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Research Article

Gaming & Geography (Education): A Model of Reflexive Analysis of Space & Action in Video Games

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Abstract: Since philosophical turns such as the spatial turn etc., geography has been dealing more intensively with the subjective perception and construction of space. Video games, and especially the vast digital spaces therein, are developed by teams of programmers, developers, and designers who make creative spatial construction decisions based on different worldviews, experiences, values, and skills. These processes result in a specific intended spatial experience for players to traverse. However, these players also approach the games with certain worldviews, prior experiences, values, etc., and the question arises to what extent spatial experiences can be intentionally passed through and what consequences the perception has for the (young) players we address with geography instruction. Thus, there is undoubtedly communication between both sides about digital space in video games. Furthermore, the question arises what role the creation of digital spaces in the games plays for the experience, understanding and reception of real analog spaces as well as for the further competences of students¹ like, exemplary, in the field of sustainability or decision reflections. Thus, it cannot be dismissed that an engagement with video games should play a stronger role in the context of addressing the reflection of spatial perceptions and constructions in geography education. Yet, they are still largely underrepresented in studies of geography education and many studies lack sufficient empirical proof and orientation for teacher professionalization. In the paper, results from the research project "Gaming & Geography" will be presented, which attempts to create further legitimizing foundations for the integration of video games as a medium in the didactic discourse of geography via a mixed method a-proach and transfer services for teachers. Based on the research in the project, a model for reflexive analysis of digital space and action in video games will also be presented, which should facilitate a stronger and more serious didactic integration of video games in geographic education. The results of the study provide a significant contribution to take the medium of video games as a geographical medium more seriously and the study provides further establishment measures to use the presented model didactically, because they show that students actively engage in geographic contexts in games, they reflect on the contexts presented and the experts encourage the necessity of the presented model.

Keywords: video games, deconstruction, gamification, geography education, critical geography, reflexive competences, spatial turn, cultural turn, reflexivity, teacher professionalization, digital media.

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Highlights:

- Strengthening the discourse around video games as a geographic medium
- Discussion of the model of reflexive spatial analysis of digital space in video games in geography education
- Quantitative and qualitative empirical approaches and results towards spatial reflection regarding digital space/action in video games

1. Introduction

We write articles in this journal because we are geographers, geography teachers and/or researchers in geography education who deal with that science of space. Since philosophical/cultural turns such as the spatial turn etc., geography has been dealing more intensively with the subjective perception and construction of space. Teams of programmers, developers, and designers create video games, and particularly the huge digital worlds found within them. These teams base their creative spatial construction choices on their varied worldviews, experiences, values, and skills.

Players can now navigate a certain planned spatial experience as a result of this. However, because these players also bring specific worldviews, past experiences, values, etc. to the games, it is unclear to what extent spatial experiences can be purposefully filtered and what effects the perception has on the (young) players we aim to educate about geography. Therefore, there is unquestionably communication about digital space and action in video games between the two sides. The topic of what impact the development of digital environments in games has on players' experiences, comprehensions, and reception of actual analog environments as well as on their potential to develop extra skills, such as sustainability or decision-making, also arises. Therefore, it cannot be denied that playing video games should be part of the conversation about how spatial perceptions and constructions are reflected in geography education.

Let's go through a few popular games of the last years as examples to consolidate these thoughts a bit (Figure 1).

¹ Students is always meant synonymous to pupils here. Meant are children in primary school, secondary school and high school.



- GTA V satirically paints a cynical portrait of modern America. In an open game world, in which the player's freedom is almost unlimited,
 a detailed and accurate representation of Los Angeles is presented. Many buildings can be recognized, there is a city map and a street
 network based on the real city, and urban geographic problems such as segregation and poverty are also depicted in the game world.
- In the cartoon worlds of the extremely popular game Fortnite, players compete against each other, taking into account different elements of flora and fauna, as well as climatic conditions. A map is crucially implemented and to be used to gain success and advantages in the game.
- 3. In the dystopian world sections of a Last of Us, the North American continent is depicted as nearly depopulated after a global pandemic, and nature reclaims the habitat.
- 4. In Celeste, a 2D platform game, climbing a mountain and scaling various platforms through jumping passages is represented as an allegory for overcoming depressive moods. The colors and ice levels strongly correlate with the intended emotional experience of the game.
- 5. In the video game "This War of Mine", the player takes on the role of a survivor in a war-torn city. The objective is to survive by collecting food, medicine and other resources and trying to survive the conflict unscathed. In doing so, the player must make difficult moral decisions and confront other survivors who are also struggling to survive. The game emphasizes a (realistic) portrayal of war and shows the human impact on the civilian population. The spatial representation is done from a side view, similar to a 2D platform game. The player sees the individual rooms and objects in the buildings and can navigate between the different locations in the city. The environment is often gloomy and destroyed to give the impression of a war zone. The spatial representation is used to give the player a realistic and immersive experience in a city affected by war.

Hence, fearful spaces and spaces of positive emotional charge are developed, representation of ethnic minorities, certain groups as well as representation of nations, countries and cities take place (Figure 1).



Figure 1. Examples of spatial experiences in video games (GTA V, first row), (Fortnite, middle row left) vs. approaches of realism (Last of Us, middle row right) (own screenshots) and 2D approaches (Celeste (down left) vs. This War of Mine (down right), Tropico (last row) (own design)



Strategy games (Figure 1) are also a valuable addition to the geography classroom because they are often based on (real) maps and implemented (geographic) data and allow players to experience and apply geographic concepts and principles. In games such as Civilization, students can explore the impact of geographic factors on the formation and growth of civilizations, such as the role of rivers and sea access in trade, the importance of mountains and forests for defense, or the impact of climate and natural resources on economic development. Real-time strategy games such as Age of Empires or Rise of Nations can encourage students to explore geographic concepts such as geopolitical strategy and warfare by analyzing historical maps and events and developing strategies for victory. Games such as Tropico or Crusader Kings II can encourage students to examine complex geopolitical contexts and historical events by placing them in the role of state leaders and making decisions that affect their nation's geographic expansion and political development. By connecting strategy games to geography lessons, students can gain a deeper and more experience of geographic concepts and principles and improve their skills in analyzing and applying geographic data and information (also see Lux & Budke, 2020a; 2020b).

So, there are spatial experiences/actions happening in video games. Why should we especially care in geography education? Because everyone is playing video games. Globally, the number of video gamers has risen to over three billion in 2023 (Bitkom studies, 2021; May, 2021; game/spiel, 2022; Benrath, 2022). That's half of the global population. Over half of children play video games from the age of 6. The number increases until they enter secondary school and beyond. So, it's a leisure and consumer issue that's present from elementary school to university and beyond. Economically, the video game industry has already overtaken the music industry and the movie industry. Video games are therefore deeply rooted in youth culture, a youth culture that the subject of geography must address in order to meet the challenges of the future (Mehren, 2022). A large proportion of students surveyed, for example in the Bitkom studies, believe that they learn skills with video games and that they can no longer imagine a life without video games. According to studies, more than 90% of all young people (in Germany) between the ages of 10 and 18 play games for up to two hours a day, depending on the cohort. Especially during the pandemic, these numbers have risen further (Bitkom studies, 2021; May, 2021; spiel/game, 2022; Benrath, 2022).

To sum up then, in video games developers and designers create a certain cultural, spatial experience in digital worlds, experiences that students need to put in a certain context, for exactly what we need geography (teachers) – what they have been doing regarding the reflection of other cultural representation of space like in movies, documentaries or tourism adverts or maps for instance. It is clear that a study of video games should be conducted in the context of addressing the reflection of spatial perceptions and constructions in geography classes based on the aforementioned arguments and when we take into account current standards in curricula (next chapter) thus far. They continue to be largely underrepresented in studies on geography education despite this or the studies lack a broader empirical foundation. In order to offer a complex and usable model of reflexive spatial analysis/action of space in video games in geography education, the purpose of the following paper is to first discuss theoretical perspectives on spatial reflexivity in (digital) geographies. In addition, the article is intended to discuss the model by triangulating empirical methods and to provide impetus for further revision. The article is based on empirical work from the research project "Gaming & Geography - A multi-perspective approach to understanding the impact gaming has on geography (education)", which aims to deepen the discourse on video games as a geographic medium and to bring insights of that into teacher professionalization and schools and university through scientific transfer and communication.

2. Video games and spatial reflexivity in geography education: A model of spatial reflexivity in video games in context of geography education

If we want to approach that discourse of video games as a complex medium in geography education, we need to define what video games are but video games are so different, so manifold, that this definition by Feige makes sense: "What the computer game is cannot be clarified by an abstract definition that names essential characteristics and thereby distinguishes it from other aesthetic media in a separable way, but rather by looking at how the medium has evolved and with a sensitivity to the fact that this evolution is open-ended" (Feige, 2019). We need to highlight therefore, that the medium is constantly changing, evolving and different genres of games use different degrees of geographic involvement and themes. Further we need to ask what has already been discussed in the discourse of geography education. Of course, only a very small insight can be made here and it is to mention that especially cultural/critical geography and parts of geography education has done a lot here already in terms of deconstruction and critical, cultural awareness in geography (e.g., Lux & Budke, 2023; Woods, 2021; Ash, 2009; 2010; Ash & Gallacher, 2011; 2012, Dornieden, 2020; Tomashot, 2017; Lux, Budke & Guardiola, 2021). For the insight regarding the discourse in geography education itself the analysis by Lux and Budke (2020a) is pretty helpful, who analyzed popular strategy games regarding their 1) potential and their creating 2) threats for geography education.

