Journal of Informatics Education and Research
ISSN: 1526-4726
Vol 5 Issue 1 (2025)

A Classroom Experiment Using Blippar to Innovate Teaching Procedures and Enhance Student Understanding of 3D Printing, Gamixfication Reality

Deepak Sharma[1, a], Jitendra Sharma[2, b], Niket Mehta[3, c]

[1] Deepak Sharma*
Research Scholar, Faculty of Design & Arts, Animation & VFX Department, Poornima University,Jaipur, Rajasthan (India)
[a]deepaks.sharma20@gmail.com
Orcid: 0000-0002-6599-4574

[2] Jitendra Sharma
HOD, Dean, Faculty of Design & Arts, Animation & VFX Department, Poornima University, Jaipur, Rajasthan (India)
[b]jitendra.sharma@poornima.edu.in
Orcid: 0000-0002-1018-5366

[3] Niket Mehta
Assistant Professor, Animation & Multimedia Department, Birla Institute of Technology, Noida (India)
[c]niket@bitmesra.ac.in
Orcid: 0000-0001-7832-2104

ABSTRACT

It is difficult for many science and engineering undergraduate students to develop a visual image of the complicated, multi-stage process of 3D printing as an outcome of digital modeling to a piece of plastic. The old graphical models and discussions do not always tell the whole picture with regard to the dynamism in this technology. We have developed a new classroom experiment taking into consideration the "Gamixfication Reality" as a combination of both gamification challenges and immersive augmented reality (AR). The article provides a description of a new protocol of a practical activity in the classroom that enables students to work with smartphones or AR headsets and the Blippar application with a gamified module to have an opportunity to play with virtual 3D printer parts and processes. The experiment will aim at changing a challenging technical discussion into a fun, natural, and memorable learning process, enhancing understanding and an application.

KEYWORDS: Augmented reality, Virtual reality, Gamification, Education, Science technology.

1. INTRODUCTION

Figure1. Students Learning through gamixfication Reality

The contemporary digital landscape is characterized by a relentless pursuit of innovative methods to enhance engagement, motivation, and learning across diverse platforms. In this evolving environment, gamification has emerged as a powerful strategy, leveraging game design elements in non-game contexts to captivate and motivate users.[1] Concurrently, the rapid advancements in immersive technologies, specifically Augmented Reality (AR) and Virtual Reality (VR), have revolutionized user experiences by offering dynamic, interactive, and deeply engaging environments.[1] The convergence of these two powerful paradigms—gamification and immersive reality—gives rise to a new, transformative concept: "Gamixfication Reality".[1]

Coined by researcher and game designer Deepak Sharma, Gamixfication Reality is an ideological framework that combines the principles of gamification with the capabilities of mixed reality (MR).[1] Mixed reality, often referred to as extended reality (XR), represents an immersive experience that seamlessly blends virtual reality with augmented reality, creating a new reality for the next generation of digital interaction.[1] The genesis of Gamixfication Reality lies in the potential for applications that integrate mixed reality with gamified elements to explore diverse genres across various industries.[1] This synergistic combination promises highly engaging and immersive experiences that harness game design principles to achieve specific objectives, with profound implications for education, entertainment, marketing, healthcare, wellness, and social interactions.[1]

This paper aims to delve into the foundational aspects of Gamixfication Reality. We will explore its origins, articulate its defining characteristics, and delineate its core objectives. A key focus will be to differentiate Gamixfication Reality from traditional gamification techniques, highlighting its unique advantages stemming from the integration of immersive technologies. By examining its functionality and benefits, this research seeks to underscore its potential to significantly enhance user experience, productivity, and efficiency. Furthermore, the paper will discuss the broader impact and implications of Gamixfication Reality on learners and users, while also addressing the inherent limitations and outlining promising avenues for future development and research.

