






A Model of Using Digital Information Systems to Create Video Game Contexts: The Case of GPT Models and Its Effect



Oksana Zhukova¹, Volodymyr Mandragelia², Viktoriia Chepurna¹, Liudmyla Ivanenko¹,
Margaryta Noskova^{3*}

¹ Department of Pedagogy, V. N. Karazin Kharkiv National University, Kharkiv 61000, Ukraine

² Department of Philosophy and Social Sciences, Chernihiv Polytechnic National University, Chernihiv 14027, Ukraine

³ Department of Pedagogy and Innovative Learning, Lviv Polytechnic National University, Lviv 79000, Ukraine

Corresponding Author Email: margaryta.v.noskova@lpnu.ua

Copyright: ©2024 The authors. This article is published by IETA and is licensed under the CC BY 4.0 license (<http://creativecommons.org/licenses/by/4.0/>).

<https://doi.org/10.18280/isi.290227>

ABSTRACT

Received: 19 February 2024

Revised: 16 March 2024

Accepted: 26 March 2024

Available online: 25 April 2024

Keywords:

artificial intelligence, information technology, information systems, video games, digital sphere, chat model, management strategies

The main goal of the study is to identify factors influencing the formation of video game content through GTP models, and based on these factors to formulate strategies for improving these processes. The object of the research is digital information systems for creating the context of video games. The scientific task of the study is the formation and selection of the most optimal strategy for adapting an information system under the influence of negative factors for video game developers. The research methodology includes the use of a combined approach, including hierarchy analysis, pairwise comparison of alternatives, expert analysis and the Delphi method. As a result of this combined analysis and innovative methods, we developed and selected the most optimal strategy for optimal use of GPT models in video games, which takes into account both technological opportunities and challenges. The study has limitations because the strategies were formed on the basis of a certain list of factors, which theoretically could lead to failure to take into account secondary factors and elements that may also influence the area being studied.

1. INTRODUCTION

The modern world of video games is undergoing significant changes due to the rapid development of digital information systems. In recent years, the video game industry has seen the emergence of new technologies that impact the way game content is created and experienced. One of the key innovations is the introduction of artificial intelligence and machine learning, in particular models like GPT (Generative Pre-trained Transformer), into the game development process.

Models like GPT open new horizons for game developers, providing the ability to create deeper, more dynamic and adaptive game worlds. The use of such systems can greatly enhance the realism of the gaming experience, allowing the creation of complex scenarios and dialogues that respond to the actions and decisions of players. This, in turn, paves the way for more personalized gaming experiences.

However, along with the benefits these technologies offer, they also pose new challenges for developers. One of the main challenges is the need to balance technological capabilities and creative expression. The increasing role of artificial intelligence in the game creation process may disrupt the traditional approach to script development and game design.

Another important issue is the moral and social challenges associated with the use of artificial intelligence. There is a risk that intelligent systems may not always influence the content of the game adequately, which may cause disputes or misunderstandings among players. Additionally, the issue of

privacy and data security is important, especially in the context of personalized gaming experiences.

However, the potential for using models like GPT in video games is enormous. They can play a role not only in creating dialogue and scenarios, but also in shaping unique game mechanics, adaptive worlds, and even the development of game characters. This opens up new possibilities for interactive storytelling and deep emotional involvement of players.

The development of digital information systems and their implementation in the video game industry reflects a general trend towards greater integration of artificial intelligence technologies into different areas of our lives. This requires game developers not only to be technically skilled, but also to have a deep understanding of the potential social and moral implications of using such technologies.

In light of these challenges and opportunities, a key question is how digital information systems can be used to create the context of video games. The case study of GPT chat as an element of an interactive gaming system provides important insight into this process, demonstrating both the opportunities and challenges facing the modern video game industry.

The use of GPT (Generative Pre-trained Transformer) in the context of video game creation opens up new horizons in the gaming industry, offering game developers the tools to revolutionize game content design. Developed by OpenAI, this technology has the potential to transform traditional ways of creating game worlds, characters and stories, offering

deeper and more dynamic interactions with players.

The first area where GPT can make a big difference is in game content development (script and dialogue). Capable of generating texts that mimic human writing, the GPT model can be used to create complex and realistic dialogue between characters, as well as adapt storylines based on players' actions and choices. This allows for more personalized gaming experiences, where each playthrough of the game can be unique, reflecting each player's choices and playstyle.

Last but not least is the use of GPT to design game worlds and challenges. The model can help create more complex and varied gaming environments by offering automated content generation that can include textual descriptions of locations, task histories, or even entire scenarios. This reduces the burden on game developers and allows them to create more diverse game content.

Overall, integrating GPT into the video game creation process has the potential to revolutionize the way we perceive and interact with game worlds, providing developers with a powerful tool for creating deeper, more interactive and personalized gaming experiences.

The main goal of the study is to identify factors influencing the formation of video game content through GTP models, and based on these factors to formulate strategies for improving these processes.

The structure of the article includes an introduction, a literature review, a description of the methodology, a presentation of the results, their comparison with existing literature, and conclusions.

2. LITERATURE REVIEW

The study of modern literary sources is an important step in the formation of a management system using economic and legal methods for the effective use of artificial intelligence in an educational campaign. Analysis of current scientific works, articles, case studies and empirical studies provides valuable information about the latest trends, challenges and opportunities for using artificial intelligence in education.

