Paper Analysis Notes

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October 2, 2024

1 Introduction

This document contains an analysis of papers analyzed

2 Use of Gamification and Game-Based Learning in Educating Generation Alpha: A Systematic Literature Review

2.1 Authors

- **Authors:** Pumudu A. Fernando, Salinda Premadasa

2.2 Publication

- **Publication:** Educational Technology & Society 27(2):114-132
- **Date:** April 2024

2.3 Relevant to the My Research

Yes

2.4 Aim

The study aims to explore the current state of gamification and game-based learning adoption for primary education students, using recent peer-reviewed research. Through a systematic mapping design, the reviewed papers are categorized and analyzed based on attributes like:

- Type of gamification and game mechanics.
- Evaluation context.
- Experimental outcomes.
- Academic subjects.
- Types of applications involved.

2.5 Key Focus Areas

- Type of gamification and game mechanics used.
- Focus on Generation Alpha students (primary education).
- Educational context and subjects involved.
- Experimental outcomes and effectiveness.

2.6 Gaps Addressed

- Limited to primary education students, excluding secondary and tertiary levels.
- Gen Alpha students get bored due to their changing interests.

2.7 Findings

- Gamification and game-based learning (GBL) showed positive effects on student engagement and motivation, especially in primary school subjects such as mathematics. Game elements like quizzes, storylines, and avatars were effective in boosting participation.
- Generation Alpha students generally preferred interactive and gamified learning, although some negative reactions were noted for leaderboards, which could demotivate lower-performing students. Gender differences were observed in student responses to game elements.
- Gamification strategies, particularly those with adaptive elements, improved student performance, collaboration, and social skills. These methods align well with Generation Alpha's preference for technology-driven, interactive learning.

2.8 Future Work

- **Observation of Realistic Behavioral Attributes of Generation Alpha:** Further empirical and qualitative studies are necessary to confirm the actual learning preferences and behavioral patterns of Generation Alpha, as current research largely relies on assumptions derived from previous generations.
- **Need for Novel Gamification Mechanics:** New, more engaging, and innovative game mechanics are required to go beyond the commonly used Points, Badges, and Leaderboards (PBL) framework to maintain the attention of Generation Alpha learners. Future research should explore emerging designs such as augmented reality, gamified e-books, interactive avatars, and narrative-driven role-playing games. It is also important to integrate mobile-friendly and online social communication features, such as chatbots and instant feedback, to align with Generation Alpha's preference for digital environments.
- **Need for Adaptive Gamification-Based Learning Strategies:** Further studies are needed to explore adaptive gamification strategies that account for individual learning styles, cognitive abilities, emotions, and skill levels. Research into machine learning and deep learning techniques is critical for predicting student performance and personalizing the in-game learning experience. Additionally, more refined adaptive algorithms should be developed to improve the effectiveness of adaptive games over traditional instructional methods.
- **Need for Long-Term Studies with Diverse Learner Samples:** Long-term and large-scale experiments are essential for better understanding the sustained effects of gamified learning and its long-term psychological impact. Studies should also consider factors such as gender, skill level,

socio-economic background, and prior knowledge when selecting learners for evaluating the impact of gamification on education.

2.9 Notes

The paper defines "Gamification" as "the use of game design elements in non-game contexts." It also mentions that components of games, such as points, badges, and challenges, are employed in gamification, not to build a game, but to motivate and enhance the learner's experience and increase engagement. The paper cites and explains the two diffrent types of gamification:

- **Structural Gamification:** This type of gamification involves the use of game elements like points, badges, and leaderboards to motivate learners.
- **Content Gamification:** This type of gamification involves the use of game elements like stories, characters, and challenges to engage learners.

so in more simple words structural gamification is about the rewards and content gamification is about the story and characters. There also exists Game-Based Learning (GBL) which is the use of games to teach students, as the game is mapped to the learning objectives. Structural and content gamification both are means to motivate learners, however GBL is a means to teach students.
In the gamification elements and mechanics, the paper mentions the following: the use of combinations of of storylines, narratives, and avatars appears to be a popular choice among these studies, while the traditional triad of game elements - points, badges, and leaderboards (PBL) - are used less frequently and in fewer combinations.
Most studies on gamified learning have found positive effects on learners' motivation, attention, performance, and engagement, though a few have shown mixed results. However, many of these findings rely on qualitative comments and surveys rather than empirical data, and some studies lack sufficient information about the experiment context, duration, and sample selection, making it difficult to conduct a meta-analysis. Most research has focused on using gamification in Mathematics for primary school children, with mobile educational games and apps being seen as ideal, particularly due to Generation Alpha's increased screen time and use of mobile devices.