"...digital games are not merely a popular leisure activity among young people, but are also suitable as a teaching and learning medium. A special feature of this interactive medium is that the game environments place learning in a context in which what is learned is directly relevant and practiced, for example, in solving problem situations that arise in the course of the game. If these contexts could also be docked in terms of subject matter, digital games could contribute to constructive, self-directed, and situated learning in subject lessons (Lux & Budke, 2020a)."

"However, it also became clear that some of the topics were presented in a very simplified manner, such as the local nature of environmental damage or the exclusion of agriculture from the climate system. In particular, the causes and effects of migration are presented in a superficial and one-sided manner. This superficiality is not surprising due to the focus of the games on entertainment; although even "serious" simulations are always based on simplified, imperfect models". (cf. Lux & Budke, 2020a).

The first quote shows how challenging but also nurturing such games can be in geographic contexts because they can show students as actors how to cope with an economy or the climate crisis, workforce and migration in a state. Students can learn that different issues are crucially interwoven and it can be pretty difficult to serve different issues at once. The games thus introduce potentials for systemic, critical thinking in geography and also invite critical model analysis (Mehren et al, 2016). The second quote shows that teachers are needed to present this complexity of systemic issues and to help students discover superficiality. For example, one strategy game ignored the impact of agriculture on the climate crisis. In other examples, such as Sim City, where a whole city is to be built and planned, and infrastructure plays a role, the player does not have to build parking spaces and does not take into account the space occupied by cars. Students, hence, need to have deconstructive,



reflective, and critical cultural skills when playing video games because these skills allow them to understand the complex social, cultural, and political themes present in many modern video games.

By learning to analyze and reflect on these themes, students can then develop critical thinking skills and take a critical stance toward the ideas and values contained within them (de Paula, 2020; Gigerl, 2020; Goethe, 2019; Atteneder, Gryl & Jekel, 2022; Gryl, 2012; Gryl & Kanwischer, 2011). For example, many video games may address issues such as violence, gender roles, ethnic identity, political power, and social inequality – only to name a few. By recognizing and reflecting on these themes in video games, students should develop a deeper understanding of how they play out in society and how they relate to real-world issues. They can also learn to question and critically evaluate their own values and beliefs, which can help them gain a fuller understanding of the world around them (Morawski, 2023; Lux & Budke, 2020a,b,2023).

- 1. In the game "Papers, Please," for example, players must work as immigration officers in a fictional communist state, deciding who can and cannot enter the country. The game addresses issues such as the impact of poverty and political oppression on migration, the ethical challenges of border control, and the responsibilities of immigration officers to the people they control.
- 2. In Life is Strange, players play the role of a high school student in rural, suburban America who has the ability to turn back time. The game deals with issues such as depression, suicide, bullying, domestic violence and the consequences of decisions that affect the mental state of others. The game encourages players to question and reflect on their own prejudices and stereotypes.
- 3. "Gone Home" is an interactive narrative game in which players take on the role of a young woman who returns to her childhood home and tries to figure out what happened to her family. The game addresses issues such as family relationships, gender roles, sexual identity, and dealing with illness and death.

Geography teachers need to reflect that younger students might experience United States, South America or Africa or other spaces/transcultural contexts through these games and not via field trips in schools or due to money issues or other decisions made by parents during the holidays. Students, therefore again, need to be able to put these games as subjective constructions into context. Teachers and researchers of geography education need to ask modern questions, addressing the current generation of students, like how is the US, South America, Africa, or Native Americans, how Is London, Los Angeles, problems of mega cities, or female characters presented in games and what does this mean for the world view of our students, who play these games?

When teachers analyze the curricula (here: the example in Germany – nevertheless we find global/European curricular overlapping) in that regard, they present us legit demands to understand video games as geographic media and the influence of digital spatial experience on the world view of our students. By means of the Media Competence Framework (in the federal state North Rhine Westphalia for instance here (NRW)), children and young people are supported in systematically acquiring important key qualifications in six different areas. In addition to "operating and using", "informing and researching", "communicating and cooperating", these also include "producing and presenting" and "analyzing and reflecting". The area of "problem solving and modeling" enables a basic education in information technology already from the first grades. It is not only in the area of "reflecting" that it becomes apparent that the reflective handling of the youth culture artifact video game and the influence on the spatial perceptions of students is a necessity in the classroom (Media Consulting NRW, 2018). The German educational standards of geography, which in contrast to the federal core curricula, make a scientifically-based recommendation for the quality assurance of geographic education at the federal level, call in the standard for the competence area of "Spatial Orientation" to promote the ability to reflect on spatial perception and construction in geography lessons (DGfG, 2020, p.16f.). Furthermore, the standards state that the "ability to describe and reflect on the methodological steps of gaining geographic/geoscientific knowledge in a simple form" (M 4), the "ability to reflect on actions with regard to their natural and socio-spatial effects" (H 4) or the "ability to evaluate selected geographic/geoscientific information from the media based on criteria (media competence)" (B 2) should be promoted. In addition, the standards frequently point out that the subject should enable students to develop a "reflected awareness" (DGfG, 2020, p. 2) and the "reflected handling of media" (3) as well as to "lead to a reflected, ethically justified and responsible spatial ability to act" (4). The mode of reflection is also explicitly stated in the subject-specific formulation of the requirement areas (AFB) in the hierarchy-highest AFB III (AFB III = reflection and problem solving). It can be stated therefore that reflection/reflexivity in the educational standards for geography is a cross-cutting competence that should be promoted in every area of competence.

Another theoretical bedrock to analyze the spatial experience in games stems also from the established concept of reflexive map competences (see for example: Gryl, 2012; Atteneder, Gryl & Jekel, 2022). Maps help with spatial experiences and maps are subjectively constructed. Generalization of a slum in Dharavi in Open Street Map as a simple grey matter in contrast to an extremely detailed urban center, for instance, can also be detected as discriminating procedures. Those reflexive competencies of our students and students regarding the understanding of the spatial constructions in games are needed.

Learners who possess reflexive geomedia competencies are better able to gain a deeper understanding of geographical issues and to participate in daily spatial decision-making with greater maturity. Reflection is understood here as an externalized process that describes the questioning of a particular issue or object. Reflexivity, on the other hand, questions one's own thinking and actions in this context. Specific competencies to use geomedia maturely are thus in a reciprocal interrelationship with maturity-oriented competencies beyond geomedia (Atteneder, Gryl & Jekel, 2022)

With the intention to analyze and deconstruct the subjective decisions in game design and their effect on the world view and spatial perception and construction of geography students, the authors developed a "toolbox" for deconstructive analysis of game design for geography education (Figure2). It can be understood as a theoretically collected from game and cultural studies what creative decisions might construct digital spatial experience in video games, so teachers and students can take a look at these parts for a detailed analysis in their lessons. Again, in figure 2, then, dimensions are offered that we think reflect the choices game designers make that establish and influence geographic, spatial immersion in video games, respectively, interaction there, perception there, and communication there (Morawski, 2023; Ash, 2012; 2015; Feige, 2019; Schell, 2019; Lux & Budke, 2020a,b; 2023). These individual dimensions can be identified by scholars of geography and didactics to deconstruct different spatial experiences in games. In addition, the figure offers the possibility for teachers to extract individual dimensions and make them the subject of a game analysis in a geographical context. Figure 2 is also established and explained fundamentally detailed in Morawski (2023).