In the work of Alazam et al. [1] authors explore modern socioeconomic systems in the context of global digitalization and legal compliance. This study focuses on e-commerce, so its findings may be important for understanding how information models can be adapted for video games, especially in the context of introducing GPT models to enhance interactivity and personalize gaming experiences.

An interesting study is by Cesário et al. [2], who in their study analyzed the formation of a gaming context using the example of modern games. Thus, by focusing on the role of narrative, localization and immersion in gameplay, this study is particularly relevant to the chosen topic as it highlights the importance of story and dialogue in games - aspects that can be greatly improved by technologies like GPT.

Colledanchise and Ogren [3] analysis of the modularization of hybrid control systems and their application in the context of games provide insight into how structured approaches to behavior can be integrated into game design. This is especially important when considering implementing GPT to control the behavior of characters and game elements.

Also important is the work of Sylkin et al. [4] in their study focused on the formation of performance models, which can be effectively used by GPT in gaming systems.

In a study by Alazzam et al. [5] provided valuable insight

into balancing technological development and environmental conservation in their study. Likewise, this may indicate the need to find a balance between technological progress and maintaining moral standards in video games.

Relevant to the topic under study is the work of Alexiou and Schippers [6], who, in their work on digital game elements, user experience and learning, offer a conceptual framework for understanding the relationship between these elements. This research is important to our topic because it examines how digital innovation can impact user and learning experiences, which is key to understanding the impact of GPT on gameplay.

Thus, Cossu [7] research focuses on building artificial intelligence in games using C#. The section is especially valuable for understanding the basics of creating behavioral models in game AI, which is key to integrating GPT and similar systems into game mechanics.

An interesting study is by Krupa et al. [8], who in their study proposes a new information system model for assessing the performance of e-business in tourism. Today, this approach is actively used and adapted to evaluate the effectiveness of digital information systems, including GPT, in the context of video games.

Issues of the practical part of doing business using innovative technologies are actively studied in the work of Alazzam et al. [9] explore approaches to choosing a business management strategy. This methodology can be useful for identifying strategies for integrating GPT into the gaming industry.

Fan et al. [10] review examines the connections between brain science and artificial intelligence. This research may help understand how the principles of the human brain can be used to improve artificial intelligence algorithms such as GPT in the context of game development.

In the context of our study, the work of Costa et al. [11], who study an interactive information system to support an augmented reality game, is important. This work is relevant to understanding how information systems can interact with innovative gaming technologies, including the use of GPT to create gaming content.

Equally important is the study by Saleh et al. [12], who in their study analyze the legal aspects of managing cryptocurrency assets. This work provides important guidance on legal and regulatory aspects that may be relevant when considering the adoption of GPT and other digital innovations in video games.

Sylkin et al. provide an essential backdrop by discussing the financial security of engineering enterprises as a precondition for applying anti-crisis management strategies. While not directly related to video games, their insights into financial stability and innovation management are pertinent for video game developers considering the integration of advanced AI technologies like GPT models. This financial aspect is crucial for understanding the resources required for AI implementation and the potential return on investment it can offer within the video game industry. Yesimov and Borovikova delve into the administrative and legal frameworks surrounding the rights of business entities, highlighting the importance of navigating legal considerations when implementing AI technologies in video games. This perspective is complemented by Kronivets et al. [13], who examine the legal foundations for utilizing AI in educational processes. Both studies underscore the significance of understanding the legal landscape, including copyright issues and data privacy concerns, which are critical when developing

video game content with AI [14, 15].

The work of Ho et al. specifically addresses the application of AI in video games through a trace-based multi-criteria preselection approach for decision-making in interactive applications like video games. Their methodology provides a valuable framework for evaluating and selecting AI technologies that enhance gameplay and player engagement. Mikac and Bernik explore the impact of video games on physical activity and motivation for exercise using virtual reality (VR) technology. This study, while focused on VR, offers insights into the broader implications of how advanced technologies, including AI-driven systems, can influence player behavior and contribute to the immersive experience of video games [13, 16].

Lastly, Kryshchanovych et al. discuss modeling the planning of potential for sustainable development in the context of public administration, and another study by Kryshchanovych et al. on modeling information support for state economic security management amidst economic turbulence. These articles, though not directly related to video games, emphasize the importance of strategic planning and information management in implementing new technologies. Their findings can be extrapolated to the development of AI-integrated video game systems, suggesting that careful planning and support are essential for the successful and sustainable integration of AI technologies in video games [17, 18].

After reviewing the current scientific literature, we can say that one of the main scientific gaps in current research on the use of digital information systems, in particular GPT, in video game development is the lack of a comprehensive understanding of the impact of these technologies on various aspects of the gaming experience. Most existing research focuses on the technical aspects of implementing and optimizing these systems, but does not go into deep analysis of their impact on gaming behavior, players' emotional reactions, or gameplay dynamics. This is especially true when exploring how artificial intelligence can change the perception of a game's story and characters, as well as how it can influence players' decision-making.

Another limitation of current research is the lack of a comprehensive approach to assessing the ethical and social implications of using GPT models in video games. Most studies do not address important issues related to data privacy, potential biases in generated game scenarios, or possible negative impacts on social and cultural norms. This opens up space for further research to better understand and address these critical issues, which is essential for the sustainable and responsible development of the gaming industry.