3 Generative AI for Customizable Learning Experiences

3.1 Authors

- **Authors:** Ivica Pesovski, Ricardo Santos, Roberto Henriques, Vladimir Trajkovik

3.2 Publication

- **Publication:** Sustainability, Volume 16, Article 3034
- **Date:** April 2024
- **DOI:** 10.3390/su16073034

3.3 Relevant to My Research

Loosely relevant

3.4 Aim

The paper proposes an affordable and sustainable approach to personalizing learning materials, developing a tool integrated into an LMS.

3.5 Key Focus Areas

- Generative AI and Personalized Learning.
- Tool integrated into LMS for generating materials based on learning outcomes.
- Learning materials in three formats: traditional, pop-culture-inspired (e.g., Batman, Wednesday Addams).
- Assessment via multiple-choice questions.
- Experiment with 20 software engineering students.
- Positive findings: engagement and increased study time.

3.6 Gaps Addressed

- Lack of empirical studies on LLMs in classrooms.
- Limited research on AI-generated lesson creation.
- Unclear effectiveness of virtual AI instructors.

3.7 Findings

- Students found the different styles of learning materials engaging. While the traditional style was most used, pop-culture-inspired materials doubled the study time. AI-generated quizzes were also popular for self-assessment.
- The variety of formats (traditional and pop-culture inspired) increased engagement, particularly for students struggling with the material. Initially, fictional styles were preferred, but traditional materials became the favorite for long-term learning six months after the course.
- The experiment showed that AI-generated materials benefited less proficient students and promoted inclusivity. The method can be applied across various educational contexts to offer personalized and effective learning experiences.

3.8 Future Work

- Further study on integrating LLMs into more educational contexts.
- Long-term research on the reception of AI-generated content.

3.9 Notes

The paper emphasizes that generative AI can engage students through personalized, multi-format content that caters to various learning styles.

4 Art of Computer Game Design

4.1 Authors

- **Author:** Chris Crawford

4.2 Publication

- **Publication:** Washington State University
- **Date:** Originally published in 1982, with an electronic version in 1997
- **DOI:** Not available; however, the electronic version is accessible at Washington State University Vancouver

4.3 Relevant to My Research

Highly relevant for understanding the fundamental principles of game design and the role of games as an art form.

4.4 Aim

The book explores the concept that computer games are a new art form, focusing on how games evoke emotion through fantasy, and discusses various aspects of game design, including representation, interaction, conflict, and safety.

4.5 Key Focus Areas

- Definition of games and their fundamental components: representation, interaction, conflict, and safety.
- The role of fantasy and participation in games, making them an interactive art form.
- A comparison of games with other art forms like music and literature, emphasizing the participatory nature of games.
- Game design principles and techniques.
- The importance of emotional engagement in games.
- A taxonomy of computer games, including skill-and-action games, strategy games, and more.

4.6 Gaps Addressed

- Lack of established theories on game design.
- Minimal focus on the artistic potential of computer games in the early 1980s.
- The book challenges the view that computer games are mere entertainment, emphasizing their capacity as an art form.

4.7 Findings

- Games are an interactive form of art, allowing players to create their own experiences within the framework provided by the designer.
- The participatory nature of games offers a deeper emotional engagement compared to other art forms.
- Computer games, though still developing as an art form in the early 1980s, hold vast potential for emotional and intellectual engagement.
- The success of game design depends on understanding the fundamental elements of games and creating experiences that resonate emotionally with players.

