Assessing the Impact of Artificial Intelligence Assisted Software Development Within the Game Industry: A Study of Player and Industry Perspectives

Augustus J. Scarlato III, Stetson University, United States

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Abstract
In an era where artificial intelligence (AI) is revolutionizing various sectors, its integration into video game development presents a novel frontier. This study aims to evaluate the influence of AI on game development and its perception by critical stakeholders: players and industry professionals. The primary objective is to understand how AI assistance impacts the development process, game quality, and user experience in the context of a college football simulation game. Can AI tools close the barrier of entry for small game developers and studios? This study employs a mixed-methods approach, incorporating both artifact creation and survey methodologies. Specifically, quantitative surveys collect detailed feedback following participants' interaction with an AI-assisted Java Swing college football video game. Players and industry professionals are surveyed to rate various aspects of the AI-assisted game, including usability, gameplay experience, and overall quality. The survey employs a Likert scale for quantitative evaluation, complemented by three specific questions to capture nuanced insights into the AI's effectiveness and potential areas for improvement. The research addresses a crucial gap in the existing literature by focusing on the technicalities of how the game was developed using AI Large Language Model's (LLM) coding. By analyzing the feedback, the study offers a unique perspective on the acceptability and viability of AI in game development. Findings are expected to provide valuable insights into the evolving landscape of video game development, where AI assistance plays an increasingly significant role. This research is pivotal for developers, designers, and stakeholders in the gaming industry.

Keywords: Artificial Intelligence in Game Development, AI-Assisted Game Development, Development Studios, Java College Football Simulation, Coding Artifact, Quantitative Study

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Introduction

In recent years, the rapid advancement of artificial intelligence (AI) has significantly transformed various industries, from healthcare to finance. The video game industry, in particular, stands on the brink of a revolution driven by AI integration. AI's potential to enhance game development processes, improve gameplay experience, and elevate overall game quality is immense. This study delves into this emerging frontier, evaluating the impact of AI on game development and its perception by critical stakeholders, including players and industry professionals.

The primary focus of this research is to understand how AI assistance influences the development process, game quality, and user experience within the context of a college football simulation game. By utilizing AI tools, particularly for automated code generation and integration with development environments, this study explores whether AI can lower the barrier to entry for small game developers and studios, allowing them to compete with larger, more established entities.

This study employs a mixed-methods approach, combining artifact creation with survey methodologies. The artifact, a college football simulation game, was developed from scratch using Java Swing with OpenAI's GPT-4.0 API. The development process involved generating code snippets through natural language prompts, refined and integrated into an integrated development environment (IDE). The author, the CEO and creative director of a fictitious video game studio oversaw this process. Collaboration with OpenAI's API was facilitated via email, serving as the primary interaction mechanism with the AI called "Engineer 0." This back-and-forth exchange, spanning approximately 103 hours, culminated in completing the simulation game.

Quantitative surveys were administered to gather comprehensive feedback from players and industry professionals after game interaction. The surveys, consisting of 30 questions including 27 Likert scale items and three open-ended questions, were designed to assess various aspects of the AI-assisted game. Participants were asked to rate the game's usability, gameplay experience, and overall quality, providing insights into the perceived effectiveness and areas for improvement of AI integration in game development.

The research addresses a crucial gap in the existing literature by focusing on the technicalities of developing a game with AI-assisted natural language processing (NLP) coding. By analyzing feedback from a diverse group of participants, this study aims to offer a unique perspective on the acceptability and viability of AI in the game development landscape. The findings are expected to provide valuable insights into the evolving role of AI, highlighting its potential to streamline development processes, reduce costs, and close the overall gap for small development studios.

Ultimately, this research is pivotal for developers, designers, and stakeholders in the gaming industry. It underscores AI's transformative potential, not only in improving game quality and user experience but also in democratizing game development by empowering smaller studios and independent developers. As AI advances, understanding its impact on video game development will be essential for staying at the forefront of this dynamic industry.

