small groups brainstorm ideas for gamified lessons in their subject areas, using templates provided.

- Sharing: Groups present their ideas for peer feedback.

#### **5. Reflection and Next Steps (15 minutes)**

- Journal prompt: "What is one takeaway from today that you are excited to try in your classroom?"
- Discussion: Facilitator outlines upcoming workshops and shares resources for further exploration.

### **Support for Implementation**

#### **1. Resources**

- Access to templates, tools, and lesson examples from the workshops.
- List of recommended apps and platforms with tutorials.

#### **2. Ongoing Collaboration**

- Establish a peer network or professional learning community for sharing progress and troubleshooting challenges.

#### **3. Coaching**

- Provide follow-up coaching sessions to help teachers refine and troubleshoot their gamified lessons.

#### **4. Student Feedback Mechanisms**

- Equip teachers with methods to gather and analyze student feedback on gamified lessons for continuous improvement.

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