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Article

Constructing in Minecraft in Primary School as a Boundary-Crossing Practice

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Abstract: This study explores the educational adoption of Minecraft as a boundary-crossing practice in primary schools. Previous research indicates that Minecraft can facilitate connections between educational activities and students' out-of-school experiences, promoting the development of skills such as creativity, innovation, and collaboration. Using a qualitative approach, this study analyzed group interviews with 37 primary school students who participated in a Minecraft-based school project. The analysis focused on instances of boundary crossing associated with the Minecraft activity, allowing an examination of how various socio-cultural boundaries were overcome. The results suggest that educational activities in Minecraft can facilitate connections between school and out-of-school contexts. Moreover, the results indicate that Minecraft can serve as an interdisciplinary learning environment, enabling students to acquire knowledge and skills across diverse domains and disciplines. The analysis also underscores the significance of teachers' design work in transforming the game into an educational resource. Overall, this article argues that the educational adoption of Minecraft has the potential to foster the construction of continuity between students' different spheres of life, as well as prompting a reconsideration of students' previous cultural classifications and social positions.

Keywords: Minecraft; boundary crossing; boundary object; qualitative analysis

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1. Introduction

Over the past two decades, an expanding body of academic literature has explored the potential of games as valuable learning tools across various contexts and disciplines [1–3]. Within this literature, many authors have documented the educational relevance of Minecraft, which is an extremely popular digital game featuring an edition designed specifically for educational use [4–7]. In particular, some scholars have discussed how Minecraft provides a open and flexible environment and allows for a wide range of learning activities, including problem-solving, critical thinking, and collaboration [6,8]. In addition, recent studies demonstrated how the use of Minecraft in schools promotes the acquisition of skills related to creativity and innovation, as well as communication and collaboration [9]. Furthermore, according to some authors, the adoption of games in educational contexts tends to blur the boundaries between in- and out-of-school contexts [10], potentially facilitating connections between educational activities and students' out-of-school participation. For example, Pettersen and colleagues [11] have explored how digital literacy practices enacted in Minecraft allow for the emergence of new agencies and new forms of "hybridity".

The emphasis on viewing learning processes as something that can transcend traditional classroom boundaries, rather than being confined within the school environment [12], is particularly relevant given the ongoing shifts in the educational landscape. Indeed, the adoption of digital and mobile technology as well as the development of novel pedagogical approaches—such as connected learning [13]—have been challenging the traditional clear-cut boundaries defining where and when learning takes place [14,15]. In response to these

and other societal shifts, many educational institutions are actively working to establish connections with a range of various out-of-school experiences that students engage in [16]. These societal changes require acknowledging the significance of learning that occurs outside of the classroom [17].

A valuable framework for understanding learning across contexts can be found in the literature on "boundary crossing" [18]. Grounded in the third generation of cultural-historical activity theory [19,20] and related situated and socio-cultural approaches to learning [21,22], this body of literature offers a nuanced perspective on learning and social interaction across contexts. This body of literature conceptualizes contexts as practices or activity systems that are both culturally and historically informed, yet continuously (re)constructed. A boundary-crossing perspective sensitizes us to how learning may take place across contexts despite differences in the purposes, meanings, and forms characterizing each context. Learning across contexts can therefore be viewed as a process of engagement with a particular content or activity not constrained within any specific context. Boundary crossing can be captured by examining the (dis)continuity of learning across contexts [16].

Several authors have examined the use of various objects and technologies as tools able to facilitate boundary crossing—labeled as "boundary objects"—often emphasizing the potential and affordances of technologies to connect learning contexts [23]. Based on such a conceptualization, a recent study on the educational adoption of games [24] conceptualized Minecraft as a boundary object enabling the emergence of boundary crossing between formal and informal learning. According to these authors, as a virtual world, Minecraft provides a platform for children to explore and experiment with educationally relevant phenomena and concepts both in formal and informal settings, thus bridging the gap between formal and informal learning.

Nevertheless, our understanding of the boundary-crossing processes associated with the educational use of videogames is still limited. For example, little is known about how students make sense of boundary crossing taking place during educational activities involving gaming and how they discursively connect it with their learning trajectories. Shedding light on this aspect is important because computer games are not good learning resources by themselves. Rather, they are flexible artifacts that may take on different meanings when adopted across different learning contexts, being transformed into learning resources through the sensemaking of the individuals engaging with them in practice [11,25]. One aspect that might affect such sensemaking is the previous experience that the students have with the game before engaging with it for an educational activity. Indeed, it is reasonable to expect that having previously played a game for leisure might affect how a student approaches its usage for educational aims. Furthermore, existing scholarly work tends to address the boundaries between in-school and out-of-school contexts without delving into the potential variety of boundary types that students encounter (and traverse) when engaging in educational gaming activities.

The present study aims to contribute to the literature on the boundary-crossing processes associated with the educational adoption of games by analyzing how boundary crossing is discursively constructed by the students attending an extensive educational activity in Minecraft lasting 2 school years. In particular, we discuss which kind of boundaries are mentioned by the students during narrative descriptions of episodes involving boundary crossing, how the students account for the role of different actors during these events, and the learning implications that can be inferred from the students' discourse.