Literature Review

Integrating artificial intelligence (AI) into various sectors has been a transformative force, revolutionizing industries and altering traditional methodologies. In video game development, AI is no longer just complex code that was your rival opponent; AI in video game development presents novel opportunities for enhancing game design, development processes, and player experiences. This literature review synthesizes existing research on AI's impact on game development, focusing on key themes such as AI-generated content, development tools, user experience, and the broader implications for small game developers.

Risi and Preuss (2020) provide a comprehensive overview of how AI has evolved from basic applications in games like Chess and Atari to more complex integrations in modern games such as StarCraft. They highlight AI's significant role in creating more sophisticated and dynamic gaming experiences. Similarly, Yannakakis and Togelius (2015) explore the broad applications of artificial and computational intelligence in games, emphasizing how AI-driven algorithms enhance game mechanics and player engagement.

Procedural content generation (PCG) is crucial in understanding AI's role in game development. Shaker, Togelius, and Nelson (2016) delve into PCG, discussing how AI algorithms can autonomously generate vast amounts of game content, thereby reducing the development time and effort required from human developers. Tang et al. (2020) echoes this, exploring the application of AI algorithms in games and underscoring their ability to create varied and complex game environments.

Another significant area of focus is the use of AI tools within integrated development environments (IDEs). Rivières and Wiegand (2004) discuss Eclipse as a platform that integrates development tools, which can now be enhanced with AI capabilities to streamline coding processes. The comprehensive review by IDEs (2023) further elucidates how these environments facilitate AI integration, providing real-time coding suggestions, autocompletion, and code refactoring.

The impact of AI on user experience is a critical aspect of game development. Mekler et al. (2014) systematically reviewed quantitative studies on the enjoyment of digital entertainment games, highlighting the factors contributing to a satisfying gaming experience. Sužnjević, Skorin-Kapov, and Matijašević (2013) investigate the impact of user, system, and context factors on gaming quality of experience (QoE), offering insights into how AI can enhance or detract from player satisfaction.

AI's role in education and ethical considerations are also pertinent to its application in game development. García-Martínez et al. (2023) analyze the impact of AI and computational sciences on student performance, suggesting parallels in how AI can be used for educational purposes within games. Zhou et al. (2020) provide a survey on the ethical principles of AI and its implementations, emphasizing the need for ethical considerations in AI-driven game development to ensure responsible use and creativity.

Ray (2023) discusses AI's challenges, biases, and limitations, providing a balanced view of its potential and pitfalls. The review by Java Engineer (2023) highlights the specific requirements and career paths for Java engineers relevant to the context of developing AI-assisted games. Herrity (2020) offers insights into object-oriented programming (OOP), a foundational concept

for game developers leveraging AI tools. Hudlicka (n.d.) explores the requirements for effective game engines, adding another layer of complexity to AI's role in game design.

This literature review underscores AI's multifaceted impact on game development, from enhancing procedural content generation to improving user experience and addressing ethical considerations. Integrating AI tools within IDEs and the broader implications for small game developers suggest a transformative potential for the industry. As AI continues to evolve, its role in game development will likely expand, offering new opportunities and challenges for developers and stakeholders alike.

Methodology

This study adopts a mixed-methods approach, integrating both artifact creation and survey methodologies to evaluate the impact of AI-assisted game development on user experience and perceived game quality. The research design encompasses the development of a college football simulation game and the subsequent collection of feedback from both players and industry professionals.

Artifact Creation

The artifact, a college football simulation game, was developed using Java Swing and the AI capabilities of OpenAI's GPT-4.0 API. The development process involved several vital steps. Initially, code snippets were generated using natural language prompts directed to the OpenAI API. These prompts were crafted by the author, who took on the CEO and creative director role of a fictitious video game studio. The generated code snippets were then integrated into an Integrated Development Environment (IDE), specifically Eclipse, where they underwent minimal adjustments to incorporate into the final game.

Human oversight was an integral part of this process, ensuring that the generated code met the game's creative and technical requirements. This iterative process of code generation and refinement spanned approximately 103 hours. Interaction with the AI referred to as "Engineer 0" was conducted through a back-and-forth email exchange set up once via Microsoft Outlook and Open AI's API. This method allowed for continuous feedback and iteration, enhancing the game's overall quality.