1.1. Background and Origin

The individual concepts of gamification and augmented reality have been established for some time, each independently contributing to engaging audiences through immersive experiences across various sectors.[1] Gamification, at its core, is the strategic application of game elements and principles to non-game contexts to boost engagement, motivation, and participation.[1] Augmented Reality (AR) enriches the real world by overlaying digital information, while Virtual Reality (VR) creates fully simulated environments. Mixed Reality (MR) then takes this a step further, merging real and virtual worlds to produce new environments and visualizations where physical and digital objects coexist and interact in real time.

The conceptualization of "Gamixfication Reality" arises from the recognition that the combined power of gamification and mixed reality can unlock unprecedented levels of immersion and interaction. This fusion is not merely additive but transformative, creating experiences that are more compelling and effective than either component alone.[1] The origin of this ideology is rooted in the burgeoning applications where mixed reality and gamified elements converge to redefine engagement across diverse industries, from educational simulations to interactive entertainment and professional training.[1]

1.2. Objectives of Gamixfication Reality

Gamixfication Reality is driven by several key objectives designed to revolutionize interaction and learning:**Blending Real-World Applications:** A primary objective is to seamlessly integrate real-life applications with extended reality. This involves creating experiences where digital or virtual components are smoothly combined with the actual, physical environment. The goal is to enable users to meaningfully engage with and respond to digital content while leveraging the context of their real surroundings.[1] This includes contextual communication, where the surrounding environment is a key factor in user interactions, such as navigating a city or museum with digital overlays.[1]

Figure 2 : Gamixfication Mixed reality Interaction learning

1. **New Perspectives to Entertainment and Learning Processes:** Gamixfication Reality aims to create captivating and enjoyable mixed reality experiences that provide entertainment and delight.[1] These immersive encounters are designed to be both engaging and memorable, fostering social connection and mutual enjoyment when users participate alone or in groups.[1] In education, the objective is to significantly increase student engagement through gamified augmented learning activities, encouraging active involvement and creating a more fun and engaging extended learning environment, ultimately leading to improved learning outcomes and better comprehension.[1]

Figure3: Learning through Gamixfication reality (Badges,points,rewards)

2. **Research Development and Innovation:** A major objective is to facilitate experimental learning for researchers and innovators by providing deeper understanding and insights through simulations.[1] Gamixfication Reality can transform traditional research processes into hands-on experimental learning, boosting creativity and problem-solving abilities. It offers next-generation researchers and innovators enhanced resources for exploration and training in their specializations, making complex subjects more approachable and increasing interest in certain professions.[1]

2. LITERATURE REVIEW

The integration of advanced technologies and innovative pedagogical approaches is a defining characteristic of modern education. This review synthesizes existing academic literature on Augmented Reality (AR) and Virtual Reality (VR) in education, the impact of gamification on learning outcomes, their synergistic effects, and their specific application in technical education.

2.1. Recent Trends and Existing Research on AR/VR in Education

Augmented Reality and Virtual Reality are increasingly prevalent in diverse educational settings, largely due to their dynamic and interactive capabilities.[3] These immersive technologies have demonstrated significant potential in enhancing knowledge retention and facilitating skill development across a wide array of disciplines, including STEM fields, medicine, and language learning.[3] AR, by overlaying digital information onto the real world, allows for the visualization of complex concepts, such as the human body in 3D or molecular structures, in a tangible and interactive manner.[13] This capability is particularly beneficial for abstract subjects that are difficult to convey through traditional static diagrams or textbooks. Similarly, VR platforms provide fully immersive simulations that enable hands-on experiences, with data suggesting a 75% higher retention rate for students utilizing VR in training compared to traditional methods.[4]

Empirical evidence consistently supports the efficacy of AR/VR. Studies have reported a 30% increase in comprehension and retention scores for participants engaging with AR/VR-based learning compared to traditional methods.[13] Furthermore, 85% of students in AR/VR groups have reported higher engagement, and 70% found that the interactive nature of these platforms improved their understanding of complex concepts.[13] Despite these compelling benefits, the widespread adoption of AR/VR in education faces several challenges, including high equipment costs, technical constraints, and the need for robust infrastructure.[3] Effective deployment necessitates collaborative efforts among educators, policymakers, and industry stakeholders to ensure accessibility, develop appropriate pedagogical frameworks, and provide adequate teacher training.[3]