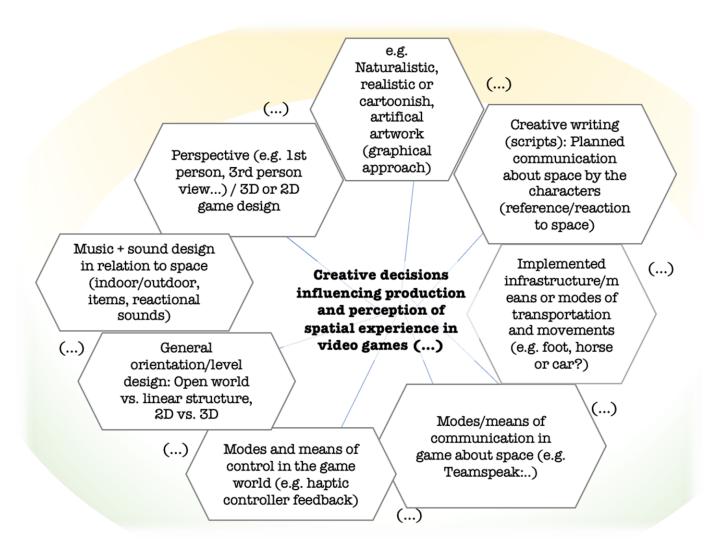


Figure 2. Creative decisions influencing the perception of spatial experiences in video games (own design based on: Morawski, 2023; Ash, 2012; 2015; Feige, 2019; Schell, 2019)

Based on previous findings and theoretical framing, the following model (Figure 3) has been designed to add more fundaments to the dimenions in figure 2. The model should help to position lesson planning in the discourse of video games in geography education and the article should further critically discuss it, so that the model can be empirically-proven used in teacher professionalization and scientific discoursed. With the model the following issues/questions/intentions should be addressed in geographic contexts:

- 1. "How should we talk about video games in didactic geographical settings?": This intention refers to the need to develop a framework for discussing video games in the context of geography education. It requires an understanding of the ways in which video games can be used to teach geographic concepts and how to communicate these ideas effectively to students.
- 2. "Helping to put video games into didactic, reductive arrangements, i.e., helping in lesson planning": This point involves the development of instructional materials that use video games to teach geographic concepts. It requires identifying the specific game mechanics and elements that can be used to illustrate these concepts and creating structured lesson plans that integrate the game into the (geography) classroom curriculum.
- 3. "To make clear aspects of the communication processes between developers and players": This aspect addresses examining the relationship between game developers and players and how this relationship affects the design and reception of video games. It requires an understanding of the ways in which developers communicate with players through game design and how players respond to these messages in geographic contexts.
- 4. "To set impulses for didactically deconstructing critical research processes": This focus involves using video games as a tool for teaching critical thinking and research skills. It requires developing lesson plans that challenge students to analyze and critique the design and content of video games, as well as the underlying cultural assumptions and biases that inform them.
- 5. "To set impulses for communicating about games in social groups and the processes there": This intention should examine the social dynamics of video game culture and how they shape the way people talk about and interact with games in geographic contexts. It requires an understanding of the ways in which gamers communicate with one another, the social norms and expectations that govern these interactions, and the role of games in shaping social identity and relationships.
- 6. "To offer impulses for the analysis of reflection and participation strategies through gaming": This idea refers to using video games as a tool for promoting reflection and critical self-evaluation. It requires developing lesson plans that challenge students to reflect

on their own experiences with games, the ways in which they engage with game content, and the role of games in shaping their beliefs and values. It also involves promoting strategies for active participation in game communities and using games as a means of exploring and challenging social and cultural norms.

The model is presented in much more detail also in Morawski (2023). In brief, the model posits that video games are subjective constructions that depend on certain influences, decisions, and coincidences on the part of the production and development side (Figure 3). Players, in turn, experience games in a certain way because of certain presuppositions. The exchange between these two sides, developer and player, takes place largely through the action in the game, the communication there, and the spatial representation there. Both developers and players communicate about the video game experience in the "real" world through various media. Through this, they constitute further elements of their worldview. Experiences in video games can also develop different readiness for participation in the "real, analog" world. For example, the depicted conflict with migration or the climate crisis in video games might lead to participatory, emancipatory, democratic actions outside the games on the part of the students. The didactic researchers and/or the teachers analyze didactically reducing with a deconstructing view this communication and consider how they can analyze the communication process in the lessons (Morawski, 2023).

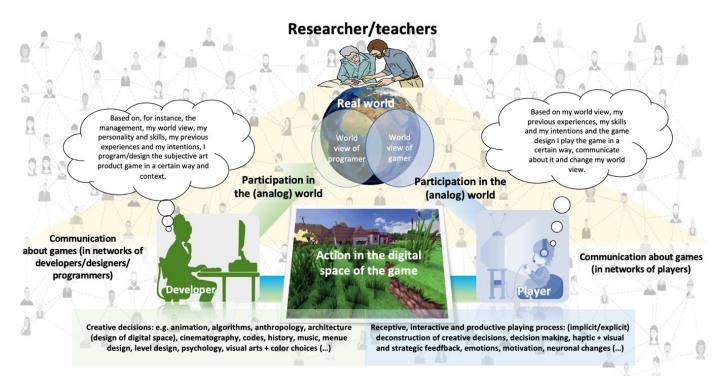


Figure 3. Model of reflexive analysis of space and action in video games: own design based on ideas of (Morawski, 2023; Gryl, 2012; Ash, 2012; Schell, 2012; Lux & Budke, 2020a,b; Applis, 2022; Kanwischer, 2014; Ash et al., 2018)

The presentation of the triangular mixed-method methodology in the next chapter should empirically deepen the ideas/intentions of the model. At this point, we would also like to point out, again, the intentions and research questions of the article:

- How do we (further) approach the discourse around gaming in geography education?
- In how far does the triangular research help to further establish the model of reflexive analysis of digital space in video games to implement video games more fundamentally as a medium in geography education?

3. Materials and Methods

The following figure 4 gives an overview of the structural, logical and empirical flow of the research project "Gaming & Geography". The empirical procedures used/being relevant in this article here are marked in the red rectangle. It should also be noted again that the results are also being transferred into school practice and the professionalization of teachers (figure 4).

It must be emphasized at this point that, due to the brevity of the article, only excerpts from the various surveys can be presented here. However, in order to capture the overall context of geographic education and the project, it was decided to present the triangulation rather than just one survey to transfer the ideas to a broader audience. A mixed-method approach can be useful when conducting research on reflexivity in video games because it allows for a more comprehensive and nuanced understanding of the phenomenon, since reflexivity in video games involves examining the ways in which players reflect upon and critically engage with the representations, narratives, and social dynamics present in the gaming environment. By combining qualitative and quantitative methods, researchers can capture both the subjective experiences and perspectives of players (qualitative) as well as gather empirical data and statistical trends (quantitative) (Johnson, Onwuegbuzie & Turner, 2007; Creswell & Plano Clark, 2018; Fetters, Curry & Creswell; 2013). Qualitative methods, such as interviews, observations, and focus groups, can provide rich and detailed insights into players' thoughts, feelings, and reflections on the gaming experience. These methods allow researchers to delve into the complexities of how players interpret and make meaning of the game content, the social interactions they engage in, and the impact on their identities and worldview. On the other hand, quantitative methods, such as surveys or broader frequency analysis, can provide a broader perspective by collecting data from a larger sample size. These methods can help identify common patterns, trends, and correlations across a wide range



of players and games. For example, quantitative analysis may reveal common themes or tendencies in how players engage in reflexive practices, such as critical discussions on online forums or engagement with fan communities. By combining qualitative and quantitative data, researchers can triangulate their findings, comparing and contrasting different sources of evidence to gain a more comprehensive understanding of reflexivity in video games. This mixed method approach allows for a more robust and validated interpretation of the research results, enhancing the credibility and generalizability of the findings. Additionally, a mixed method approach can help address potential limitations of individual methods. For example, qualitative methods may provide in-depth insights but might be limited in terms of sample size or generalizability. Quantitative methods, on the other hand, may lack the depth and richness of qualitative approaches. By combining both, researchers can mitigate these limitations and capture a more complete picture of reflexivity in video games. In summary, a mixed method approach in researching reflexivity in video games allows for a comprehensive exploration by combining the strengths of qualitative and quantitative methods. It facilitates a deeper understanding of individual experiences while also identifying broader patterns and trends within the gaming community (Johnson, Onwuegbuzie & Turner, 2007, Creswell & Plano Clark, 2018, Fetters, Curry & Creswell, 2013).

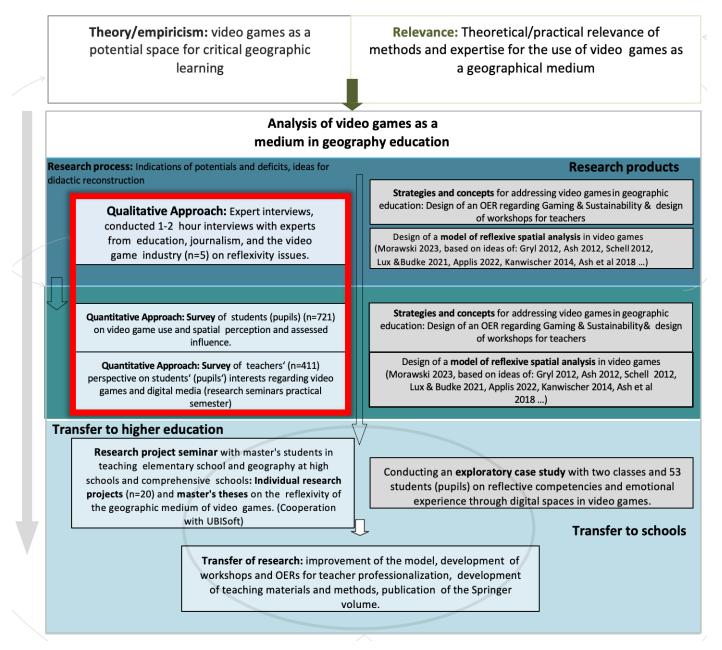


Figure 4. Structure of the research project "Gaming & Geography (Education) - A multi-perspective approach to understanding the impacts of gaming on geography (education)" and embedded empirical research, highlighted red are the empirical methods/results discussed in this article.