Thus, the papers reviewed cover a wide range of topics, from the technical aspects of introducing artificial intelligence into games to localization, story and interactivity, pointing to the potential and challenges that these technologies bring to game development. However, the review also identified some key gaps in research, particularly the lack of in-depth analysis of the impact of GPTs on gaming perceptions and behavior, and insufficient examination of the ethical and social aspects of their use.

This literature review highlights the need for a more comprehensive approach to the study of digital information systems in video games, with a particular focus on influences on gaming experience and social consequences. Such an approach should include not only the technical aspects of implementation, but also a deeper examination of how these

innovations affect the behavior and perceptions of players, as well as the broader ethical and cultural aspects of the games industry. This comprehensive view is key to understanding and leveraging the potential of digital innovation to create more engaging and meaningful gaming experiences.

After a thorough analysis of advanced research and literary sources, we can conclude that the topic of developing a management system using economic and legal methods for the use of artificial intelligence in an educational campaign is extremely relevant. This is confirmed by the rapid development of artificial intelligence technologies and their increasing influence on the educational process. However, there are significant unexplored areas, in particular regarding the long-term consequences of the use of artificial intelligence in education, ethical aspects, and the specification of legal and economic management methods. This opens up significant opportunities for further research and development in this important and dynamic area.

The scientific task of the study is the formation and selection of the most optimal strategy for adapting an information system under the influence of negative factors for video game developers.

3. METHODOLOGY

A carefully selected methodology allowed us to comprehensively analyze this complex topic, taking into account the various aspects and challenges associated with the integration of artificial intelligence in the field of game development. Using a combined approach including hierarchy analysis, paired comparison of alternatives, expert analysis and the Delphi method provided depth and objectivity to the analysis, allowing us to develop a clear and informed understanding of the potential and challenges of using GPT in the video game industry.

The hierarchy analysis method is based on structuring a problem or choosing a strategy by establishing hierarchical relationships between different elements. In the context of our study, this method helps to break down the overall task of implementing GPT in video games into smaller, manageable subtasks such as story development, dialogue systems, player interaction, etc. This structured approach allows you to focus on each component individually, assessing its importance and impact on the overall project. However, the method can be cumbersome to use because it requires detailed analysis and can be temporary, especially with a large number of components.

The even comparison method involves evaluating each alternative by directly comparing it with other alternatives. Our study uses this method to evaluate different ways of integrating GPT into the game development process. For example, you can compare the effectiveness of using GPT to generate dialogue versus using it to create dynamic storylines. This method allows a detailed evaluation and derivation of the relative advantages and disadvantages of each approach. However, it can be subjective because it is based on the assessments of researchers and difficult to use when there are many alternatives.

Expert analysis involves the opinions and assessments of experts in the field. In our case, we reached out to experienced game developers and artificial intelligence experts to get their assessments and opinions regarding the use of GPT in video games. This provided a deep understanding of practical

aspects and potential problems. The disadvantage of expert analysis is its potential subjectivity, since different experts may have different opinions and approaches. 25 experts were used in the research process. The entire process of expert research took place in accordance with the ethical standards of expert surveys.

The Delphi method is a method of achieving consensus among a group of experts through anonymous surveys conducted in several rounds. Our study used this method to reconcile different views on the optimal use of GPT in video games. The Delphi method helps avoid groupthink and focus on objective analysis, but can be labor-intensive, requiring several rounds of questionnaires to achieve consensus among experts.

The combination of these methods in our study allowed us to conduct a comprehensive and in-depth analysis of the use of GPT models in video games, taking into account different aspects and possible challenges. This design employs a hierarchy analysis to systematically prioritize factors influencing video game content creation, pairwise comparison to evaluate alternatives against each other, expert analysis to incorporate insights from individuals with specialized knowledge in video game development and AI technologies, and the Delphi method to achieve consensus among experts on the most optimal strategies for utilizing GPT models. The culmination of these methods enables the development of a strategic model that balances technological opportunities with potential challenges. Together, these methods offer a comprehensive and robust framework for developing effective strategies for the use of GPT models in video game contexts, balancing technological opportunities with potential limitations and challenges.

4. RESULTS OF RESEARCH

Video game development in the modern world is constantly evolving, and one of the key elements contributing to this development is the GPT model (Generative Pre-trained Transformers). These AI-based models are having a significant impact on the field of video games, particularly content creation.

Overall, GPT models make significant contributions to the development of video games, helping developers create more immersive, interactive, and richly layered game worlds. This not only strengthens the field of video games as an art form, but also opens up new opportunities for innovation and creativity.

The hierarchy analysis technique includes creating a model with a hierarchical structure, calculating the sum of elements in the columns of inverse symmetric matrices, and also checking the consistency of the obtained data. The basis of this method is taking into account expert assessments provided on the basis of the scale of relative importance of objects, shown in Figure 1. This approach is effective for developing potential future scenarios and solving management problems.

Now, let's highlight the most significant factors of GTP models based on the results of expert analysis, which can and currently influence the development of content in video games:

Factor 1. Ability to generate text. One of the most important aspects of GPT models is their ability to generate correct and variable text. In video games, this can be used to create dialogue, scenarios, item descriptions, or quests. This feature can significantly improve the quality of the game's story and

dialogue, making it more nuanced and interesting for players.

Factor 2. Language understanding. GPT models have a high level of language understanding, which allows them to capture subtleties and context. This is important for video games because it allows for the creation of more realistic and coherent game worlds where NPCs (non-characters) can have more natural and meaningful interactions with the player.

