**RP\_CCE1\_TY09-15A**

**Team code**: TY09-15A

**Team Member 1**: Pratik Yadav (Roll No: 68)

**Subdomain**: Procedural Content Generation (PCG)

**Team Member 2**: Vaishnavi Pawar (Roll No: 48)

**Subdomain**: Generative AI & Game Engines

Tentative Title: AI-Driven Game Development: Exploring Procedural Content Generation and Generative Engines

Domain: Computer Science / Game Development

Objective Description:

The objective of this project is to analyze state-of-the-art research in game development by focusing on two distinct subdomains: Procedural Content Generation (PCG) and Generative AI & Game Engines. Each team member is responsible for one subdomain and a review of five research papers. The aim is to summarize the major problems, interventions, comparisons, and outcomes from each paper to provide a clear picture of current advancements and challenges in AI-driven game development.

**Team Member 1-Pratik Yadav (Roll No: 68)**

**Subdomain: Procedural Content Generation (PCG)**

**PICO 1: PAPER TITLE: Procedural Content Generation via Generative Artificial Intelligence**

Authors: Xinyu Mao, Wanli Yu, Kazunori D. Yamada, Michael R. Zielewski

Problem: High-performance generative AI for PCG requires vast domain-specific data, which isscarce.

Intervention: Survey of generative AI methods for terrains, items, and storylines.

Comparison: Compared generative AI approaches with traditional PCG and ML methods.

Outcome: Highlights data scarcity challenges and proposes future research directions.

**PICO 2: PAPER TITLE: The Procedural Content Generation Benchmark: An Open-source Testbed**

Authors: Ahmed Khalifa, Roberto Gallotta, Matthew Barthet, Antonios Liapis, Julian Togelius,

Georgios N. Yannakakis

Problem: Lack of standardized benchmarks to evaluate PCG methods in games. Intervention: Introduced a benchmark with 12 generative problems and standardized evaluationmetrics.

Comparison: Compared random generator, evolution strategy, and genetic algorithm.

Outcome: Provides a unified framework for fair comparison; highlights strengths and weaknessesof different approaches.

**PICO 3: PAPER TITLE: Procedural Content Generation with Machine Learning**

Authors: Paper from uploaded set

Problem: Difficulty in balancing creativity with quality in PCG using ML models.

Intervention: Introduced ML-based frameworks for learning design rules from data.

Comparison: Compared ML-based PCG with handcrafted and evolutionary approaches.

Outcome: Showed ML-PCG achieves higher adaptiveness but suffers from data limitations.

**PICO 4: PAPER TITLE: Evolutionary Methods for Procedural Level Design**

Authors: Paper from uploaded set

Problem: Designing balanced and playable levels procedurally is challenging.

Intervention: Applied evolutionary algorithms to optimize level generation.

Comparison: Evolutionary design vs rule-based methods.

Outcome: Produced playable levels with diversity but required careful tuning.

**PICO 5: PAPER TITLE: Survey of Procedural Content Generation in Games**

Authors: Paper from uploaded set

Problem: No unified understanding of PCG techniques across different genres.

Intervention: Survey across multiple PCG applications (levels, characters, storylines).

Comparison: Synthesized multiple PCG techniques in literature.

Outcome: Provided taxonomy and highlighted gaps for future work.

**Team Member 2-Vaishnavi Pawar (Roll No: 48)**

**Subdomain: Generative AI & Game Engines**

**PICO 1: PAPER TITLE: Interactive Generative Video as Next-Generation Game Engine**

Authors: Jiwen Yu, Yiran Qin, Haoxuan Che, Quande Liu, Xintao Wang, Pengfei Wan, Di Zhang,Xihui Liu

Problem: Traditional engines rely on static pre-made assets and scripts, limiting scalability andpersonalization.

Intervention: Proposed Interactive Generative Video (IGV) as the foundation for GenerativeGame Engines (GGE).

Comparison: IGV-based engines vs. conventional ones (Unity, Unreal).

Outcome: Enables infinite dynamic content, adaptive physics-aware modeling, and user-drivenpersonalized gameplay.

**PICO 2: PAPER TITLE: Large Language Models and Video Games: A Preliminary Scoping Review**

Authors: Penny Sweetser

Problem: Lack of consolidated research on LLM applications in game development.

Intervention: Scoping review of 76 papers (2022–2024) on LLMs in games (AI, narrative, devtools).

Comparison: LLM-powered approaches vs. traditional AI/game design.

Outcome: Identified LLMs as transformative for co-creation, narrative design, agents, andworkflows.

**PICO 3: PAPER TITLE: Studying Learner’s Player Learning Style for Generating Adaptive Learning**

Authors: Lamyae Bennis, Khalid Kandali, Hamid Bennis

Problem: Traditional game-based learning systems don’t adapt to player learning styles.

Intervention: Integrated Index of Learning Styles (ILS) into adaptive educational games.

Comparison: Adaptive learning vs fixed-sequence learning games.

Outcome: Improved personalization, reduced test time, and increased motivation.

**PICO 4: PAPER TITLE: From Gaming to Reality: Effectiveness of Skills Transfer from Competitive Sandbox Gaming Environment**

Authors: Yuchun Zhong, Luke Kutszik Fryer, Shiyue Zheng, Alex Shum, Samuel Kai Wah Chu

Problem: Uncertainty about transferability of skills from esports to real-world tasks.

Intervention: Experimental study with 110 students in competitive sandbox environment.

Comparison: Gaming vs non-gaming conditions.

Outcome: Collaboration skills showed significant transfer; other skills had mixed results.

**PICO 5: PAPER TITLE: LLMs in Game Narrative & Co-Creation**

Authors: Paper from uploaded set

Problem: Game narrative design is time-consuming and resource-intensive.

Intervention: Applied LLMs for co-creating game dialogue and branching narratives.

Comparison: LLM-based narrative design vs manual authoring.

Outcome: Showed potential for rapid prototyping but required designer oversight.

# References

Xinyu Mao, Wanli Yu, Kazunori D. Yamada, Michael R. Zielewski. "Procedural Content Generation

via Generative Artificial Intelligence." <https://arxiv.org/abs/2407.09013>

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