4.8 Future Work

- Further exploration of games as an art form.
- Development of more sophisticated game design theories and methodologies.
- Expansion of the taxonomy of computer games as the industry evolves.

4.9 Notes

This foundational book in the field of game design emphasizes the artistic and participatory aspects of games, proposing that computer games have the potential to evoke deep emotional responses through interactive fantasy worlds. The text provides a basis for understanding the core principles of game design and their artistic potential.

5 Automatic Generation and Recommendation of Personalized Challenges for Gamification

5.1 Authors

- **Authors:** Reza Khoshkangini, Giuseppe Valetto, Annapaola Marconi, Marco Pistore

5.2 Publication

- **Publication:** Springer Nature
- **Date:** 24 May 2020

5.3 Relevant to My Research

Yes

5.4 Aim

The study aims to address common gamification limitations by proposing an automatic system for generating personalized and contextualized challenges based on player preferences, game status, and performance.

- Overcoming boredom and frustration caused by generic game elements like points, badges, and leaderboards.
- Automatically generating challenges that are tailored to individual players.
- Comparative evaluation between manually designed challenges and those generated automatically.

5.5 Key Focus Areas

- Use of Procedural Content Generation (PCG) for challenges.
- Player-specific challenge personalization and contextualization.
- Efficiency of automatically generated challenges in gamification.

5.6 Gaps Addressed

- The lack of personalized game elements in many gamification systems.
- Reliance on static game elements, which fail to engage players long-term.

5.7 Findings

- Automatically generated challenges showed comparable, if not superior, results in keeping players engaged compared to manually designed challenges.
- Personalized challenges improved user engagement and retention in a 12-week urban mobility experiment.
- Dynamic challenge assignment aligned with player performance and game objectives can reduce the effort required by human game designers.

5.8 Limitations

- period of the experiment was relatively short (3 weeks).
- it does not include players' characteristics and physiological signals, which are widely used in digital games for advanced personalization and to increase players' engagement
- player's elevation status was not considered in the challenges.

5.9 Future Work

- **Expansion of the System to Other Domains:** The system could be adapted to other gamification contexts beyond urban mobility.
- **Further Research on Procedural Content Generation in Gamification:** More studies on PCG for challenge personalization in different application domains.
- **Integration of Machine Learning Techniques:** Explore the use of ML to enhance personalization and adapt challenges in real-time.
- **Long-Term Impact Assessment:** Future work could focus on assessing the long-term impact of personalized challenges on user behavior and sustained engagement.

6 Notes

6.1 Research Questions

- **RQ1: Player Acceptance:** How does the player acceptance rate for automatically generated challenges compare to the acceptance rate of manually assigned challenges?
- **RQ2: Challenge Impact:** How does the improvement recorded on the target goal for automatically generated challenges compare to the improvement recorded for manually assigned challenges?

- **RQ3: Reward Efficiency:** How do the rewards computed for automatically generated challenges compare to those of manually assigned challenges?

6.2 Trento Play&Go: A Gamification Campaign

Trento Play&Go was a large-scale, long-running open-field gamification campaign that lasted 12 weeks (from September 10 to December 2, 2016). The game targeted residents of Trento, Italy, and commuters from the surrounding Trentino province. Participants used the Viaggia Play&Go mobile app to plan and track journeys, check their game status, share results, and receive notifications.

6.3 The Challenge Model

A challenge model is a system for creating personalized tasks for players. It consists of the following components:

- **Player (P)**: The individual playing the game.
- **Goal (G)**: The task or objective to be completed.
- **Constraint (C)**: Conditions for reaching the goal (e.g., deadline).
- **Difficulty (D)**: The level of challenge for the player.
- **Reward (R)**: The prize awarded for completing the challenge.
- **Weight (W)**: The importance of the challenge.

6.4 Example Challenges

- **Example 1:** Increase walking distance by 10% next week and earn 200 points (Green Leaves).
- **Example 2:** Increase train trips by 30% next month and earn an additional 20 points per trip.
- **Example 3:** Complete at least 1 bike-sharing trip next week and earn 80 points.