Factor 3. Development automation. Using GPT models can automate parts of the game development process, especially in the content and design aspects. This can reduce development costs and time, allowing developers to focus on the more complex and creative aspects of the game.

Factor 4. Adaptation to different languages and cultures. The ability of GPT models to handle different languages and adapt to cultural contexts is very valuable in the globalized world of video games. This allows games to be created that resonate with international audiences, increasing their appeal and accessibility.

Factor 5. Support interactivity and adaptability. GPT models can be used to increase the level of interactivity in video games, in particular by creating more intelligent NPCs. These characters can adapt to the player's actions and choices, making the gaming experience more dynamic and personal.

Along with this, two possible adaptation strategies under the influence of these factors should be highlighted (Table 1).

Figure 2 shows that the top of the hierarchy is the goal, namely "type of adaptation." The second level of the hierarchy is occupied by criteria describing "the influencing factors we have identified." The third level presents various adaptation options, or "modes of adaptation," that serve as alternative paths for the development of events.

Now let's analyze different possible scenarios. Several comparisons need to be made (1):

$$\frac{n * (n - 1)}{2} \tag{1}$$

where, n means the number of criteria of each level. In our case, with five key factors that influence and influence the content of video games, we must carry out ten comparative analyzes of different pairs. When comparing two elements with each other, depending on their significance and influence on the process, we will obtain proposed estimates of the corresponding elements in the matrix of paired comparisons at positions (k1, k2). We will enter all significance estimates as the results of comparisons of parts into matrix A, which is presented in table form (Table 2). Since the matrix is square and inversely symmetric, the elements on its diagonal are equal to one, while the bottom of the matrix is filled with inverse values.

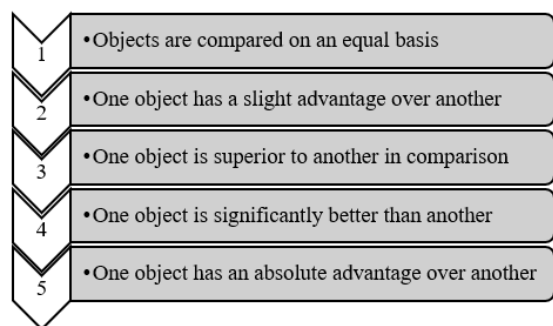


Figure 1. Scale of relative importance of comparison objects

Table 1. Possible scenarios for adapting an information system under the influence of negative factors for video game developers

Strategy 1	Strategy 2
In this scenario, video game developers integrate GPT models to create multilingual content, paving the way for the globalization of their games. Thanks to GPT's adaptability to different languages and cultures, developers can easily localize dialogue, quests, and item descriptions for different regions, providing deeper cultural immersion. This not only improves the games' accessibility to international audiences, but also increases the potential market. Developers can use these models to automatically generate a variety of content such as character names, world legends, and backstory, saving significant time and resources.	In the second scenario, developers use the power of GPT to create dynamic, interactive game worlds. By using GPT to create NPC dialogue and behavior, developers can create characters that react to the player's actions in unique and unpredictable ways, making the gaming experience more personal and immersive. These NPCs can adapt to the player's choices, changing storylines and reacting to the player's actions, creating the feeling of a living, dynamic world. This approach allows developers to create more complex and flexible game scenarios, increasing game replayability and player engagement.

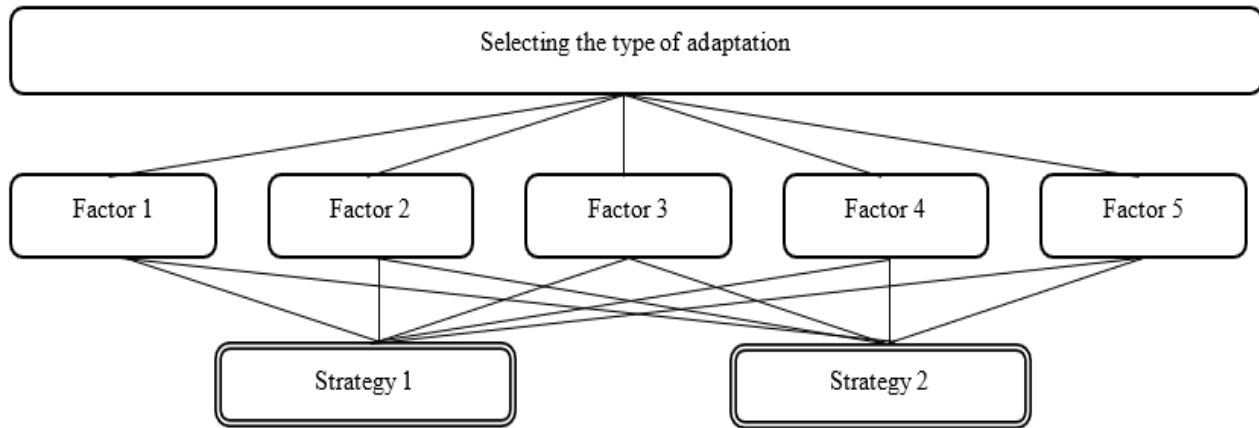


Figure 2. Hierarchy of the problem of choosing the type of adaptation

Upon completion of creating a matrix of paired comparisons based on the five selected factors, the sums of the elements of each column of this matrix (w) were calculated, and the consistency of the consistency of the matrix was checked through CI and CR) using its eigenvalue (k_{max}).