2.2. Comprehensive Overview of Gamification's Impact on Student Engagement and Learning Outcomes

Gamification, defined as the strategic application of game design elements—such as points, badges, leaderboards, and challenges—into non-game educational contexts, is a potent strategy for increasing student engagement and performance.[2] Research consistently demonstrates gamification's positive influence on student motivation and engagement, leading to increased behavioral engagement in various learning environments and fostering more enjoyable learning experiences.[14] This approach is particularly effective because it taps into intrinsic motivation by providing immediate feedback and recognition, and by addressing fundamental psychological needs for autonomy, competence, and relatedness.[14]

Numerous studies have reported improved learning outcomes and academic performance in gamified learning environments. For instance, gamified learning has shown better success rates, excellence rates, and average grades compared to both online and traditional learning methods in both theoretical and applied course settings.[15] Students often perceive gamification as an effective educational approach that enhances their learning outcomes, engagement, productivity, and motivation, triggering both intrinsic and extrinsic drive.[15] However, it is important to acknowledge that the effectiveness of gamification is highly dependent on its implementation; poorly designed systems can lead to adverse outcomes such as frustration, disengagement, or an overemphasis on extrinsic rewards.[14]

2.3. Exploration of the Synergistic Effects when AR/VR and Gamification are Combined

The convergence of AR/VR technologies and gamification is profoundly reshaping traditional pedagogical practices, fostering the creation of highly immersive educational ecosystems that are adaptable to the individual needs of students.[16] When combined, these technologies enhance engagement, motivation, and knowledge retention, particularly in disciplines that demand spatial visualization and practical simulations, such as science, medicine, and engineering.[16] The integration of game elements, such as scoring systems, badges, and collaborative competition, within immersive environments

activates intrinsic motivational mechanisms. This synergy enhances persistence in the face of complex cognitive challenges, leading to more profound learning.[16]

Examples of this combined approach include the use of VR and gamified escape rooms in healthcare education. These applications have been shown to improve clinical decision-making, teamwork, and knowledge retention in high-pressure scenarios, demonstrating the transformative potential of such integrated frameworks.[17] This convergence signifies a "systemic reconfiguration of the educational process," moving beyond isolated pedagogical gains to a more holistic and effective learning paradigm.[16]

2.4. Specific Focus on the Application and Effectiveness of AR/VR in 3D Printing Education

In the context of technical education, AR specifically aids students in overcoming challenges associated with technical drawings by enhancing their visualization skills, which are crucial for interpreting complex images.[12] For 3D printing education, AR applications can facilitate the exploration of key 3D printer components—such as the filament, heat bed, and nozzle—through real-time visualization and interactive 3D models.[6] This allows students to understand the functionality and interplay of these parts in a cost-effective and risk-free environment, a significant improvement over static diagrams or theoretical descriptions.[6]

Similarly, VR holds transformative potential in 3D printing education by bridging the gap between theoretical knowledge and practical application. It enables students to design and test virtual prototypes, gaining firsthand experience of engineering concepts in practice.[10] This immersive approach fosters a deeper understanding of the subject and enhances problem-solving skills. Empirical studies have already demonstrated significant improvements in knowledge retention and engagement in AR-enhanced 3D printing education, with one study reporting a 40% score increase in the AR group compared to a 15% increase in a control group.[6]

2.5 Overcoming a Common Hurdle in Technical Education

Figure.1 (Augmented Reality experiment Test 3D Printer)

3D printing is taught in most designing and engineering courses. Yet, the students have difficulty in understanding the complex interaction between a 3D model (CAD file) and the slicing process (converting the model into G-code) and the actual layering (Fused Deposition Modeling - FDM) that make an object real. This workflow is largely abstract, which poses a serious pedagogical problem.

To this end, we propose a brand-new classroom experiment that exploits the potential of two strong modern technologies, namely, gamification and augmented reality (AR). We have exported this synergetic methodology, so it is known as Gamixfication Reality. It transforms students into active participants instead of mere observers and enables them to get inside the process of 3D printing within the comfort of their own classroom. This paper explains a process of conducting

such an experiment with the help of readily available Blippar application that can make a challenging concept interesting and enjoyable.