6.5 How the System Works

1. The **challenge generator** creates a set of possible challenges.
2. The **challenge valuator** calculates difficulty and assigns rewards.
3. The **filtering and sorting module** recommends challenges based on player profile, game history, and campaign objectives.

6.6 RQ1: Player Acceptance

To evaluate RQ1, the success rates of players in completing automatically generated challenges (RS challenges) were compared to those assigned manually. The analysis focused on 82 RS players during weeks 10-12 of Trento Play&Go, who received a total of 220 RS challenges. The completion rates of these players were contrasted with those of non-RS players categorized into four distinct groups:

- **Group 1:** This group includes both RS and non-RS players.
- **Group 2:** A subset of Group 1, consisting solely of active players during weeks 10-12.
- **Group 3:** This group excludes top performers.
- **Group 4:** This group compares the performance of RS players on RS challenges versus challenges assigned by experts.

An equivalence test (TOST) was employed to determine if the completion rates were statistically similar. The results indicated the following:

- RS players exhibited superior performance in Group 1; however, this group included a significant number of inactive players.
- In Group 2, non-RS players demonstrated slightly better performance, likely due to the presence of weekly champions.
- In Groups 3 and 4, RS and non-RS challenges were found to be statistically equivalent, suggesting no significant difference in player acceptance between the two types of challenges.

Therefore, it can be concluded that there is no significant difference in player acceptance between RS challenges and expert-assigned challenges.

6.7 RQ2: Challenge Impact

For RQ2, improvement during a challenge was measured relative to a player's performance in the previous week using the following formula:

$$\text{Imp} = \frac{\text{counter} - \text{base}}{\text{base}} \tag{1}$$

In this equation, *counter* represents the current performance indicator value (ranging from 0 to $+\infty$) and *base* refers to the previous week's value. Improvement (Imp) ranges from $[-1, +\infty]$, where -1 indicates no action towards the goal, and 0 signifies no improvement.

The focus was placed on *percentageIncrement* challenges, with 129 out of 164 categorized as such. These challenges were divided into those aimed at

improving the number of trips and those focused on distance (Km). Comparisons between RS and non-RS challenges revealed that RS challenges generally resulted in greater improvements.

Quantitative analysis utilizing the area under the improvement curve (AUiC) demonstrated that RS challenges frequently yielded higher values, with significant differences in positive improvement highlighted through the Wilcoxon test (p-values of 0.0003194 for Km-related challenges and 6.549e-06 for trip-related challenges). Thus, RS challenges appear to facilitate greater improvement compared to manually assigned challenges.

7 RQ3: Reward Efficiency

To evaluate RQ3, the improvement achieved through various challenge types was correlated with the rewards allocated by the game for challenge completion. Improvement was characterized using the AUiC+ data in Table 3, concentrating on players who achieved improvement in their challenges, as non-RS challenges often resulted in negative total AUiC.

Given the differing sizes of player sets yielding improvement in RS versus non-RS scenarios, the data were normalized based on the number of players contributing to that improvement (as detailed in the "players improved" column of Table 3). The per capita reward attributed by the system per unit of AUiC+ (denoted as $\text{Reward}_{\text{pc}}$) was computed using the formula:

$$\text{Reward}_{pc} = \frac{\text{Reward}_{tot}/\text{players}_{imp}}{\text{AUiC}^{+}} \tag{2}$$

The data suggest that challenge proposals generated by the system are more cost-effective concerning rewards as incentives per unit of improvement. RS challenges consistently yield lower rewards per unit of improvement when compared to non-RS challenges. Specifically, the per capita reward attributed per unit of improvement in non-RS trip-based challenges is 1.91 times higher (561/293) than in the RS case, while in non-RS Km-based challenges, it is 2.3 times higher (782/340).

Moreover, the experiment indicates that players could enhance their performance even without completing the assigned challenges. For instance, one player increased his walking performance from 3 km in week "x" to approximately 4 km in week "x + 1," despite not completing the challenge aimed at improving to 5 km. This observation illustrates that the primary objective of gamified systems is to influence player behavior, with challenges serving as mechanisms to encourage such improvement. Therefore, further normalization (using Eq. 1) is essential for calculating the unit of improvement, irrespective of challenge completion.