The methodology used assumes an acceptable level of disagreement in the pairwise comparison matrix. Relative differences should remain within 10%. If the consistency index (CR) exceeds this threshold, experts need to re-evaluate the original parameters of the problem and reconsider the logic of their conclusions. According to Matrix A, the results of even comparisons are considered acceptable because $CR \leq 0.1$. This indicates a sufficient consistency of expert conclusions regarding the importance of GTP model factors that can and currently influence the development of content in video games.

The next step is to analyze alternative scenarios (2):

$$n \frac{m * (m - 1)}{2} \quad (2)$$

Considering that the hierarchy contains two alternatives and five factors of GTP models that can and do influence the development of content in video games, it is necessary to compare pairs of alternative scenarios, where m is the number of alternatives, namely five pairwise comparisons (Table 3).

Similarly, a matrix should be built to determine factor 2 (Table 4).

Similarly, a matrix should be built to determine factor 3 (Table 5).

Similarly, a matrix should be built to determine factor 4 (Table 6).

Table 2. Matrix A

k1/k2	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	=1	=1/2	=1/3	=3	=2
Factor 2	=2	=1	=1/2	=3	=4
Factor 3	=3	=2	=1	=4	=5
Factor 4	=1/3	=1/3	=1/4	=1	=2
Factor 5	=1/2	=1/4	=1/5	=1/2	=1
w	=0.17	=0.25	=0.41	=0.09	=0.06
$k_{max}=5.1$	CI=0.03			CR=0.02	

Table 3. Matrix for comparison of strategies for the development of factor 1

Factor 1	Strategy 1	Strategy 2
Strategy 1	=1	=3
Strategy 2	=1/3	=1
w	=0.7	=0.3

Table 4. Matrix for comparison of strategies for the development of factor 2

Factor 2	Strategy 1	Strategy 2
Strategy 1	=1	=5
Strategy 2	=1/5	=1
w	=0.8	=0.2

Table 5. Matrix for comparison of strategies for the development of factor 3

Factor 3	Strategy 1	Strategy 2
Strategy 1	=1	=1/2
Strategy 2	=2	=1
w	=0.4	=0.6

Table 6. Matrix for comparison of strategies for the development of factor 4

Factor 4	Strategy 1	Strategy 2
Strategy 1	=1	=1
Strategy 2	=1	=1
w	=0.5	=0.5

Table 7. Matrix for comparison of strategies for the development of factor 5

Factor 5	Strategy 1	Strategy 2
Strategy 1	=1	=4
Strategy 2	=1/4	=1
w	=0.8	=0.2

Similarly, a matrix should be built to determine factor 5 (Table 7).

In the following, the strategy itself is selected (synthesis of priorities) U_j is carried out according to Eq. (3):

$$U_j = \sum_{i=1}^n w_i u_{ij}; j = 1, \dots, m \quad (3)$$

Entering data from the tables will allow you to obtain priority values for each of the considered strategies: $U_1=0.57$ and $U_2=0.43$. Thus, to adapt to the influence of certain factors, there is Strategy 1.

In a practical application of this strategy, video game developers are implementing GPT models to create multilingual content that promotes the globalization of their products. At the initial stage, the team identifies the key markets they plan to enter and the languages they support. Next, using GPT for automatic translation, developers localize game elements such as dialogue, quest and item descriptions, ensuring they are culturally appropriate and relevant.

To effectively integrate GPT models into the development process, the team ensures they are configured and optimized for the specific requirements of the game. This includes tweaking language models to preserve the style of the game world and adapting to the literary features of each language. It is also important to involve linguists and cultural experts to check and correct translations to avoid errors and inappropriateness.

5. DISCUSSIONS

The modern scientific approach requires not only the creation of new knowledge, but also its integration with existing research work. This comparison process allows us to discover the uniqueness of our research, its contribution to the academic community and the video game industry, and how our results fit into the broader context of current trends and challenges in the fields of digital information systems and artificial intelligence. By analyzing how our findings relate to other studies, we can determine the potential of our strategies and methods, and identify areas for further research and development in the context of using GPT models in video game content creation. Let's compare our study with others that are involved in our results.

A study by Tortorella et al. [19] designs context-aware learning systems, which shows the importance of adapting technologies to a specific context. Our strategy, based on

comprehensive analysis, expands on this idea by emphasizing the need to adapt GPT models to the specifics of the gaming industry, including game mechanics and game world design.

The work of Shum et al. [20] explores personalized learning through contextual adaptation in serious games. Their findings reflect the importance of adaptability and personalization, which aligns with our GPT optimization strategy to create more personalized and immersive gaming experiences.

However, in the work of Alazzam et al. [21] raises the issue of improving blockchain technologies and electronic contracts, noting the importance of technological innovation in the modern world. Although this study focuses on the financial industry, it points to a broader trend of integrating advanced technologies, similar to our approach to using GPT in video games.

Finally, Haenlein and Kaplan [22] offer an overview of the development of artificial intelligence to help understand the historical context and potential of AI in the modern world. This underpins our GPT integration strategy, based on an understanding of how these technologies can transform the gaming industry.