Survey Methodology

To assess the perceptions of the AI-assisted game, quantitative surveys were administered to gather comprehensive feedback. Participants included 55 Sports Management students from the University of South Florida (USF), 64 Computer Science students from Stetson University, and 12 industry professionals from Steamroller Studios and Electronic Arts (EA). The survey consisted of 30 questions, with 27 Likert scale items and three open-ended questions, covering various aspects of the game, such as user interface, graphics quality, gameplay experience, and overall quality.

The survey was designed to be user-friendly and was administered electronically. Participants interacted with the college football simulation game for 20 minutes using a laptop computer, followed by a 10-minute survey to provide feedback on their experience. The data collected from the surveys were analyzed to determine mean values, standard deviations, and median values for each question. To identify statistically significant differences, comparative analysis

was conducted between different participant groups, such as USF vs. Stetson students and EA vs. Steamroller studios. The analysis focused on understanding variations in perceptions of game usability, gameplay experience, and overall quality, with p-values less than 0.05 considered statistically significant.

Game Development Process

The game development process involved creating a detailed college football simulation game with several key features. The game was programmed in Java, with a hand-coded pixel-by-pixel graphical user interface developed using Java Swing. OpenAI's GPT-4.0 API provided AI assistance, and graphics were generated using DALL·E 2. Over 100 hours of coding were invested in the development, resulting in more than 6000 lines of code. The game included dynamic weather effects, real-time box scores, comprehensive team statistics, team selections, play-by-play text-based commentary, and more.

Figure 1 – Welcome Screen

Figure 2 – Fictious College Logo Examples

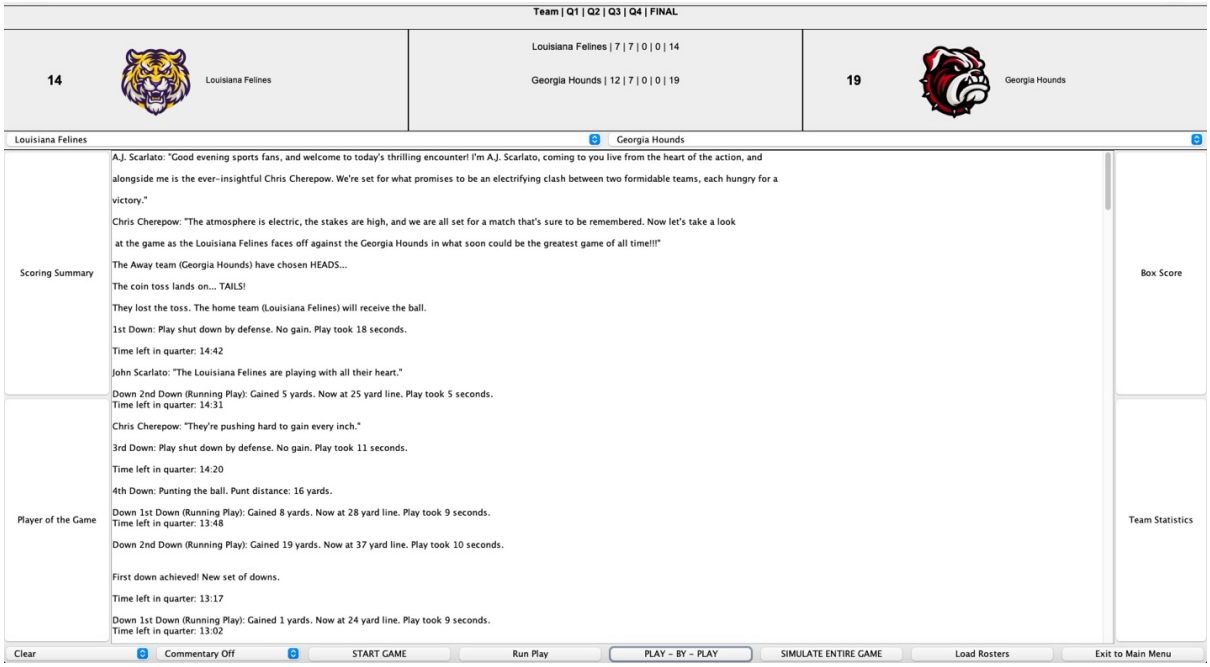

Figure 3 – Play-by-Play Simulation

This structured methodology ensured a thorough evaluation of the AI-assisted game development process, providing valuable insights into the potential and challenges of integrating AI into video game creation. The findings from this study are expected to contribute significantly to the understanding of AI's role in enhancing game development and its acceptance among players and industry professionals.