3.1. Qualitative Approach

Qualitative research methods such as expert interviews are particularly well suited to generating hypotheses, as they make it possible to gain in-depth insights into the phenomenon under investigation and to understand complex interrelationships (Mayring, 2015). This is particularly important when the research topic is poorly researched or unclear and there are no established hypotheses yet. So, in this case, the idea of



analyzing a spatial reflexivity and deconstructing representations in digital spaces and actions in video games in contexts of geography education. According to Mayring (2015), qualitative content analysis is based on a deductive, inductive, or abductive approach. The inductive approach involves generating new hypotheses or theories from the data by analyzing them systematically. Thus, the expert interviews can help generate new hypotheses by providing insights into the phenomenon under study and its complex interrelationships. Helfferich (2019) emphasizes that qualitative research methods such as expert interviews make it possible to capture the subjective perspective of the interviewees and thus gain a better understanding of the phenomenon under study. Expert interviews can help uncover hidden contexts, motivations, and ways of thinking that may not be captured in other research methods due to their complexity or subtlety. Qualitative research methods such as expert interviews are, hence, particularly well-suited to provide in-depth insights into complex contexts and capture the subjective perspective of interviewees. Accordingly, the project began by seeking out 5 experts who look at the topic of spatial reflexivity in video games from different perspectives. The experts were drawn from the fields of (geography) education, video game journalism and video game development. The contacts could be established partly due to joint planning of digital learning units and courses and the gaming research in the institution. Interviews were conducted live, recorded, and transcribed. Five interviews have been conducted so far because the researchers identified theoretical saturation regarding the research question. Achieving theoretical saturation is an important aspect of quality assurance in qualitative research. It means that the researcher has gathered a sufficient variety of opinions, perspectives, and information to conduct meaningful analysis and interpretation. However, it is important to note that the number of interviews needed for theoretical saturation may vary depending on the research question, context, and complexity of the topic (Rowlands, Waddell & McKenna 2015). In general, the interviews have been extensive partly over two hours and have yielded a wealth of data. Two experts from education, two experts from the gaming industry, and one journalist were interviewed. The transcripts were analyzed along deductive categories with inductive refinement steps along the content-structuring summary content analysis elaborated by Mayring (2015). Three coders compared category assignments and were able to ensure interrater reliability. Questions were recorded in a semi-structured guide that allowed for openness and flexibility. In general, questions about the importance of video games for (geographic, sustainable) education, critical cultural and media reflection, and the future of the medium were discussed. The interviews lasted approximately 45-125 minutes. Students as players were not interviewed at this point because they were interviewed in larger sample numbers after the hypothesis generating expert interviews.

3.2. Quantitative Approach

There were two questionnaires/two quantitative studies in the research project. One for students in primary/secondary schools and one for teachers. Teachers were surveyed by students over a 30-month period. Different groups of students explored this in a total of four consecutive practicum seminars as research during their practicum semester. The practical semester in the teacher training program in NRW (largest federal state in Germany) is a compulsory part of the program that usually takes place in the third or fourth semester in the Master's degree program. During the practical semester, prospective teachers complete a longer internship at a school in order to gain initial practical experience in teaching. During the internship, students are usually assigned to one or more mentors who support them in planning and implementing teaching units. The specific tasks and activities during the internship semester may vary depending on the subject area and type of school. Students must also carry out study projects as part of the practical semester. These projects aim to put theoretical knowledge into practice and promote reflective thinking. This study project resulted in a quasi-representative sample for the state of NRW, of teachers with 2 to 35 years, between 26- and 65-years old teachers, of teaching experience at both elementary and secondary schools. 411 teachers were surveyed. Teachers work in 24 different cities in the state. Teachers can be divided into different age cohorts: 20s: 2 persons, 30s: 54 persons, 40s: 89 persons, 50s: 49 persons, 60s: 7 persons. The average age was 36 years. Teachers were asked questions related to their assessment of digital media and therein the potential of video games on their teaching, as well as their assessment of the influence of video games on students' behavior at school and in their free time.

Another questionnaire was used to collect students' statements according to mentioned research question. For the quantitative study of the research project "Gaming & Geography", the research question based on previous theoretical and empirical findings was "To what extent can students' statements about gaming behavior and reflections on experiences in video games be classified in the model and which geographical references do students contextually make in their statements?". Standardization is an advantage for both surveys here, i.e. students answer the same questions in the same way. In a study by Loo (2015), questionnaires were identified as a reliable method to measure students' motivation to learn. The results showed that students' motivation can be systematically measured by using questionnaires and that the results can be used to make pedagogical decisions. Budke & Kuckuck (2015) also emphasized in their research that questionnaires are an effective method to capture students' opinions and attitudes. They found that questionnaires provide a quick and effective way to collect data on various aspects of school life. In summary, questionnaires offer the ability to collect large amounts of data quickly and efficiently and to analyze the data in numerical form to identify trends and relationships. In the survey, students were interviewed using digital and printed questionnaires. For the quantitative student survey, both digital and printed questionnaires with open-ended questions and Likert and Richter scale response options were used. Based on the research question, the aim of the study was precisely to investigate the gaming habits of a group of third to twelfth graders aged 8 to 19 years old, coming from different schools and classes. In total, the questionnaires were used in 23 classes in 6 different schools (4 high schools/comprehensive/secondary schools, 2 elementary schools) in NRW. A total of 721 students were interviewed, although of course not all students answered/responded to all questions. Therefore, it is important to consider the respective "n". Questionnaires were distributed to the following grades in North Rhine-Westphalia:

Third grade: 2 classes
Fourth grade: 3 classes
Fifth grade: 4 classes
Seventh grade: 4 classes
Ninth grade: 4 classes

Tenth grade/EF: 3 geography classes

Q1: 3 geography courses

There were three different student questionnaires, but they asked the same thing in essence, just at different age-appropriate wording levels.

In third grade, students are usually around 8 or 9 years old. In grades four through six, they are typically between 9 and 11 years old. From seventh to ninth grade, the average age is usually between 12 and 14. Students in high school, grades ten through twelve, are usually between 15



and 18 years old. The school selection took into account that the schools in the sample have a different social index, so that different backgrounds are taken into account. Access to video games can, after all, also be an economic factor. In North Rhine-Westphalia (NRW), the social index is used at schools as an instrument to record the social background of students. The social index is intended to ensure that educational opportunities are distributed fairly and that disadvantaged students are supported. The social index is based on various characteristics that are intended to capture the social background of the students. These include, for example, the educational attainment of the parents, the income of the family, the migration background and the district in which the students live. These characteristics are combined to form a social index, which is expressed as a number. (Schräpler & Jeworutzki 2021).

Content Validity involved ensuring that the questionnaire items accurately represent the construct being measured. This was done by carefully reviewing the questions and assessing their relevance to the intended concept. Additionally, expert opinions were sought to evaluate the appropriateness of the items and their alignment with the research objectives. This was achieved by conducting a thorough literature review and consulting the mentioned experts in the field of geography and gaming (Roos & Leutwyler, 2017). The research methodology used included frequency analysis (via SPSS) and content structure analysis (via MAXQDA), with Roos & Leutwyler (2017), Mayring (2015), Schreier (2014), Marienfeld (1976), and Hillers (1984) as references. The study had three main foci. Thus, there were different main categories in the questionnaire:

- 1. General information such as age, play behavior (duration), favorite games, and interests.
- 2. School/lesson-related (Here, topics from the curriculum were included in a reduced way, among other things): Can topics from school/geography lessons be found again in games?
- 3. Self-reflection: How do games change you and your behavior?

First, the study aimed to investigate the duration of gaming sessions and motivation for playing video games. Second, the study aimed let students identify geographic themes in the games played, such as conflict, resources, and urban themes. These methods of analysis are intended to gain a comprehensive understanding of gaming habits and the potential impact on this particular age group. Finally, the influence of video games as articulated by the students should be explored. In the following, exemplary questions from the survey will be presented to make the design of the survey here more transparent.

- A first sample question inquired about the role of game worlds, including places, cities, nature and landscape, and vehicles. The
 participants were asked to share their opinions on the importance of these elements in the games they played and whether there
 were any specific games where the design of the game world impressed them. The responses to this question, which was an open
 question with free text tasks, were analyzed using content analysis, which aimed to identify themes and patterns in the participants' answers.
- 2. A second sample question focused on the role of maps and orientation in the video games played by the participants. This question aimed to assess the importance of navigational tools in the games and how they impact the players' experience. The responses to this question were analyzed using both quantitative and qualitative methods, with frequency analysis and content analysis used to identify patterns and themes.
- 3. A third question sought to explore the decision-making processes in the video games played by the participants. The participants were asked to identify the types of decisions they had to make in the games and which ones they found particularly challenging. The responses to this question were analyzed using content analysis, which aimed to identify patterns and themes in the participants' answers.
- 4. Finally, a fourth question aimed to investigate the impact of video games on the players' perspectives. The participants were asked if they remembered anything from the games they played that made them think differently about real life, the world, or problems in some way. The responses to this question were analyzed using qualitative methods, with content analysis used to identify patterns and themes in the participants' answers.