Rushchyshyn et al. [23] in their work on the regulatory and legal component in ensuring the financial security of the state, they point out the importance of the regulatory and legislative framework. This is a direct link to our study, since the implementation of GPT in video games also requires consideration of legal and ethical aspects, especially in light of the collection and processing of user data.

Interesting research by Hirschheim and Klein [24] offers a detailed overview of the history of the information systems field, which helps to understand the evolution and current state of this field. This is reflected in our research, where we use best practices to develop strategies for using GPT, reflecting the ongoing development of digital information systems. But at the same time, our research went further in the context of the formation of specific strategies for managing this process.

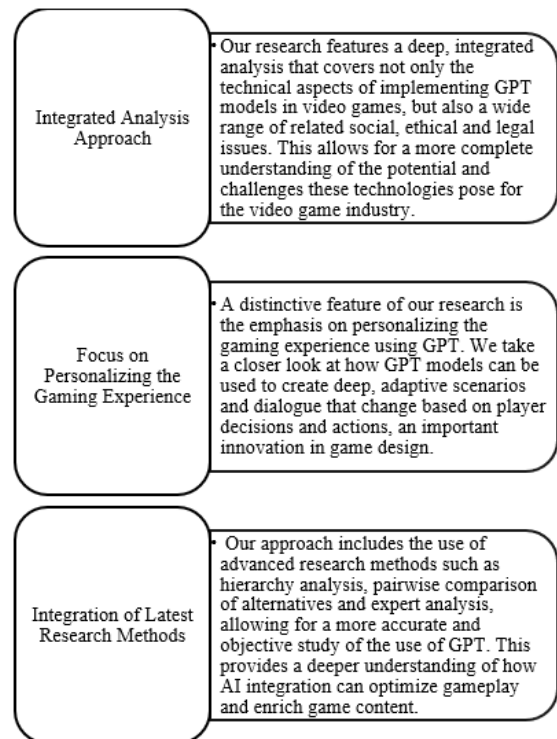


Figure 3. Advantages and differences of the conducted research

It appears that the research of Zhu and Ontañón [25], who analyzed game-centric artificial intelligence for automatic game personalization, highlights the challenges associated with adapting games to the needs of players. This directly correlates with our GPT strategy, where we strive to create personalized game content that responds to player choices.

Van Engelenburg et al. and others [26-29] explore the design of context-sensitive systems and propose a method for understanding and analyzing context in practice. This work highlights the need to adapt GPT to specific game scenarios, providing more realistic and immersive gameplay experiences. However, it does not offer real steps to optimize this area. Our study analyzes the issue of both theoretical and practical measures.

To summarize, Figure 3 depicts the key differences between the conducted research and existing ones.

As a result, our strategy for using GPT in video games is deeply analytical and comprehensive, allowing us to focus on adaptability, personalization and effective implementation of these technologies, taking into account both the technical and social aspects of their application in the gaming industry.

6. CONCLUSIONS

In conclusion, we can say that the current state of the use of digital information systems, in particular GPT models, in creating the context of video games, opens up new horizons in the development of game content. Capable of processing and generating language at previously unattainable levels, these systems are transforming the way we create dialogue, storylines, and interactive game elements. Their ability to adapt and respond to player input in real time opens up new possibilities for creating unique gaming experiences.

At the same time, with the introduction of these technologies, new challenges and problems arise. One of the main challenges is the need to strike a balance between automated content and the creative expression of developers. There is a risk that over-reliance on automated systems could lead to less uniqueness and creativity in game worlds. It is also important to ensure that the content generated by AI is appropriate and does not violate moral and cultural norms. Balancing technical challenges and creative expression in the context of developing information systems using artificial intelligence (AI) requires an integrated approach that combines software engineering with design principles. First, it is important to identify the technical limitations and opportunities that the use of AI imposes, setting clear technical parameters for the system. Next, consider the creative needs and goals of the project, ensuring that AI technologies are used in a way that enhances, rather than limits, creative possibilities. This could include developing AI algorithms that support creative processes such as content creation or automating routine tasks, allowing creators to focus on the more innovative aspects of their work. Using iterative development techniques to continually test and adjust the system based on feedback from end users and creators is also key to achieving a balance between technical excellence and creative expression.

Another significant issue is the impact of these technologies on the gaming industry and its consumers. On the one hand, they offer an enriched and personalized experience. On the other hand, there is the question of the impact of automated systems on labor relations in the industry, especially in relation

to the role of writers and content designers. Also important is the issue of collecting and processing user data, which calls into question the confidentiality and security of personal information.

Additionally, there is a challenge to the accuracy and appropriateness of AI-generated content. Because models such as GPT learn from existing data, there is a risk of replicating existing warnings and stereotypes. This may result in the creation of content that may be inappropriate or sensitive for different groups of players, requiring developers to have a high level of vigilance and control over the content generated.

Currently, the use of GPT and similar systems in creating context for video games is an actively developing area. Developers and researchers continue to work to improve these technologies to minimize their shortcomings and maximize their potential. This includes developing algorithms that can better understand context, avoid bias, and generate more relevant and inclusive content.

Thus, while the use of GPT and other digital information systems in video games opens up new opportunities for the industry, it also poses new questions and challenges. Addressing these issues will be important to ensure that these technologies make a positive contribution to the gaming industry and provide players with a quality and safe experience.