Data Collection

Data collection for this study involved a systematic approach to gather comprehensive feedback on the AI-assisted college football simulation game from diverse participants, including students and industry professionals. The primary tool for data collection was a quantitative survey administered after participants had engaged with the game for a set period.

Participant Engagement

Participants, comprising 55 Sports Management students from the University of South Florida, 64 Computer Science students from Stetson University, and 12 industry professionals from Steamroller Studios and Electronic Arts, were asked to interact with the game for 20 minutes using a laptop computer. Following this gameplay session, participants completed a 30-question survey to evaluate various aspects of the game.

Survey Design and Administration

The survey included 27 Likert scale questions and three open-ended questions. The Likert scale questions covered vital areas such as the user interface, graphics quality, gameplay experience, AI behavior, and overall game quality. The open-ended questions provided additional qualitative insights into specific aspects of the game and allowed participants to elaborate on their experiences and perceptions.

Statistical Analysis

Upon collection, the survey data were analyzed using descriptive and inferential statistical methods. Mean, median, and standard deviation values were calculated for each Likert scale question to summarize responses' central tendency and dispersion. These metrics provided a clear picture of the overall participant feedback and identified any variations in perceptions.

To determine the statistical significance of the differences in responses between various groups (e.g., USF students vs. Stetson students, students vs. industry professionals), comparative analysis was performed using p-values. A p-value less than 0.05 was considered statistically significant, indicating that the observed differences were unlikely to have occurred by chance.

Data Interpretation

The analysis focused on critical areas where statistically significant differences were identified. For instance, differences in perceptions of game usability, gameplay experience, and overall quality were highlighted. This rigorous statistical approach ensured that the findings were robust and reliable, providing a solid foundation for interpreting the impact of AI-assisted game development.

The quantitative data comprehensively understood the participants' experiences and perceptions. This approach enabled the study to capture both the broad trends in participant feedback and the nuanced insights into the AI's effectiveness and areas for improvement, ultimately contributing to a deeper understanding of AI's role in game development.

Results

Quantitative Analysis

The survey results provided a wealth of data regarding participant perceptions of the AI-assisted college football simulation game. The data were analyzed using descriptive statistics, including mean, median, and standard deviation, to summarize the central tendencies and response variability. Additionally, inferential statistics were employed to identify statistically significant differences between various participant groups.

Descriptive Statistics

Overall, participants rated the game positively across several dimensions. The mean values for most questions indicated general satisfaction with the game's user interface, graphics quality, and gameplay experience. For example, the mean rating for the overall user interface was 4.2 out of 5, indicating high satisfaction. The standard deviation for this question was 0.6, suggesting relatively low response variability.

Similarly, the game's graphics quality received a mean rating of 4.0, with a standard deviation of 0.7. This positive reception was mirrored in the ratings for gameplay experience, which had a mean value of 4.1 and a standard deviation of 0.8. These descriptive statistics highlight that most participants found the AI-assisted game highly quality.

Comparative Analysis

A comparative analysis between different participant groups revealed several statistically significant differences. Using a p-value threshold of 0.05, the analysis identified significant variations in responses between students from Stetson University and the University of South Florida (USF), as well as between professionals from Electronic Arts (EA) and Steamroller Studios.