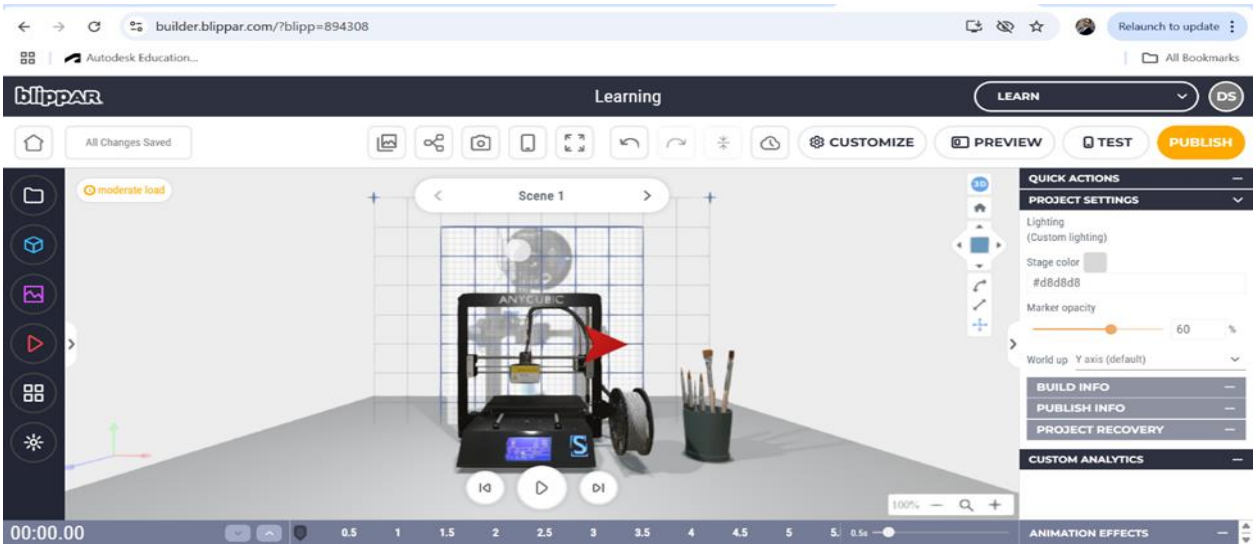

Figure.2 Blippar Interface Setting up AR experience

2.6 THE CONCEPT: What is Gamixfication Reality?

Gamixfication Reality integrates game design elements—such as points, challenges, and rewards—with the immersive, interactive capabilities of augmented reality.

Augmented Reality (AR) enriches the real world by overlaying digital information and interactive models onto it, typically viewed through a smartphone or AR glasses.

Gamification applies game-like rules to boost motivation and engagement in non-game contexts.

By combining these, the learning process becomes an interactive quest rather than a passive lesson, promoting skill development, problem-solving, and deeper understanding.

Figure 3. Students engage with a "Gamixfication Reality" lesson, where learning objectives are visualized as interactive game elements.

3. THE CLASSROOM EXPERIMENT: A Step-by-Step Procedure

This experiment is designed for a typical 90-minute undergraduate lab session. It uses the Blippar platform to deliver AR and gamified content.

Objective

To provide students with an intuitive, hands-on understanding of the 3D printing workflow, specifically the functions of key components and the transition from a digital model to a physical object.

Materials

For the educator: A Blippar account with the pre-created 3D printing learning campaign.

For each student/group:

- A smartphone or tablet with the Blippar application installed, or an AR headset.
- A printed marker image (a "Blipp") to activate the AR experience.
- A clear desk space.
- 3D Asset of 3D printer and elements

Experimental Procedure for Students

The experiment is conducted using the Blippar application, which guides students through three gamified modules. Students earn points and badges for completing each stage.