In conclusion, challenges assigned by the system provide greater improvement for the same per capita reward, effectively achieving similar levels of improvement for lower rewards.

8 Terminlology

- **Procedural Content Generation (PCG):** The automatic generation of game content, such as levels, challenges, and environments, using algorithms.
- **Recommendation System (RS):** A system that suggests items or actions to users based on their preferences, behavior, or context.

9 MDA: A Formal Approach to Game Design and Game Research

9.1 Authors

- **Authors:** Robin Hunicke, Marc LeBlanc, Robert Zubek

9.2 Publication

- **Publication:** AAAI Workshop - Technical Report
- **Date:** January 2004

9.3 Relevant to My Research

Yes

9.4 Aim

The study aims to present the MDA framework, which provides a formal approach to game design and game research. The framework is based on three primary components: Mechanics, Dynamics, and Aesthetics.

- **Mechanics:** The rules and systems that define the game's behavior.
- **Dynamics:** The run-time behavior of the mechanics acting on player inputs and each other.
- **Aesthetics:** The emotional responses evoked in players during gameplay.

9.5 Key Focus Areas

- introduce the MDA framework as a formal approach to game design and research.
- discuss the three primary components of the MDA framework: Mechanics, Dynamics, and Aesthetics.
- provide examples of how the MDA framework can be applied to game design and research.

9.6 Gaps Addressed

- provide a formal approach to game design and research.
- offer a structured framework for analyzing and designing games.
- emphasize the importance of aesthetics in game design.

9.7 Gap in the Research

- The study does not provide empirical evidence to support the effectiveness of the MDA framework in game design and research.
- The study does not compare the MDA framework with other game design frameworks to highlight its unique features and advantages.

9.8 Findings

-

9.9 Future Work

- Explore the integration of AI in the MDA framework to enhance the dynamics and aesthetics of games.
- Investigate the application of the MDA framework in emerging technologies such as VR, AR, and MR.
- Conduct empirical studies to validate the effectiveness of the MDA framework in game design and research.

10 Notes

11 Terminlology

- **MDA Framework:** Mechanics, Dynamics, Aesthetics framework.
- **Mechanics:** The rules and systems that define the game's behavior.
- **Dynamics:** The run-time behavior of the mechanics acting on player inputs and each other.
- **Aesthetics:** The emotional responses evoked in players during gameplay.

12 Categorizing Game Design Elements into Educational Game Design Fundamentals

12.1 Authors

- **Authors:** Mifrah Ahmad

12.2 Publication

- **Publication:** 10.5772/intechopen.89971
- **Date:** 20 November 2019

12.3 Relevant to My Research

Yes

12.4 Aim

to discuss recent and prominent proposed game design elements that demonstrate their important characteristics in designing educational games, and to categorize these elements into established fundamental elements of educational game design.

12.5 Key Focus Areas

categorizing various existing game elements into established fundamental elements

12.6 Gaps Addressed

- The paper addresses the gap in theoretical frameworks like:
  - **the balance framework**, which aims to balance player's skill level with the challenge of the game or aligning the game's realism (fidelity) with educational goals.
  - **The Gaming System Framework**: This framework is divided into three levels:
    - **Micro level**: Focuses on problem-solving and challenges that the player faces. It emphasizes learning outcomes through motivational and exploratory experiences, helping players develop skills.
    - **Macro level**: Deals with the game's fiction and scenarios, focusing on how players adopt gameplay strategies and enhance their identity. This level aims to support motivation through immersive, experiential learning.

    - **Metalevel**: Divided into two sublevels:
        - **Builder level**: Involves contributing to game design skills.
        - **Social level**: Focuses on social experiences and the social identity of players.
  - **Collaborative Multiplayer Game Framework**: This framework is based on multiplayer game dynamics and design principles. It:
    - Begins with analyzing an existing player model to understand the audience.
    - Proposes a typology of gameplay themes to help designers visualize actions within the game.
    - Outlines five key components for game design: learning objectives, story, 3D world, gameplay, and evaluation. These elements help guide the design process to ensure that the game aligns with educational and gameplay goals.