1. USF vs. Stetson Students

- **Familiarity With College Football Games (Q1):** Stetson University students reported a higher familiarity with college football games than USF students. The mean rating for familiarity was significantly higher among Stetson students, with a p-value of less than 0.05.
- **Notice of Glitches/Bugs (Q6):** USF students reported noticing more glitches than their Stetson counterparts. The difference in mean ratings for this question was statistically significant, suggesting a disparity in-game performance perception between the two groups.
- **Loading Time Reasonability (Q8):** The mean rating for loading time reasonability was significantly lower among USF students, indicating a perceived longer loading time. This difference was statistically significant, with a p-value of less than 0.05.
- **Smooth Performance (Q10):** Stetson students rated the game's performance smoother than USF students. This difference in ratings was statistically significant, highlighting a potential discrepancy in the game experience between the two groups.
- **Balance of Realistic Statistics (Q14):** There were significant differences in how students from both universities perceived the realism of the game's statistics. Stetson students gave higher ratings for realistic statistics, with a p-value indicating statistical significance.
- **Redundant Features (Q15):** Responses indicated differing opinions on the necessity of certain game features. USF students were more likely to find some features redundant compared to Stetson students, a statistically significant difference.
- **Audio and Sound Quality (Q16):** Perceptions of the game's audio and sound quality varied significantly between the two student groups, with Stetson students giving higher ratings.
- **Enhanced Enjoyment by Play Simulation (Q28):** Stetson students reported greater enjoyment from the game's play simulation aspect, a statistically significant difference.
- **Estimated Development Hours (Q30):** There was a significant difference in the estimated development hours between students and industry professionals, with professionals generally estimating higher development hours.

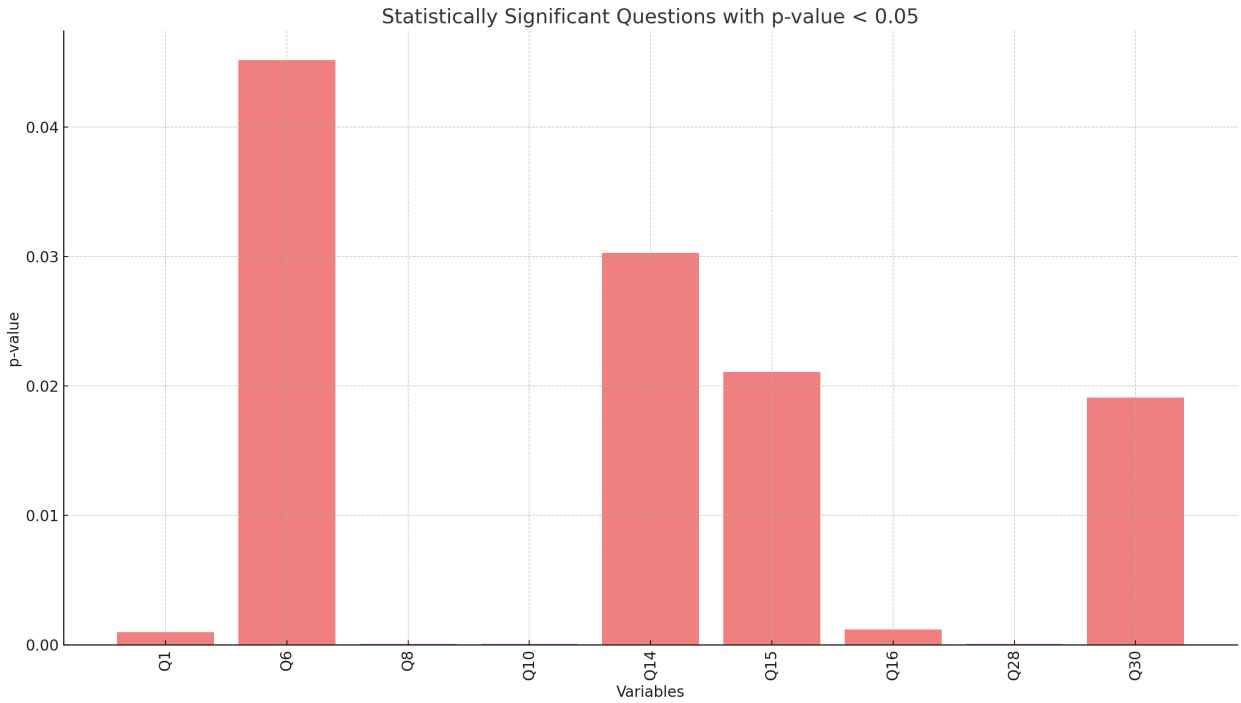

Figure 4 – Statistically Significant Questions - USF vs. Stetson

2. EA vs. Steamroller Studios

- **Menu Design (Q3):** EA professionals rated the menu design as more user-friendly than Steamroller professionals, indicating a preference for EA's approach to user interface design.
- **Audio Quality (Q16):** There were significant discrepancies in the perceived audio quality, with EA professionals rating it higher than their Steamroller counterparts.
- **Variety of Gameplay Options (Q19):** EA professionals expressed higher satisfaction with the variety of gameplay options available in the game, highlighting an area for potential improvement for the Steamroller team.