In the next section, we briefly introduce the theoretical framework of the study, largely informed by the literature on boundary crossing and boundary objects [16,18] and by previous investigations examining students' media literacies and educational games [8,11]. Subsequently, we describe the context and participants involved in this study, the methods for data collection and analysis, and present the results. Finally, we discuss our findings, focusing on both theoretical and practical implications.

2. Theoretical Framework

As outlined in the influential literature review by Akkermann and Bakker [18], the notion of "boundary" has been examined across a broad spectrum of social sciences to understand how "markers of difference" are created, perpetuated, or contested at various levels. Within the realm of educational theory, there is a particular interest in investigating the dynamics and learning mechanisms associated with social and cultural boundaries [26]. In this context, a boundary can be seen as a sociocultural difference leading to "discontinuity in action or interaction" [18]. Boundary crossing, instead, is defined as the deliberate efforts to establish or restore continuity in action or interaction across different contexts and practices, at the individual, group, or institutional level [27].

Simultaneously engaging in different practices also involves the shifting between different ways of positioning oneself [28]. According to this view, the engagement in educational activities and the learning processes that stem from them can be shaped and mediated by the particular social roles and cultural classifications at play, which all involve the establishment, maintenance, or redefinition of some kinds of boundaries. For example, a student might position themselves as a gamer, as a student, as a girl, and so on. Each of these positions can be interpreted as different from other positions and social roles.

These social and cultural distinctions are frequently intertwined with chronotopic relations, encompassing spatial and temporal boundaries [29,30]. Indeed, when participants make sense of a learning activity and of their participation in it, they also define it in terms of what spatial and temporal boundaries are considered relevant [31]. Thus, learners define and mark the boundaries of the learning situation both in terms of space and time and in terms of social roles and cultural classifications appropriate for the situation. Accordingly, the boundary-crossing literature examines how people may collaborate across various places, times, and activities, or make connections between various practices or contexts by enacting various kinds of social positions. In this sense, contexts of learning are not "static backgrounds" [16]. Indeed, individuals are not just situated "in" a context but also socially construct that same context [32].

In this field, it has been argued that people have the capacity to establish connections between learning contexts by engaging in processes of sense-making, translation, and integration, which might also involve the introduction of elements from one domain of practice into another [33]. Thus, learning processes are expected to extend across various contexts, with diverse participants, settings, and experiences all contributing to the gradual development of expertise and continued participation within a specific domain over time. Multiple scholars (e.g., [17,34]) have observed how young children often accumulate significant knowledge in areas of personal interest across multiple contexts, and that such learning may intersect with knowledge domains relevant to educational contexts.

Individuals who can integrate elements from one practice into another have been denoted as "brokers" [35], "boundary crossers", or "boundary workers" [36]. The significance of such individuals is rooted in their proficiency to transition and forge connections, thereby facilitating collaboration and alignment between distinct practices or activity systems. It is worth noting that boundary crossers or brokers frequently navigate domains where their expertise may not be all-encompassing, and they can assume a multifaceted role [33]. Indeed, they contend with the intricate task of negotiating and amalgamating elements from diverse contexts to formulate hybrid scenarios [37]. Nevertheless, these challenges underscore the potential for learning through boundary crossing. It is therefore crucial for scholarship on these processes to discuss who are the actors of boundary crossing and how they are described—in terms of social positions and cultural classifications—by the participants in boundary-crossing situations.

In addition to individuals, both real and virtual objects can play a crucial role in boundary crossing. Science and technology studies, for example, have explored how objects can facilitate communication and collaboration across different contexts [18]. The term "boundary object" has long been employed to describe and examine the role of artifacts that serve as connectors among different practices [38]. Boundary objects are

defined as objects that serve the informational needs of multiple intersecting domains and can adapt to the unique requirements and constraints of the various parties involved. Despite their adaptability, boundary objects also maintain a consistent identity across different contexts [38].

Boundary crossing can have significant implications for learning and development. By encountering unfamiliar contexts and negotiating differences, learners can develop new skills, knowledge, and perspectives that can enhance their professional practice. For example, boundary crossing can facilitate the creation of hybrid situations that draw on the strengths of different contexts, leading to innovative solutions and practices [18]. Furthermore, boundary crossing can promote reflexivity and critical thinking, as learners are forced to question their assumptions and engage in dialogue with others who have different perspectives. Overall, boundary crossing is often considered a powerful tool for learning and can lead to more effective and innovative practices in a range of fields, including educational practices based on virtual games such as Minecraft [6].

3. Aims and Research Questions

The main aim of the present study is to discuss possible instances of boundary crossing identified in the students' accounts of the didactic activities carried out utilizing Minecraft Education Edition. The research questions can be summarized as follows:

- What types of sociocultural boundaries are involved in the instances of boundary crossing detected in the students' speech?
- What is the role of different actors in the instances of boundary crossing detected in the students' speech?
- What are the possible interconnections between boundary crossing and the learning processes as represented in the students' speech?
- Are there differences in boundary crossing based on the students' previous experience in Minecraft?