Overall, the survey aimed to utilize a range of questions to gather in-depth insights and opinions from the participants, enabling a comprehensive understanding of the role of game worlds, maps, decision-making processes, and the impact of video games on the players' perspectives. In addition to open-ended questions, question formats with Likert and Richter scale response options were used. A Likert scale is a common type of response scale in questionnaires used to measure attitudes, opinions, or evaluations. In this scale, participants are presented with a statement or proposition and asked to indicate their agreement or disagreement on a scale of 1 to 5 (or similar), where 1 represents "strongly disagree" and 5 represents "strongly agree." Likert scale allows researchers to measure and quantify the intensity and direction of participants' attitudes or opinions. They can also be used to measure the frequency of behaviors or the importance of certain factors. A similar type of response scale is the Richter scale, which is also used to measure attitudes and ratings. In a Richter scale, participants are also presented with statements or testimonials, but instead of rating their agreement or disagreement on a scale of 1 to 5, they are asked to indicate their rating on a scale of, for example, -3 to +3, with 0 representing "neutral." This type of scale could allow participants to differentiate their ratings here more accurately and distinguish between positive and negative ratings. In either case, the results of the scale can be used to make and quantify statements about the distribution of attitudes or opinions among a group of participants. The Liker and Richter scales are often used as effective quantitative research methods in empirical social research because they provide a quick and effective method for collecting data (Babbie, 2016). The questionnaires can be viewed in the digital appendix.²

3.3 Limitations:

There are limitations to these methods. For example, the selection of experts can be biased, as researchers may choose individuals based on their own subjective criteria. In addition, the opinions of experts may not necessarily reflect the views of the wider population. Also, experts may have their own interests, biases, and values that influence their responses. Therefore, the results of expert interviews should be interpreted with caution and cannot be generalized to the wider population without further validation (Kvale & Brinkmann, 2015; Creswell, 2014; Cohen, Manion & Morrison; 2018). However, there are also several methodological limitations to consider regarding surveys. One limitation is that questionnaires are often subject to response bias. Respondents may not answer truthfully or accurately due to social desirability bias, where they

² Morawski (2023). Survey Secondary School.pdf. figshare. Journal contribution. https://doi.org/10.6084/m9.figshare.23641089.v1



provide answers they believe are socially acceptable. Additionally, questionnaires may not provide enough contextual information, making it difficult to interpret responses. The wording of questions can also influence the responses, with leading questions or ambiguous questions potentially leading to inaccurate responses. Furthermore, questionnaires can also be limited in their ability to capture the complexity and richness of participants' experiences and perspectives. They may not be able to capture the nuances of individuals' thoughts and feelings, and may not be able to provide in-depth insights into specific topics (Kvale & Brinkmann, 2015; Creswell, 2014; Cohen, Manion & Morrison, 2018).

4. Results

4.1. Quantitative approach: Students' survey

In this questionnaire, students were asked to identify which topics from their geography lessons they recognized in the games they play (Figure 5). The survey provided a list of geography curriculum topics relevant to their grade level, but students were also given the opportunity to provide additional answers. Additionally, an open-ended question asked them to briefly explain their choices. The analysis of the questionnaire responses unveiled that - in students' views - a significant number of games establish a dynamic relationship between the (human) player and the virtual environment, particularly in terms of the portrayal of nature or (cultivated) landscapes. As reported by the students, nature in these games serves multiple functions. It is primarily depicted as a source of discoveries, where players can stumble upon hidden treasures or uncover secret locations. Nature also serves as a setting for item searches or exploiting, requiring players to explore the virtual landscapes to find valuable objects or resources. Furthermore, it plays a crucial role in providing orientation within the game world, allowing players to navigate and familiarize themselves with the surroundings. Additionally, nature is portrayed as a resource-rich environment, emphasizing activities such as resource identification, mining, and collection (often referred to as "looting" in gaming terminology). Players engage in these actions to acquire materials or items that can be utilized for various purposes within the game, such as forging weapons or achieving specific objectives. This aspect of gameplay was noted across a range of popular games, including The Witcher, Anno, Elden Ring, Assassin's Creed, Animal Crossing, Zelda, and Fortnite, among others. These games present diverse virtual worlds where players interact with nature in different ways, highlighting the significance of the environment within the gaming experience. The portrayal of nature as a source of discovery, a resource hub, and an orientation tool contributes to the immersive and interactive nature of these games, allowing players to engage with and explore the virtual environments (often in a dominant and often exploiting way - what means that nature functions as a store of resources the player needs to exploit in order to proceed or be successful) or on their quests and adventures (Figure 5).

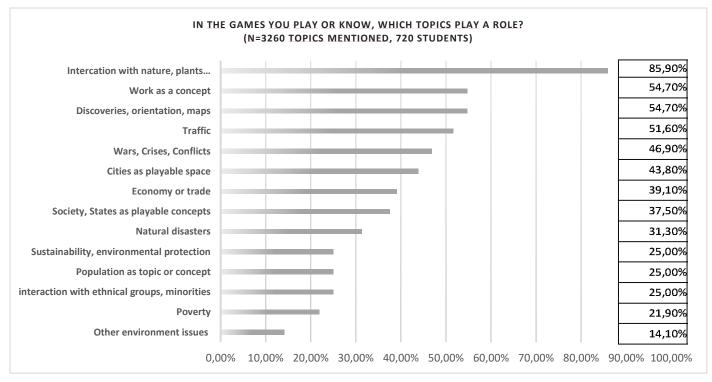


Figure 5. Results regarding which (geographic) topics occur in video games according to students

The concept of performing tasks or work in exchange for money emerged as a recurring theme in the students' responses, indicating the prevalence of in-game economies and various forms of virtual currencies. In these games, players are required to complete specific missions or objectives, investing their game time and effort to earn in-game currencies. These currencies can then be used to purchase items, upgrades, or other rewards within the game world. On the other hand, gathered items (from the natural world) can be sold at merchants. This system of earning and spending virtual currency adds a layer of economic simulation and progression to many of the mentioned gameplay experiences (Figure 5).

When it comes to navigation and orientation within the games, students heavily rely on maps to plan and execute their strategies and actions. These maps serve multiple purposes, including guiding military campaigns, managing resource production and distribution, and facilitating exploration of new territories, coordinating/planning with teammates or NPCs (non-playable characters). While these in-game maps often incor-



porate stylistic elements to align with the game's fictional setting, they still adhere to fundamental cartographic principles. This includes, in students' descriptions, representing spatial relationships between locations, using symbols to denote different types of terrain or features, and employing a grid system to measure distances accurately. By incorporating these cartographic elements, the in-game maps provide players/students with a visual tool for spatial understanding and decision-making (Figure 5).

Transportation, as observed in games like mentioned games Sim City and other similar titles, is primarily portrayed as a means of efficiently moving within the game worlds. From the students' perspective, transportation and infrastructure in these games are not subject to critical evaluation or problematization. Instead, transportation is primarily viewed as a tool to reach game goals or specific destinations, with varying levels of speed and safety attributed to different modes of transportation. Games encompass a wide range of transportation modes, including traditional methods like horses, modern vehicles like cars, airplanes and even futuristic options like spacecrafts/shuttles. The inclusion of these transportation options within the games reflects the concept of modal split in transport geography, where different modes of transport are utilized based on their suitability and availability in a given context (Figure 5).

57% of the students from the third to the thirteenth grade answered the question with the fixed answer options to the effect that they already feel that video games influence their view of the world. In a later article, the individual answers will be qualitatively analyzed and presented. In the following, general results will be summarized on the basis of the 716 questionnaires (Figure 6). Firstly, most students do not believe that video games significantly influence their decision-making or decision-making abilities. However, the qualitative identified answers one is able to identify geographical issues within games and recognize streamers as having an influence on topics, tropes, and issues related to video games. Secondly, students recognize the capitalistic drive of many video games. This suggests that they are aware of the commercial nature of video games and the potential influence of profit motives on the design and development of games. Thirdly, students who are interested in video games give detailed answers, estimate their own competences, and recognize a higher impact of video games on themselves. This indicates that video games may have a greater influence on individuals who are more invested and engaged in playing them. Finally, the survey found that while some students think critically about video games and can identify critical issues related to them, they do not believe that video games significantly influence their decisions in real life. This suggests that while video games may have an impact on individuals in certain ways, their influence may not extend to all aspects of an individual's life. Overall, the survey results provide insights into the complex relationship between video games and individuals' perceptions of geographical themes. While video games may have both positive and negative influences on individuals, the extent of their impact may vary depending on an individual's level of engagement and investment in playing them.