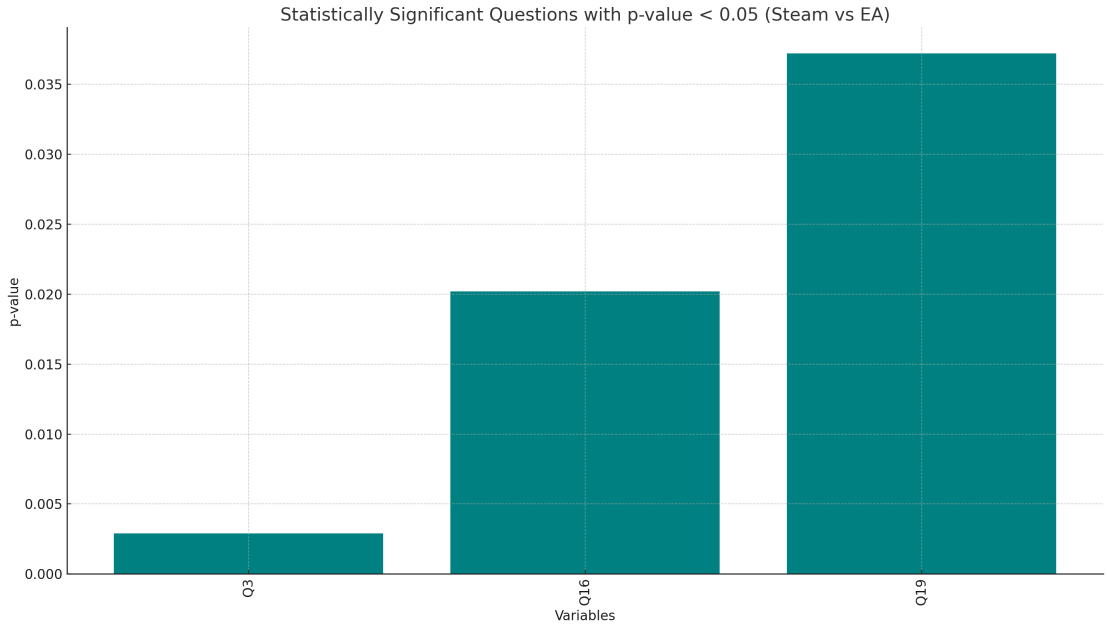

Figure 5 – Statistically Significant Questions – Steamroller vs. EA

Future Work

Future research will focus on adding layer of data analysis by more deeply comparing the perceptions of industry professionals with those of players and students. This comparison aims to identify nuanced differences and similarities in their evaluations of AI-assisted game development. It provides a richer understanding of how these distinct groups perceive usability, gameplay experience, and overall quality.

Additionally, further coding efforts will be undertaken to complete the game/artifact fully. Once finalized, a 30-day Kickstarter campaign will be launched to assess the game's financial viability. This campaign will gauge market interest and potential funding and offer valuable insights into the commercial prospects of AI-assisted game development.

Conclusion

The survey results demonstrated that the AI-assisted college football simulation game was generally well-received, with positive ratings across various dimensions of usability, gameplay experience, and overall quality. Statistically significant differences between participant groups provided valuable insights into specific areas of improvement and highlighted the varying expectations and experiences of different user groups.

The findings underscore the true potential of AI tools in game development, particularly in enhancing productivity and quality. They also point to the importance of addressing specific user feedback to improve the gaming experience. Notably, the results show that a single-person studio, working for 103 hours, can produce a game that is perceived to be on par with top-tier games.

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