12.7 Findings

- Elemental Tetrad is a model used in many games in the modern-day.
- Elemental Pentad is a model that describes the five key components of a game: mechanics, story, aesthetics, technology, and education.
- Educational game design elements can be categorized into established fundamental elements.
- The Elemental Pentad can be used to categorize game design elements into educational game design fundamentals.

12.8 Future Work

- Ambiguity and duplication in game mechanics hinder clarity.
- Repetition of design elements (challenges) under the story fundamental element leads to confusion.
- Confusion arises from general vs. specific concepts in educational game design.
- A deeper understanding is needed to address the duplication of proposed game elements and the limited use of the Elemental Pentad.
- There is a need to categorize terminology used for educational games (e.g., serious games, effective video games).
- The rapid emergence of game design elements leads to duplication, necessitating clearer definitions (e.g., elements, factors, key elements).

- A need exists to reduce duplication of design elements to avoid confusion among researchers and practitioners.
- Establishing a common language may assist game designers in communication and organization.
- Stakeholders (educators, teachers, learners) should relate their experiences to design elements to facilitate the game design process.

13 Notes

- the Elemental Tetrad is a model that describes the four key components of a game: mechanics, story, aesthetics, and technology.

14 Analysis of Game Design FrameworkThrough Elemental Tetrad

14.1 Authors

- **Authors:** Mohamad Isa bin Ahyar

14.2 Publication

- **Date:** April 2022

14.3 Relevant to My Research

Yes

14.4 Aim

better explain and analyze the Elemental Tetrad game design framework, and give examples

14.5 Key Focus Areas

The paper focuses on explainaing the Elemental Tetrad, which consists of four key components of a game: mechanics, story, aesthetics, and technology. The paper also provides examples of how the Elemental Tetrad can be applied to game design.
the paper discuss the relation between the components

- Aesthetics, which is described by the story and mechanics, and is supported by technology, and is about the atmosphere and the feel of the game.
- Mechanics, which is justified by the story, presented by the aesthetics, and is achiveable through technology, is about the rules and the gameplay.
- Story, which creates the mechanics, and is presented by the aesthetics, and is supported by technology, is about the narrative and the plot.
- Technology, must meet the need of the story by supporting the mechanics and aesthetics, is about the platform and the tools.

14.6 Gaps Addressed

- The paper addresses the gap that is analysis of the Elemental Tetrad game design framework

14.7 Findings

- The Elemental Tetrad is a model used in many game in the modern day.

14.8 Future Work

Different games using the Elemental Tetrad can be analyzed and compared to see how the components are used in different games.

15 Notes

- the Elemental Tetrad is a model that describes the four key components of a game: mechanics, story, aesthetics, and technology.

16 SGAME: An Authoring Tool to Easily Create Educational Video Games by Integrating SCORM-Compliant Learning Objects

16.1 Authors

- **Authors:** ALDO GORDILLO, ENRIQUE BARRA, AND JUAN QUEMADA

16.2 Publication

- **Publication:** Digital Object Identifier 10.1109/ACCESS.2021.3111513
- **Date:** 9 September 2021

16.3 Relevant to My Research

Yes

16.4 Aim

This article presents a teacher-oriented authoring tool for educational games called SGAME. It explores teachers' perceptions of the tool and evaluates the effect of the educational video games it helps create on students' perceptions and learning outcomes.

16.5 Key Focus Areas

Three evaluation instruments were used:

- A questionnaire to gather teachers' perceptions of the SGAME authoring tool.
- A questionnaire to collect students' perceptions of a game created with SGAME.
- Pre- and post-tests to assess students' learning gains from playing the game.

A total of 201 teachers and 79 students participated in the evaluation. The results show that SGAME is a user-friendly tool for creating effective and motivating educational video games.

16.6 Gaps Addressed

The use of game-based learning in educational settings is limited by the lack of authoring tools that allow teachers to easily create and adapt educational video games to their needs and contexts.