When you play, how often do you feel that video games affect the ideas you have about the world? (n=716)

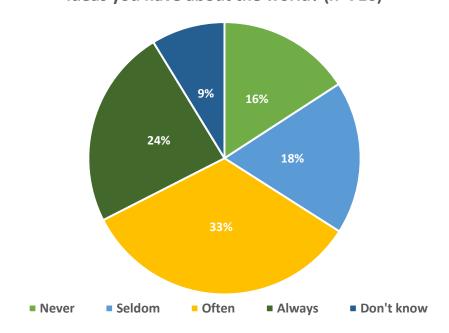


Figure 6. Results regarding the assessed influence students reflect

The result of the question in the survey "How frequently during school weeks do you talk with classmates about video games?" may actually have a connection to how students imagine spaces and cultures and construct or reinforce stereotypes (Figure 7). Video games can contain a variety of themes, settings, and characters that can often reflect or perpetuate stereotypes or cultural stereotypes. If students frequently talk about video games, this may mean that they have internalized certain stereotypes or cultural patterns presented in these games and are perpetuating them in their conversations with other classmates. In addition, video games can also be a way for students to explore and better understand different spaces and cultures. Some video games contain realistic representations of real-world places and cultures, while others create fictional worlds with their own rules and cultures. By talking about video games, students can share their experiences and compare and discuss their ideas about these different spaces and cultures. This can lead to a deeper understanding and appreciation of other cultures and spaces. Overall, the frequency of conversations about video games during school weeks can help deepen students' understanding of different spaces and cultures,



but can also lead to the perpetuation of stereotypes and cultural stereotypes. In addition, conversations about video games can also help students improve their cognitive skills by expressing and discussing their thoughts and opinions on complex topics. Therefore, how often students talk about video games with classmates could help deepen understanding of the role of video games in students' social and cognitive development. Studies also show that playing video games can lead to positive effects on students' cognitive abilities, such as improving spatial orientation and problem-solving skills.

HOW FREQUENT DURING SCHOOL WEEKS DO YOU TALK WITH CLASSMATES ABOUT VIDEO GAMES? (N=721)



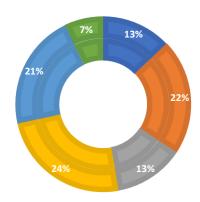


Figure 7. Results regarding the assessed frequency of conversation about video games

4.2. Quantitative (and qualitative) approach: Teachers' survey

The study surveyed elementary and secondary school teachers (n=411) - during the practical semester of students doing their study projects - regarding their perceptions of the educational potential and effects of video games (Figure 4). The results indicate that teachers identified critical consumption and concentration issues, as well as concerns about the privacy of private data and the duration of playing as important considerations related to video games. However, teachers did not report significant influences of gaming on behavior, skills, thought patterns, strategies, or spatial understandings (in geographic perspectives). The study also found that teachers do not recognize the potential of serious games to improve decision-making skills, and that there no understanding of how to address cultural influences and problems related to video games, especially not in the perspective of geography. Additionally, teachers reported the use of learning apps and e-classroom management as potential benefits of video games. The two teachers quoted reflect this analysis well:

LO7: "Children are more affine with the view of the playful or I see now also in the use of the tablets that the reward systems work very well, such as that with the Anton app. The children are happy when they learn something new or really work on their tasks in such a way that they are rewarded accordingly with coins that they can then exchange for games. It also always depends on the grade level. I can imagine that it is important in grade 3 and 4 to definitely talk about data protection, because the children are increasingly allowed to use smartphones. More and more maybe involved in computer use. And for grade 1 and 2 that's already quite difficult in my opinion."

L138: (Asked regarding interests of students) "So internet and especially games. And I think that's also the area where you can pick it up. All games are based on an algorithm, otherwise you couldn't play through them and there would be no patterns and structures in games. Then Candy Crush would definitely not work. (laughs) And, um, yes, data security interests the children so much now/they couldn't name it like that, but if you bring it up, like do you actually know what data you're disclosing, then they're always very, very interested. And once you've mentioned it, they always ask afterwards, 'Is that okay, or should I give myself another nickname? So, from that point of view, these are all areas that interest the children very much, because they are surrounded by them."

L. 74: "Games. (laughs) Well, the kids all play on their cell phones, PlayStation, tablets and whatnot. They also like games that (...) are not yet approved for their age and so on. The topic of presenting their favorite app or something like that is very well received by the children. The children were really keen on it. When it comes to the topic of security and so on, it is of course very theoretical and dry again."

4.3. Qualitative approach: Expert interviews

In particular, the citations that demonstrate the legitimacy of the model (Figure 3) and call for a need for teachers to critically contextualize geographic problems in the classroom are discussed now.

"(...) But if you take a closer look at the game, what San Andreas really does and how it really portrays a marginalized group with its difficulties, then there is a lot of truth in it. The same also, so GTA San Andreas with black ghetto life, GTA 4 with immigrant life, a bit of clan



crime, segregation, urban decay, exclusion and gated communities also there very precisely observed, GTA 5 as it but in many respects so the dream of Hollywood, the dream of quick wealth, startups so a bit the mirror holds. If you look closely, if you create context, it's there. But it's also a bit of the recipient's responsibility to create this context. (I3: Editor in Chief – Largest European Gaming Magazine)"

In this expert interview, the speaker provides a nuanced analysis of video game portrayals of marginalized groups and societal issues. The speaker acknowledges that many video games, including titles like Grand Theft Auto: San Andreas and Grand Theft Auto 4, present these groups and issues in a negative light. However, the speaker argues that upon closer examination, there is a degree of truth to be found in these depictions. The example of Grand Theft Auto: San Andreas is highlighted as a game that portrays black ghetto life. While the portrayal may contain negative stereotypes and challenges, the speaker contends that it also critically and ironically reflects certain realities and difficulties faced by marginalized communities. Similarly, Grand Theft Auto 4 is mentioned for its depiction of immigrant life and clan crime, which, although presented in a negative manner, accurately observes social and urban problems like segregation, urban decay, exclusion, and gated communities. On the other hand, the speaker acknowledges that Grand Theft Auto 5 presents a more glamorous and idealized version of society, aligning with the dream of Hollywood and the pursuit of quick wealth through startups. This portrayal deviates from the grittier depictions of marginalized groups and societal issues found in the previous games mentioned. However, the expert emphasizes that it is the responsibility of the game recipient to create context and interpret the portrayal of these societal issues within the game. By critically analyzing and contextualizing the representations of marginalized groups and societal challenges, players can gain a deeper understanding of the problems faced by these groups. This understanding can potentially foster empathy and contribute to positive change in real-world contexts. Overall, the expert's analysis suggests that while video games may initially present marginalized groups and societal issues in a negative light, closer examination and contextualization can unveil deeper truths and provide opportu

"(...) It is true that we discuss these topics quite often and a lot, internally so to speak. But when it comes to implementing some of the dimensions or points, I'll just mention them now, it's relatively slow, or rather, I'll say, people evaluate it very strongly, for a very long time, also together with other teams, with market research and so on. Of course, you also want to see "What is our target group?" and that's always a bit tricky, especially with triple-A games" (I2 – CSR / Education management, one of the largest game publishers worldwide)

In the interview, the expert is discussing the challenges of implementing certain dimensions or points related to the, e.g., inclusion of disabled individuals, stereotypes, and beauty ideals in video games. The expert acknowledges that these topics are discussed frequently within their organization, but the process of implementing them in games is slow and involves strong evaluation, often with other teams and market research. The expert notes that identifying the target group for these types of games can be tricky, especially for triple-A games. The context of this discussion is related to the growing awareness of the impact that video games can have on individuals' perceptions of themselves and others, particularly in terms of representation and inclusion. The expert stresses that many individuals, including disabled individuals and members of marginalized groups, have called for greater representation in video games, as well as a more nuanced approach to the portrayal of these groups. The expert is acknowledging the importance of these issues but also pointing out that the process of addressing them in video games is complex and requires significant evaluation and research. Furthermore, the interviewee highlights the importance of evaluating these dimensions and points thoroughly before implementing them into games. This evaluation process includes working with other teams and conducting market research to determine the target audience for the game. The interviewee acknowledges that this can be a tricky process, especially when it comes to triple-A games, which have high production values and large budgets. Ultimately, the interviewee emphasizes the need for a thoughtful and deliberate approach to including these important dimensions and points in video games, especially considering their potential impact on the players and the broader cultural discourse around these issues. In summary, the interviewee stated that there are ongoing discussions within the industry about the inclusion of marginalized groups in video games, such as people with disabilities, and the need to address stereotypes and beauty ideals. However, the implementation of these dimensions is slow and heavily evaluated, with multiple teams and market research involved in the process. Considering the target audience when discussing the inclusion of diverse perspectives and experiences in games is particularly challenging for triple-A games, which are typically developed for a broad, mainstream audience. In order to ensure that the inclusion of diverse perspectives is effective and resonates with players, extensive market research and evaluation is necessary. This can contribute to slower progress in implementing changes, as it requires collaboration across teams and can involve significant resources. Ultimately, the interviewee suggests that while discussions around diversity and representation in games are common, meaningful change can require sustained effort and a commitment to challenging long-standing industry practices.