Module 1: The Anatomy of a 3D Printer (15-20 minutes)

1. **Activation:** Students scan the printed marker with the Blippar app, which projects a disassembled virtual 3D printer onto their desk.
2. **Challenge:** Their first task is to correctly identify and assemble the main components: the build plate, extruder, nozzle, and filament spool.
3. **Interaction:** Students tap on a component and then tap the corresponding location on the disassembled printer. Correct placements trigger a positive animation and sound, while incorrect placements provide a hint.
4. **Learning Outcome:** This interactive puzzle helps students learn the name and location of each critical component far more effectively than looking at a diagram.

Module 2: From CAD to G-Code (20-25 minutes)

1. **Challenge:** Students select a 3D model from the app's library. They are then tasked with correctly "slicing" the model by adjusting on-screen sliders for layer height and print speed.
2. **Visualization:** Once they finalize their settings, the application visualizes the slicing process, showing the 3D model being deconstructed into thin layers. This visualizes a process that is otherwise invisible.
3. **Learning Outcome:** This module demystifies the abstract concept of "slicing" by providing a clear, interactive visualization.

Module 3: The Virtual Print & Troubleshooting (25-30 minutes)

1. **Challenge:** Students initiate the "virtual print." An animation shows the object being built layer by layer on their desk.
2. **Interactive Troubleshooting:** The app simulates a common print error (e.g., "filament jam"). The student must correctly identify the problem and select the right virtual tool to fix it, earning bonus points.
3. **Reward:** Successfully completing the print unlocks a final achievement badge within the app.

4. **Learning Outcome:** This final module solidifies the student's understanding of the entire workflow and introduces practical problem-solving in a risk-free environment.

4. PEDAGOGICAL BENEFITS AND DISCUSSION

The following are some of the benefits that come with this Gamixfication Reality experiment via Blippar:

Accessibility: Accessibility to the experiment is increased due to usage of a common app, such as Blippar in smartphones; making the experiment more affordable to institutions with relatively low budgets in purchase of VR headsets.

Increased visualization: It offers a three-dimensional and interactive view that brings abstract things closer to us.

Higher Intrinsic Motivation and Involvement: Game nature and instant feedback turns the learning process into something more entertaining and increases intrinsic motivation.

Active, Hands-On Learning: The students will not just receive information but rather be actively engaged; this is shown to increase retention and will lead to increased confidence.

Safe discovery: Students can experiment and make errors without using real materials that are destroyed or high-priced equipment getting broken.

5. CONCLUSION

The suggested Gamixfication Reality and Blippar application classroom experiment is an effective and functional pedagogical tool that can be used with the help of the Gamixfication Reality environment. It provides an effective response to the long-running issue of teaching process-oriented and complex courses such as 3D printing. This can go a long way in enhancing student participation and understanding by visualizing the unseen and interacting with the abstract. In our view, such pioneering, enthusiastic access type experiments are critical to the future of science and engineering education and we strongly urge teachers to borrow and modify these methods and move them into their classrooms.