16.7 Findings

- **Positive Impact**: SGAME increases student motivation and learning outcomes.
- **Ease of Use**: Teachers found SGAME easy to use.
- **Effective Tool**: Case study results showed significant learning gains.
- **Teacher Perceptions**: SGAME was especially beneficial in primary, secondary, and special-needs education.
- **Areas for Improvement**: There is a need for more game templates, resources, and sequencing options.

16.8 Limitations

- **Volunteer Bias**: The evaluation used convenience sampling, meaning only teachers who volunteered participated, which may introduce bias.
- **Subjective Usability Assessment**: The usability of SGAME was evaluated solely based on teachers' perceptions, lacking formal usability testing.
- **Limited Templates**: SGAME currently lacks a wide variety of game templates, limiting its flexibility.

16.9 Future Work

- **Expand Game Templates**: Increasing the variety of game templates, particularly for mobile and tablet devices.
- **Enhanced Resources**: Providing more tutorials and expanding the user manual to help teachers use SGAME more effectively.
- **Advanced Options**: Adding more sequencing options and grading settings to improve the customization of games.
- **Wider Testing**: Conducting more studies in diverse educational settings to validate SGAME's long-term effectiveness.

17 Notes

Several popular game engines such as Unity, Unreal Engine, CryEngine, ImpactJS, and Phaser can be used to develop educational video games, but they require strong programming skills, making them unsuitable for most educators. Conversely, teacher-oriented authoring tools like SGAME aim to simplify the creation of educational video games for non-technical users.

17.1 Similar Tools to SGAME

Several teacher-oriented tools exist for creating educational games, such as:

- **eAdventure** (Java-based, no longer in use).
- **uAdventure** (Successor of eAdventure, built on Unity) - `https://github.com/e-ucm/uAdventure?tab=readme-ov-file`.
- **StoryTec** (Story-based game creation) - `https://ieeexplore.ieee.org/document/4688056`.
- **IOLAOS** (Game templates customized by teachers) - `https://www.researchgate.net/publication/275645732_Ludic_Educational_Game_Creation_Tool_Teaching_Schoolers_Road_Safety`.
- **EMERGO** (Scenario-based game creation) - `https://www.ou.nl/emergo`.

Other notable tools include Genial.ly for creating educational escape rooms and ARLEARN for developing educational video games, though neither has undergone significant evaluation for their educational utility.

18 Towards Automatic Personalized Content Generation for Platform Games

18.1 Authors

- **Authors:** Noor Shaker, Georgios Yannakakis, Julian Togelius

18.2 Publication

- **Publication:** Proceedings of the Sixth AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment
- **Date:** 2010

18.3 Relevant to My Research

This paper explores the automatic generation of personalized levels for platform games, which is relevant to research on procedural content generation (PCG) and adaptive gaming.

18.4 Aim

The aim of the paper is to design an online game adaptation mechanism that personalizes level design for platform games to optimize player experience based on their playing style.

18.5 Key Focus Areas

- Procedural content generation (PCG)
- Player experience modeling
- Real-time adaptation of game content
- Evaluation using human and AI players

18.6 Gaps Addressed

The paper addresses the gap in literature regarding personalized and player-adaptive PCG for platform games, building on previous work to improve prediction models and test adaptation mechanisms.

18.7 Findings

- The adaptation mechanism optimizes level design for individual players effectively.
- Accurate models for predicting player experience based on gameplay data.
- Higher predicted fun for AI agents with human-like playing styles.

18.8 Limitations

- Limited number of controllable features used for adaptation.
- Experiments were primarily conducted with AI players and a small number of human participants.

18.9 Future Work

- Expanding the set of controllable features.
- Testing the model on a larger number of human players.
- Investigating the application of the approach to other game genres.

19 Notes

The research demonstrates the feasibility of personalizing game content in real time to enhance player experience, with future improvements focusing on expanding adaptability and generalization across different types of games.