"(...) We did a lot of game analyses, including the question of how decisions are made, how does this feedback work in the system, how much do players actually reflect when playing games, and that was the first phase. Then we also dealt very strongly with these game developers, the question of why certain content is integrated into games and other content is not. So they are of course in a different context, their main goal is of course not the education, why such games are produced and then to understand why some things are integrated or not. (I1: Professor for geography (education))"

The expert's statement highlights a comprehensive research project aimed at analyzing video games and investigating various aspects related to decision-making, player reflection, and content integration in geographic contexts. The initial phase of the research involved conducting extensive game analyses to delve into how decisions are made within games and how feedback mechanisms operate within the gaming system. Furthermore, the researchers sought to examine the extent to which players engage in reflective thinking during gameplay. Moving beyond player behavior, the project also delved into the realm of game development and engaged with game developers themselves. This aspect of the research aimed to understand the factors influencing the inclusion or exclusion of specific content in games. Recognizing that game developers operate within a distinct context and have goals beyond education, the researchers sought to comprehend the motivations behind the integration of certain elements and the omission of others. The reflected research project in the statement recognizes the inherent differences in objectives between game developers and educators. While game developers primarily focus on factors such as entertainment and market appeal, educators are interested in utilizing games as educational tools. By studying the decision-making processes of game developers, the research project aimed to shed light on the opportunities and challenges associated with creating effective educational games. During the second phase of the project, the interviewee and their research team closely collaborated with game developers to gain deeper insights into their perspectives and decision-



making rationales. This shift in focus aimed to understand the motives behind the inclusion or exclusion of specific content, acknowledging that the primary goal of developers lies outside the realm of education. Understanding these motivations is crucial for determining how games can be optimized as educational tools, as well as for fostering fruitful collaborations between educators and developers. In summary, the expert's research project involved two distinct phases. The initial phase centered on game analysis and examining player behavior, while the second phase focused on engaging with game developers to understand their perspectives and decision-making processes. By comprehensively investigating both player experiences and developer motivations, the research project aimed to enhance our understanding of the potential of video games as educational tools and to provide insights into how they can be effectively utilized in educational/geographic contexts.

5. Discussion

In the following, the analyzed statements of the experts from the contexts, video game production, video game journalism and didactics of geography are first integrated into a scientific discourse. It is started with this because these interviews also represented the beginning of the research project.

The expert's comments - from the context of video game production - on the challenges of implementing inclusivity, diversity, and representation in video games highlight the complexity of balancing inclusivity and market appeal in the video game industry. Studies have shown that the lack of representation in video games can have negative effects on individuals' self-perceptions and attitudes towards others, particularly for marginalized groups (Dill & Thill, 2007; Ivory & Kalyanaraman, 2007). Therefore, it is important to address these issues in the video game industry, but as the expert notes, this process can be complex and it can be some sort of risk for the financial success of the game. Research has also shown that the representation of marginalized groups in media, including video games, can be improved by involving members of these groups in the production process (Gray, Sandvoss & Harrington, 2007; Taylor et al., 2019). Therefore, it may be beneficial for video game companies to involve disabled individuals and members of marginalized groups in the development of games that aim to address issues related to inclusivity and representation. The expert's comments on the need for market research and careful evaluation before implementing changes to video game content align with previous research on the importance of considering the target audience in media production (Weber & Rice, 2019). This is in line with the growing awareness of the impact of video games on individuals' perceptions of themselves and others, particularly in terms of representation and inclusion

However, the implementation of these dimensions and points is slow and requires extensive evaluation and research. The need to consider the target audience is particularly challenging for triple-A games, which are developed for a broad, mainstream audience. This can contribute to slower progress in implementing changes, as it requires collaboration across teams and can involve significant resources. However, it is also important to consider that the target audience for video games is not necessarily homogenous, and that games that aim to address issues related to inclusivity and representation may have a broader appeal than anticipated (Burgess et al., 2007). In a study by Duggan and Smith (2013), it was found that video games have the potential to provide a space for players to explore and understand complex social issues such as racism and poverty. However, it is important to contextualize and critically analyze the portrayals of these issues in video games, as they can perpetuate harmful stereotypes and ideologies if not approached with a critical lens. In line with this, the expert acknowledges the need for a thoughtful and deliberate approach to including important dimensions and points in video games, especially considering their potential impact on players and the broader cultural discourse around these issues. In terms of disability representation, a study by Carter et al. (2018) highlights the importance of accurate and positive representations of individuals with disabilities in media, including video games. They argue that positive representations can challenge negative stereotypes and improve attitudes towards individuals with disabilities. The expert's acknowledgement of the importance of including disabled individuals in video games is in line with this research. However, the evaluation process required to ensure accurate and positive representation may contribute to the slow implementation of these dimensions in video games.

Similarly, in terms of beauty ideals and stereotypes, a study by Dill et al. (2015) found that video games often perpetuate unrealistic and harmful beauty ideals, particularly for female characters. They argue that these portrayals can have negative effects on players, particularly young girls. The expert's acknowledgment of the need to address stereotypes and beauty ideals in video games is in line with this research. However, the evaluation process required to ensure accurate and positive representation may also contribute to slower progress in implementing changes in this area. Overall, the expert's discussion highlights the ongoing discussions within the industry about the inclusion of marginalized groups in video games and the need to address stereotypes and beauty ideals. However, it also highlights the complexity of the implementation process and the need for extensive evaluation and research. The consideration of the target audience is also crucial, particularly for triple-A games. The challenges discussed by the expert suggest that meaningful change may require sustained effort and a commitment to challenging long-standing industry practices. From this discussion, a need for a structured reflective competency of students can be clearly inferred, which are addressed in the communication process in the model, especially in terms of a critical, transcultural and feminist, inclusive geography education (Figure 3).

The expert interview in the context of video game journalism cited also raises important points about the portrayal of societal issues and marginalized groups in video games. It has been argued that video games can both reinforce and challenge societal norms and stereotypes, and that they have the potential to impact players' attitudes towards marginalized groups (also see: Ivory & Kalyanaraman, 2007; Scott, 2013). In this context, the journalist emphasizes again on the importance of contextualizing and interpreting video game portrayals is significant. It is noted that games like Grand Theft Auto 4 and San Andreas do accurately reflect real societal problems, such as segregation and urban decay. However, they also present negative stereotypes of marginalized groups, and it is important to understand this context in order to avoid reinforcing harmful beliefs and attitudes. The speaker's suggestion that educators can play a role in contextualizing video game portrayals is also noteworthy. Research has shown that games can be effective tools for teaching about societal issues, such as race and gender (Leonard, 2006). Educators can use games as a starting point for discussions about these topics, and can encourage critical analysis of the games' portrayals. In a study by Duggan and Smith (2013), it was found that video games can provide a space for players to explore and understand complex social issues such as racism and poverty.

In terms of teaching, Frazel and Frazel (2018) suggest that teachers can use video games to teach subjects such as history and geography by in analyzing and contextualizing the game's depictions of societal issues and geographic locations. Regarding urban geography specifically, Harris et al. (2019) discuss how video games can provide a platform for exploring and understanding urban environments and the societal issues that arise within them, such as segregation and gentrification. They argue that video games can be used as a tool for urban planning and policy making by providing a virtual environment for testing and exploring potential urban development scenarios. Overall, that expert interview highlights the need for a nuanced approach to analyzing video game portrayals of marginalized groups and societal issues. By contextualizing and interpreting these portrayals, it may be possible to gain a deeper understanding of the issues they reflect and use this understanding to promote positive



change. Teachers can play a role in this process by incorporating video games into the curriculum and guiding students in analyzing and contextualizing the game's depictions of societal issues and geographic locations, which again emphasized the need for these process in the model for deconstructing digital space in video games with critical geographic perspectives especially in urban geographic contexts.

The potential of video games as educational tools has been recognized by educators and researchers alike, and numerous studies have been conducted to explore this potential (e.g., Ke, 2009; Squire, 2011; Shaffer et al., 2004). However, as the expert in the statement from the field of geography education points out, game developers may have different goals and priorities than educators, which can make it challenging to create effective educational games. This highlights the importance of understanding the motives behind game developers' decisions, as was done in the second phase of the interviewee's research project. It is, therefore, important to consider the potential risks and limitations of using games in education, particularly in terms of promoting stereotypical or biased views of the world. In a study by Mikula and colleagues (2019), the authors explore the potential of using video games to teach geography, specifically focusing on the game Minecraft. The authors note that while Minecraft has been used in education for its potential to foster creativity, collaboration, and problem-solving skills, it has not been widely utilized in geography education. The authors argue that Minecraft has the potential to be a valuable tool in geography education, particularly for its ability to simulate real-world environments and allow students to explore geographic concepts in a virtual space. A study by O'Donoghue et al. (2016) found that a game-based approach to teaching geography was effective in promoting engagement and motivation among students. The study also found that students' learning outcomes were comparable to those achieved through traditional teaching methods. However, the authors note that game developers often lack knowledge of educational theory and pedagogy, which can result in games that are not effectively aligned with educational goals. Another study by Kapp (2012) emphasizes the importance of instructional design principles in the development of educational games. The author argues that educational games must be designed to be effective learning tools, and that this requires careful consideration of instructional design principles such as goal setting, feedback, and assessment. Without this attention to design, games may not effectively support learning (Ervin & Lopez-Carr, 2022). The expert's research project, which involved analyzing both player behavior and game developers' decisions, provides insight into how games can be optimized for educational purposes. By understanding the motives behind game developers' decisions, educators can work with developers to create games that are aligned with educational goals and effectively support learning. The combination of game analysis and developer perspectives is a valuable approach to understanding the potential of video games as educational tools, and can inform the development of effective educational games in the future. Overall, while video games have the potential to be a valuable tool in geography education, it is important to carefully consider their potential benefits and limitations, and to critically evaluate their content before using them in the classroom. By working with game developers and taking a careful approach to game selection and content curation, educators can help ensure that video games are used in a way that promotes positive learning outcomes and fosters a deeper understanding of geographic concepts.