In our research, we took a comprehensive approach to analyze the optimal use of GPT models in video game content creation using a variety of methods. These included methods for analyzing hierarchies and evenly comparing alternatives, which allowed us to systematize and evaluate options for using these technologies. This helped us identify the key aspects and potential benefits of implementing GPT, while weighing them against potential risks and limitations. We also drew on expert analysis and the Delphi method, including in-depth interviews with leading experts in artificial intelligence and video game development, which added depth and complexity to our research.

Because of these methods, we were able to identify the most promising areas for using GPT in video game development. Our analysis found that while the use of GPT can significantly improve the quality and depth of game content, it is important to consider issues of ethics, data bias, and player experience. Expert opinions and evaluations collected through the Delphi method noted the need for careful planning and implementation of these technologies, as well as the importance of integrating creative human intervention to ensure the quality and relevance of the content generated.

As a result of this multi-dimensional analysis, we developed a strategy for the optimal use of GPT models in video games that takes into account both technological opportunities and challenges. This strategy involves a balance between automation and creative input, emphasizing the importance of ethical and social aspects when creating game worlds. We believe this approach will not only improve the quality of content, but also ensure a more balanced and responsible use of cutting-edge technology in the gaming industry. The study has limitations because the strategies were formed on the basis of a certain list of factors, which theoretically could lead to failure to take into account secondary factors and elements that may also influence the area being studied.

Future research stemming from this study on the use of GPT models in video game development should aim to address the limitations noted in the initial investigation, particularly the potential oversight of secondary factors that could impact the effectiveness and integration of digital information systems.

Recognizing that the initial study's strategies were formulated based on a predefined list of factors, subsequent investigations could broaden the scope to include a more extensive range of variables, such as emerging technological advancements, evolving user expectations, and unforeseen challenges in the digital landscape. Additionally, further research could explore the dynamic and possibly transformative effects of incorporating user-generated content and feedback mechanisms within GPT-based systems. This expanded focus would not only mitigate the risk of overlooking critical elements but also enhance the adaptability and relevance of GPT models in creating immersive and engaging video game contexts, ensuring that future strategies remain robust in the face of a rapidly evolving digital ecosystem.

REFERENCES

- [1] Alazzam, F.A.F., Shakhathreh, H.J.M., Gharaibeh, Z.I.Y., Didiuk, I., Sylkin, O. (2023). Developing an information model for E-commerce platforms: A study on modern socioeconomic systems in the context of global digitalization and legal compliance. *Ingénierie des Systèmes d'Information*, 28(4): 969-974. <https://doi.org/10.18280/isi.280417>
- [2] Cesário, V., Ribeiro, M., Coelho, A. (2023). Exploring the intersection of storytelling, localisation, and immersion in video games-a case study of the Witcher III: wild hunt. In *International Conference on Human-Computer Interaction*. Cham: Springer Nature Switzerland, pp. 546-552. https://doi.org/10.1007/978-3-031-35989-7_69
- [3] Colledanchise, M., Ogren, P. (2017) How behavior trees modularize hybrid control systems and generalize sequential behavior compositions, the subsumption architecture, and decision trees. *IEEE Transactions on Robotics*, 33(2): 372-389. <https://doi.org/10.1109/tro.2016.2633567>
- [4] Sylkin, O., Krupa, O., Borutska, Y., Todoshchuk, A., Zhurba, I. (2023). Exploring the impact of international tourism on regional sustainable development: A Methodological approach for enhancing effectiveness. *International Journal of Sustainable Development & Planning*, 18(7): 2089-2096. <https://doi.org/10.18280/ijstdp.180711>
- [5] Alazzam, F.A.F., Aldrou, K.K.A.R., Berezivskyy, Z., Zaverbnyj, A., Borutska, Y. (2023). State management of the system of rational environmental use in the context of commercial development of the bioeconomy: Ecological aspect. *International Journal of Environmental Impacts*, 6(4): 155-163. <https://doi.org/10.18280/ijei.060401>
- [6] Alexiou, A., Schippers, M.C. (2018) Digital game elements, user experience and learning: A conceptual framework. *Educ Inf Technol*, 23: 2545-2567. <https://doi.org/10.1007/s10639-018-9730-6>
- [7] Cossu, S.M. (2020). Behaviors. In *Beginning Game AI with Unity: Programming Artificial Intelligence with C#*. 1 ed. Apress, Berkeley, CA., 117-139. https://doi.org/10.1007/978-1-4842-6355-6_5
- [8] Krupa, O., Dydiv, I., Borutska, Y., Yatsko, M., Bazyka, S. (2023). Evaluating E-business performance in tourism within the digital era: A novel information system model. *Ingénierie des Systèmes d'Information*, 28(6): 1689-1694. <https://doi.org/10.18280/isi.280627>
- [9] Alazzam, F.A.F., Tubishat, B.M.A.R., Storozhuk, O., Poplavska, O., Zhyvko, Z. (2024). Methodical approach to the choice of a business management strategy within the framework of a change in commercial activities. *Business: Theory and Practice*, 25(1): 1-10. <https://doi.org/10.3846/btp.2024.19676>
- [10] Fan, J., Fang, L., Wu, J., Guo, Y., Dai, Q. (2020). From brain science to artificial intelligence. *Engineering*, 6(3): 248-252. <https://doi.org/10.1016/j.eng.2019.11.012>
- [11] Costa, M.C., Santos, P., Patricio, J.M., Manso, A. (2021). An interactive information system that supports an augmented reality game in the context of game-based learning. *Multimodal Technologies and Interaction*, 5(12): 82. <https://doi.org/10.3390/mti5120082>
- [12] Saleh, A.J., Alazzam, F.A.F., Aldrou, K.K.A.R., Zavalna, Zh. (2020). Legal aspects of the management of cryptocurrency assets in the national security system. *Journal of Security and Sustainability Issues*, 10(1): 235-247. [https://doi.org/10.9770/jssi.2020.10.1\(17\)](https://doi.org/10.9770/jssi.2020.10.1(17))
- [13] Kronivets, T., Yakovenko, O., Tymoshenko, Y., Ilnytskyi, M., Iasechko, S., Iasechko, M. (2023). The legal foundations for the utilization of artificial intelligence in educational processes. *Relações Internacionais no Mundo Atual*, 4(42): 686-702. <https://doi.org/10.21902/Revrima.v4i42.6556>
- [14] Sylkin, O., Shtangret, A., Ogirko, O., Melnikov, A. (2018). Assessing the financial security of the engineering enterprises as preconditions of application of anti-crisis management: Practical aspect. *Business and Economic Horizons*, 14(4): 926-940. <http://dx.doi.org/10.22004/ag.econ.287238>
- [15] Yesimov, S., Borovikova, V. (2022). Administrative and legal implementation of the rights of business entities. *Social and Legal Studios*, 5(3): 16-22. <https://doi.org/10.32518/2617-4162-2022-5-3-16-22>
- [16] Ho, H.N., Rabah, M., Nowakowski, S., Estraillier, P. (2018). Trace-Based multi-criteria preselection approach for decision making in interactive applications like video games. *The Digital Turn in Higher Education: International Perspectives on Learning and Teaching in a Changing World*, 211-234. https://doi.org/10.1007/978-3-658-19925-8_15
- [17] Kryshatanovych, M., Polovtsev, O., Liubetska, M., Lukashevskaya, U., Dubin, D. (2023). Modeling the planning of the potential for sustainable development of the region in the system of public administration of social security. *International Journal of Sustainable Development & Planning*, 18(3): 757-762. <https://doi.org/10.18280/ijstdp.180311>
- [18] Mikac, E., Bernik, A. (2022). The impact of video games on physical activity and motivation for exercise using VR technology. *Advances in Modelling & Analysis. B, Signals, Information, Data, Patterns*, 65(4): 1-8. https://doi.org/10.18280/ama_b.651-401
- [19] Tortorella, R.A., Kinshuk, D., Chen, N.S. (2018). Framework for designing context-aware learning systems. *Education and Information Technologies*, 23: 143-164. <https://doi.org/10.1007/s10639-017-9591-4>
- [20] Shum, L.C., Rosunally, Y., Scarle, S., Munir, K. (2023). Personalised learning through context-based adaptation in the serious games with gating mechanism. *Education and Information Technologies*, 28(10): 13077-13108. <https://doi.org/10.1007/s10639-023-11695-8>