20 Comparing Traditional Teaching and Game-Based Learning using Teacher-Authored Games on Computer Science Education

20.1 Authors

- **Authors:** Daniel López-Fernández, Aldo Gordillo, Pedro P. Alarcón, and Edmundo Tovar

20.2 Publication

- **Publication:** IEEE Transactions on Education, vol. 64, no. 4, pp. 367–373
- **Date:** 2021

20.3 Relevant to My Research

This paper provides evidence on the effectiveness of Game-Based Learning (GBL) in computer science education, particularly through the use of teacher-authored educational games. It is highly relevant for exploring how GBL can increase student motivation and match traditional methods in knowledge acquisition.

20.4 Aim

The aim of the paper is to compare the instructional effectiveness of traditional teaching and GBL using teacher-authored games, with a focus on student motivation and knowledge acquisition in computer science courses.

20.5 Key Focus Areas

- Game-Based Learning (GBL)
- Teacher-authored educational video games
- Comparison of traditional teaching and GBL
- Student motivation and knowledge acquisition

20.6 Gaps Addressed

The paper addresses the lack of empirical studies evaluating the instructional effectiveness of educational video games created by teachers using authoring tools, particularly through Randomized Control Trials (RCTs).

20.7 Findings

- GBL using teacher-authored games was as effective as traditional teaching in terms of knowledge acquisition.
- GBL significantly increased student motivation and engagement compared to traditional teaching.
- Most students preferred the GBL approach over traditional lectures.

20.8 Limitations

- The study was limited to two computer science courses at the university level.
- GBL's novelty might affect motivation, and overuse could reduce its effectiveness.

20.9 Future Work

- Explore GBL in other knowledge fields beyond computer science.
- Investigate GBL's application in promoting practical skills and in self-paced online learning environments.
- Study gender differences in the use of educational video games.

21 Notes

This study provides valuable insights into the effectiveness of GBL, particularly through teacher-authored educational games, showing it can improve student motivation while maintaining similar learning outcomes to traditional teaching.

22 VoRtex Metaverse Platform for Gamified Collaborative Learning

22.1 Aim

The paper introduces a platform called VoRtex, designed to offer tools for creating educational experiences in virtual worlds, especially during pandemic situations.

22.2 Key Focus Areas

- Software architecture and tools for the VoRtex platform.
- Collaborative learning within a virtual environment.
- Educational experiences designed for pandemic situations.

23 Integrating Generative AI in Hackathons: Opportunities, Challenges, and Educational Implications

23.1 Aim

This study explores the impact of generative AI on students' technological choices, focusing on a case study from the University of Iowa's 2023 event.

23.2 Key Focus Areas

- Impact of generative AI on technological choices in hackathons.
- Educational implications of integrating AI in student-led events.
- Balancing innovation with ethical considerations in educational environments.

24 Development of Gamification Model for Personalized E-Learning

24.1 Aim

This study aims to design, implement, and evaluate a personality-based gamification model for e-learning systems, enhancing personalization in learning environments.

24.2 Key Focus Areas

- Personalization in e-learning through gamification based on MBTI.
- Engagement metrics such as appeal, emotion, user-centricity, and satisfaction.
- Educational usability criteria like clarity, error correction, and feedback.

25 Scribbles and brainstorming on the side

25.1 Questions to Explore and reflect on when reading

- learning is about trying new things and failing, so how can we gamify that?
- what we like about games is the sense of progression and achievement, how can we bring that to learning?
- games give the player room to explore and make choices which affect the outcome but also allow them to fail and try again, how can we bring that to learning?
- why is an app like duolingo so successful in teaching languages? what can we learn from that?
- no one one's to actually fail, so how can we make failing fun?
- also what if we had diffuculty levels where each level is a different learning curve and each diffuculty level gives out different rewards? (we are all winners)

25.2 Game Ideas

- A game where you go up against an AI chatbot that asks you questions and you have to answer them correctly to win points, in return you get to ask the chatbot questions and it will answer them for you. You can call out the chatbot if it gets a question wrong or right which will give you extra points. **Problem:** How can we make this generative for the Instructor? Can we make it so that the instructor can create "Personalties" for the chatbot to have? like in the paper above where they used Batman and Wednesday Addams as personalities for the learning materials.
- rpg game where u use programming to solve puzzles and fight monsters
- graphic novel-ish type game where the instructor fills out certain parts of the story and it gets generated into a game with choices and outcomes