REFERENCES

1. Bucchiarone, A. (2022, December). Gamification and Virtual Reality for Digital Twins Learning and Training: Architecture and Challenges. *Virtual Reality & Intelligent Hardware, 4*(6), 471-486.
2. Claros-Perdomo, D. C., Millán-Rojas, E. E., & Gallego-Torres, A. P. (2020, July 2). Application of augmented reality, gamification and m-learning. *Metaverse, 1*(2), 8.
3. Holt, S. (2023, February). Virtual reality, augmented reality and mixed reality: For astronaut mental health; and space tourism, education and outreach. *Acta Astronautica, 203*, 436-446.
4. R., Anwar, S., & Wasim, M. (2019). Augment Reality in Education System A Review. *International Journal of Advance Research and Innovation, 7*(3), 56-62.
5. Sanchez, D. R., Langer, M., & Kaur, R. (2020). Gamification in the classroom: Examining the impact of gamified quizzes on student learning. *Computers & Education, 144*, 103666.
6. Van Krevelen, D., & Poelman, R. (2010, January 1). A Survey of Augmented Reality Technologies, Applications and Limitations. *International Journal of Virtual Reality, 9*(2), 1-20.
7. Wu, Y., Zhang, M., Li, X., Gan, Y., & Zhao, C. (2020, November 11). Augment Reality-Based Teaching Practice. *Biomedical Engineering Education, 1*(1), 237-241.
8. Game on for learning: a holistic exploration of Gamification's impact on student engagement and academic performance in educational environments | Emerald Insight, accessed on July 21, 2025, https://www.emerald.com/insight/content/doi/10.1108/manm-01-2024-0001/full/html
9. (PDF) Revolutionizing Education Through Augmented Reality (AR) and Virtual Reality (VR): Innovations, Challenges and Future Prospects - ResearchGate, accessed on July 21, 2025, https://www.researchgate.net/publication/389556966_Revolutionizing_Education_Through_Augmented_Reality_AR_and_Virtual_Reality_VR_Innovations_Challenges_and_Future_Prospects
10. Future Trends - AR and VR Growth in the Education App Market - MoldStud, accessed on July 21, 2025, https://moldstud.com/articles/p-future-trends-ar-and-vr-growth-in-the-education-app-market

11. Impact of gamification on school engagement: a systematic review - Frontiers, accessed on July 21, 2025, https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2024.1466926/full
12. Enhancing 3D Printing Education Through Augmented Reality: Development, Implementation, and Impact on Student Learning Outcomes - ResearchGate, accessed on July 21, 2025, https://www.researchgate.net/publication/392991469_Enhancing_3D_Printing_Education_Through_Augmented_Reality_Development_Implementation_and_Impact_on_Student_Learning_Outcomes
13. The Difficulties of Traditional Educational Methodologies and How to Overcome Them, accessed on July 21, 2025, https://www.soroll.com/the-difficulties-of-traditional-educational-methodologies-and-how-to-overcome-them/
14. Top 10 Challenges of Traditional Training | Medium, accessed on July 21, 2025, https://medium.com/@jim_wiedman/top-10-challenges-of-traditional-training-270e638c3537
15. The Truth About Immersive Learning And Its Sharp Benefits - eLearning Industry, accessed on July 21, 2025, https://elearningindustry.com/the-truth-about-immersive-learning-and-its-sharp-benefits
16. Understanding Immersive Learning and its Benefits, accessed on July 21, 2025, https://www.zenarate.com/contact-center-glossary/immersive-learning/
17. Integrating 3D Printing And VR For Classroom Learning And Industry Applications, accessed on July 21, 2025, https://www.immersivelearning.news/2025/01/14/integrating-3d-printing-and-vr-for-classroom-learning-and-industry-applications/
18. Augmented reality in engineering education: enhancing learning and application - Frontiers, accessed on July 21, 2025, https://www.frontiersin.org/journals/virtual-reality/articles/10.3389/frvir.2024.1461145/full
19. Impact of Augmented Reality (AR) and Virtual Reality (VR) on Interactive Learning Systems, accessed on July 21, 2025, https://www.researchgate.net/publication/388917561_Impact_of_Augmented_Reality_AR_and_Virtual_Reality_VR_on_Interactive_Learning_Systems
20. The Impact of Educational Gamification on Student Learning Outcomes - International Journal of Research and Innovation in Social Science, accessed on July 21, 2025, https://rsisinternational.org/journals/ijriss/articles/the-impact-of-educational-gamification-on-student-learning-outcomes/
21. Impact of Gamification on Students' Learning Outcomes and Academic Performance: A Longitudinal Study Comparing Online, Traditional, and Gamified Learning - MDPI, accessed on July 21, 2025, https://www.mdpi.com/2227-7102/14/4/367
22. gamification, artificial intelligence and virtual reality: the future of the classroom is here! - New Science, accessed on July 21, 2025, https://periodicos.newsciencepubl.com/arace/article/download/4239/6103/17687
23. Traditional medical education under siege: the revolutionary integration of virtual reality and gamification in medical escape rooms - PMC, accessed on July 21, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC12211356/