- [21] Alazzam, F.A.F., Salih, A.J., Amoush, M.A.M., Khasawneh, F.S.A. (2023). The nature of electronic contracts using blockchain technology-currency bitcoin as an example. *Revista De Gestão Social E Ambiental*, 17(5): e03330. <https://doi.org/10.24857/rgsa.v17n5-014>
- [22] Haenlein, M., Kaplan, A. (2019). A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. *California Management Review*, 61(4): 5-14. <https://doi.org/10.1177/0008125619864925>
- [23] Rushchyshyn, N., Medynska, T., Nikonenko, U., Kostak, Z., Ivanova, R. (2021). Regulatory and legal component in ensuring state's financial security. *Business: Theory and Practice*, 22(2): 232-240. <https://doi.org/10.3846/btp.2021.13580>
- [24] Hirschheim, R., Klein, H. (2012). A glorious and not-so-short history of the information systems field. *Journal of the Association for Information Systems*, 13(4): 188-235. <https://doi.org/10.17705/1jais.00294>
- [25] Zhu, J., Ontañón, S. (2020). Player-centered AI for automatic game personalization: Open problems. In *Proceedings of the 15th International Conference on the Foundations of Digital Games*, pp. 1-8. <https://doi.org/10.1145/3402942.3402951>
- [26] Strzelecki, A., ElArabawy, S. (2024). Investigation of the moderation effect of gender and study level on the acceptance and use of generative AI by higher education students: Comparative evidence from Poland and Egypt. *British Journal of Educational Technology*, 55(3): 1209-1230. <https://doi.org/10.1111/bjet.13425>
- [27] Strzelecki, A. (2023). Students' acceptance of ChatGPT in higher education: An extended unified theory of acceptance and use of technology. *Innovative Higher Education*, 48: 223-245. <https://doi.org/10.1007/s10755-023-09686-1>
- [28] van Engelenburg, S., Janssen, M., Klievink, B. (2019). Designing context-aware systems: A method for understanding and analysing context in practice. *Journal of Logical and Algebraic Methods in Programming*, 103: 79-104. <https://doi.org/10.1016/j.jlamp.2018.11.003>
- [29] Kryshtanovych, M., Bondaruk, O., Datsii, N., Tanasiienko, N., Primush, R. (2023) Modeling information support for state economic security management amidst economic turbulence: A case study on sustainable regional development. *Review of Economics and Finance*, 21: 2683-2690. <https://refpress.org/ref-vol21-a289/>