Now the discussion is to critically reflect on the results of the quantitative student surveys in discourse. The present findings taken from the surveys provide important insights into students' perceptions and experiences related to video games in (geography) classrooms. These findings may be informative in further understanding the role of video games as learning tools and media, and in identifying potential impacts on students' perceptions of space, cultural representations, decision-making processes, and reflective competencies. One striking finding is the clear communication by students that in many games a form of human-player-environment-nature relationship is established. Nature/the world/space (all terms that fell) are perceived primarily as a means of discovery, orientation, resource acquisition, and achievement of the game goal. Findings of this study have significant implications for geography education. The prevalence of in-game economies, the reliance on maps for navigation, and the portrayal of transportation and infrastructure in games provide valuable insights into the integration of gaming elements into geography lessons. Additionally, the limited attention given to social and environmental issues within these games underscores the importance of addressing these topics more extensively in educational gaming experiences to provide a more nuanced understanding of real-world geography and its challenges. This finding is consistent with previous studies that have shown that video game players often develop an instrumental relationship with virtual nature, in which they view nature as a resource to be exploited (e.g., Klimmt, Hefner & Vorderer, 2009). This phenomenon can be attributed to the game mechanics that incentivize players to explore nature and collect resources. It is essential that students (in geography classes or other subjects) develop a broader understanding of human-environment relationships that goes beyond instrumental use. Didactic approaches such as fostering spatial action competence, critical education for sustainable development lead ecological awareness and sensitization for environmental problems should contribute to this and raise their voice in discussion of video games (e.g., Hamborg, 2017; Mehren, 2022; Keil, Kuckuck, & Faßbender, 2020; Gryl & Budke, 2016).

The present results taken from the surveys also showed that students have different assessments of how much video games influence their perceptions of the world, people, or their environment during gameplay and related decisions. A portion of the participants indicated that they never feel that video games influence their ideas, while others indicated that this is rarely, often, or even always the case. It is interesting to note that some students are unsure and do not know exactly to what extent video games influence their perceptions. It is important to note that the influence of video games on gamers' perceptions depends on several factors, including game genre, game content, game time, and individual differences among gamers (Esposito et al. 2020). Again, this provides legitimations for analyzing games in the classroom through the model of reflexivity in digital spaces to collaboratively discuss issues with the class (see Figure 3, see also Lux & Budke, 2023).

The results of the survey suggest that while video games can offer opportunities for engagement and motivation in geography education, their potential to promote deeper understanding of the discipline may be limited if not appropriately contextualized by teachers. Specifically, the students reported that in many games, the human-environment relationship is portrayed in a way that emphasizes resource extraction and acquisition, rather than more complex and nuanced understandings of environmental systems and human-environment interactions (Fochtman & Drake, 2016; Kirschner & Karpinski, 2010). The findings also suggest that while games can incorporate elements of cartography and spatial analysis, they may not engage with these topics in a way that fully aligns with the objectives of geography education. Specifically, the students reported using maps to navigate and plan military campaigns, rather than engaging with broader questions of spatial representation, scale, and geography as a social science (Dykes, 2005; DeLyser & Sui, 2013). However, the students' perceptions also indicate that beyond the depiction of wars or conflicts, other (social) issues such as poverty, exclusion, or environmental problems are rarely addressed within these games. These topics, which are highly relevant in real-world political geography, receive limited attention or are altogether absent from the students' observations. This highlights an important aspect for demanding critical geography lessons, as it suggests the need to further explore and incorporate these social and environmental challenges into educational gaming experiences to foster a more comprehensive understanding of real-world geography. Finally, the results suggest that video games may not provide opportunities to engage with key social and environmental problems, which are often central to geography education. The students reported a lack of attention to topics such as poverty, exclusion, and environmental problems, which are often central to geography education (Smith,



The survey further revealed that students engage in task reflection, orientation tasks (such as using maps), and gathering resources in video games. This suggests that video games may have a positive impact on their cognitive skills and problem-solving abilities, as well as their understanding of geographical concepts. The survey results moreover revealed that although certain students demonstrate critical thinking skills when analyzing video games and identifying related issues, they do not perceive video games to have a significant influence on their real-life decisions. This finding suggests that while video games might have an impact on individuals in specific contexts, their influence may not extend to all aspects of their daily lives.

Overall, these findings suggest that while video games can offer engaging and motivating learning experiences in geography education, their potential to promote deeper understanding of the discipline may be limited - if not contextualized properly - by the ways in which they portray human-environment relationships, engage with cartography and spatial analysis, and address key social and environmental issues. These findings are consistent with previous research that has raised similar concerns about the limitations of video games as educational tools (e.g., Gee, 2003; Kapp, 2012). To address these limitations, future research might explore the potential of game-based approaches that more explicitly engage with the goals of geography education, such as through the development of games that explicitly address issues of social and environmental justice, or that more explicitly engage with concepts of spatial representation and analysis. Additionally, game developers and educators might work collaboratively to ensure that games are designed to promote deeper learning, by incorporating instructional design principles such as goal-setting, feedback, and assessment (Kapp, 2012; Squire, 2011)

The results of the quantitative student survey further suggest that while video games may have some impact on individuals' views of the world, the extent of this impact is complex and may vary depending on an individual's level of engagement and investment in playing them. The survey revealed that most students do not believe that video games significantly influence their decision-making or decision-making abilities, which is consistent with some previous studies (Lux & Budke, 2020ab; Fochtman & Drake, 2016). However, the survey also found that students are able to identify geographical issues within games and recognize the influence of streamers on topics related to video games. This suggests that video games may have some potential to promote engagement and motivation in geography education (Fochtman & Drake, 2016). The survey revealed that students recognize the capitalistic drive of many video games, which suggests that they are aware of the commercial nature of video games and the potential influence of profit motives on their design and development (Kirschner & Karpinski, 2010). This finding is consistent with previous research that has raised concerns about the ways in which video games portray human-environment relationships and address key social and environmental issues (Smith, 2008; Slocum et al., 2009). Moreover, the survey revealed that students engage in task reflection, orientation tasks, and resource gathering in video games, which may have a positive impact on their cognitive skills and problem-solving abilities (DeLyser & Sui, 2013). However, the survey also found that while some students think critically about video games and can identify critical issues related to them, they do not believe that video games significantly influence their decisions in real life. This suggests that the influence of video games may not extend to all aspects of an individual's life (Kirschner & Karpinski, 2010). To address the limitations of video games as educational tools, future research might explore the potential of game-based approaches that more explicitly engage with the goals of geography education, such as through the development of games that explicitly address issues of social and environmental justice or that more explicitly engage with concepts of spatial representation and analysis (DeLyser & Sui, 2013). Additionally, game developers and educators might work collaboratively to ensure that games are designed to promote deeper learning, by incorporating instructional design principles such as goal-setting, feedback, and assessment. While video games may have both positive and negative influences on individuals, the extent of their impact may vary depending on an individual's level of engagement and investment in playing them. The findings suggest that video games have potential as educational tools in geography education but their design and implementation should be critically evaluated to ensure that they promote deeper understanding of the discipline and address key social and environmental issues. The necessity and usefulness of the model for the integration of these discourses in classrooms has been elaborated.

6. Conclusions

The present findings suggest again - as the studies before - that video games in geography education are a promising learning tool that can influence different aspects of students' perceptions and development. However, in order to realize the full potential of these games and maximize their effectiveness, further research in (geography) education is needed. Based on the points discussed, the following to-do points can be formulated: It is important to further explore the role of video games as learning tools in geography education in order to gain a comprehensive understanding of their impact on students' perceptions of space, cultural representations, decision-making processes, and reflexive competencies. It is necessary to go beyond the instrumental use of video games to promote aspects of spatial agency, critical education for sustainable development, and ecological awareness. This requires a deeper understanding of the complex relationships between people and the environment. In geography lessons, students should develop an understanding of the complex socio-economic relationships that go beyond the simplified representation in video games. Special attention should be paid to conflict-related resource acquisition and the promotion of solution strategies. It is necessary to explore the use of video games with cartographic elements in geography lessons in order to promote students' spatial thinking and map competence in a targeted and critical way. In this regard, appropriate didactic approaches should be developed and evaluated. Investigating the influence of video games on students' conceptions of the world, people and their environment requires further research. Different factors such as game genre, game content, game time, and individual differences of the players should be considered. Through continued research in this area, new insights can be gained and didactic approaches further developed to optimize the effectiveness and usefulness of video games as a pedagogical tool in a future-ready and critical (geography) classroom. Students need this to gain a complex understanding of the world, even though video games often offer easier and superficial solutions to problems or represent the world in morally difficult contexts. The model presented here, which has already been evaluated in different ways, can help in the development of such research approaches and teaching scenarios to establish complex and critical geography education.

Appendix: Available on figshare: https://doi.org/10.6084/m9.figshare.23641089.v1

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