4. Context and Participants

This study is part of a larger research project on the use of Minecraft as a tool for teaching and learning in primary school classrooms. This study was conducted in two sections of a primary school in Puglia, in the south of Italy, corresponding to the fourth and fifth grades in the academic years 2019/2020 and 2020/2021, respectively. A total of 50 students participated in the Minecraft activities (23 female, 27 male), aged 9–10, from diverse socioeconomic and cultural backgrounds. Even though all the students were invited to participate in the group interviews, 37 students attended the meetings when the interviews were conducted.

The teacher who designed and implemented the educational activities examined in this investigation had previously attended a course on the didactic use of Minecraft organized by the Italian National Institute for Documentation, Innovation, and Educational Research (INDIRE, a key research organization that collaborates closely with the Italian school system, focusing on teacher training, innovation, and e-learning. INDIRE is integral to Italy's National Evaluation System for Education and Training, striving to improve education quality and student achievements). This course aimed to promote the use of Minecraft as a tool for teaching and learning in Italian schools and provided training and support to teachers who wanted to use Minecraft in their classrooms, as well as access to Minecraft Education Edition, a version of the game specifically designed for educational purposes.

The teacher had initially planned to carry out the activities with Minecraft in the classroom, but with the arrival of the lockdown, she redesigned the teaching activity by inviting her students to explore Minecraft from home and assigning open-ended tasks that involved the construction of different types of buildings. During the first lockdown (spring of 2020), the students were invited to build familiar objects such as vegetable gardens, furnished houses, and amusement parks. In this phase, the students had a

high degree of freedom, and the main aim was to guide them in exploring the virtual environment and learning to navigate it. During the school year 2020–2021, the educational activities in Minecraft were connected to the school curriculum. In this phase, the students were asked to build a Ziggurat, connecting the activity to knowledge of the history and geography curriculum.

The activities were significantly affected by the policies and guidelines issued by the Ministry of Education and by regional authorities in the different phases of the pandemic. Specifically, during lockdown periods, the activities were conducted at home, while for most of the 2020–2021 school year, a hybrid education approach was adopted. This involved some students who engaged with the project from the school premises, while others were participating remotely from home. The teacher organized the collaborative learning activities in small groups but allowed for individual participation depending on local constraints (e.g., unsolvable technical difficulties encountered by the children when trying to collaborate in Minecraft). In addition, she defined together with the pupils a shared class etiquette aimed at maintaining a positive class climate of sharing and mutual respect, shared video tutorials regarding the construction of specific objects in Minecraft and arranged virtual or physical meetings during which the students were able to share their progress in Minecraft as well as to discuss possible difficulties and ongoing challenges.

In the next section, we will present the major features of Minecraft, which are relevant to data interpretation. Indeed, as claimed by Clark, Tanner-Smith, and Killingsworth [39] the game mechanics and other characteristics of game design are significant aspects to be considered when discussing the educational use of digital games.

Minecraft

Minecraft is a popular sandbox video game available on multiple platforms, including PC, Xbox, PlayStation, and mobile devices. In Minecraft, players are placed in a randomly generated world made up of blocks of different materials. In Minecraft, players can use various types of blocks to create a wide range of structures and designs, from simple houses to complex machines.

The game has two main modes: survival mode and creative mode. In survival mode, players must gather resources (including food) and build a shelter to survive against challenges including monsters and environmental hazards. In creative mode, players have unlimited resources and can build whatever they want without worrying about monsters or hunger. Minecraft can be considered a "digital making platform" [8] that allows players to engage in a wide range of creative and collaborative activities. The open and flexible environment provided by the game allows players to experiment with different (virtual) materials and tools, and to create their structures and designs.

Minecraft can also be considered as a virtual social space, where players can interact with each other and learn from each other's creations. The game also features an Education Edition specifically designed to enhance the learning experience and make it more suitable for classroom use. For example, it allows the teacher to have some control over the in-game environment and includes some additional tools such as the virtual chemistry lab. Minecraft has been used in various educational settings and has been praised for its ability to foster creativity, problem-solving skills, and collaboration. It has been used to teach subjects such as math, science, and language arts, as well as to develop social and emotional skills.

5. Materials and Methods

The present study adopted a qualitative methodological approach based on the analysis of 8 group interviews (Table 1) designed and conducted to elicit a deeper understanding of the participants' experiences and perspectives related to their use of Minecraft within both educational and non-educational settings. The researchers invited all the students involved in the project in Minecraft to participate in one of the group interviews and collected the parents' informed consent for participation in the research. Out of the 50 students who were involved in the Minecraft project, 37 opted to take part in one of the group interviews.

The interviews were conducted in small groups of four to six students and were recorded and transcribed for analysis. The researchers had prepared a set of interview questions but adapted how and when the questions were asked in response to the unfolding conversation with the participants [40]. Such a semi-structured approach allowed for both the exploration of predetermined topics and the flexibility to delve into unexpected insights, ensuring a well-rounded dataset.

Table 1. Group size, length and composition of each interview.

Interview	Group Size	Length (Minutes)	Composition
A	5	65	1 male, 4 female
B	4	77	1 male, 3 female
C	6	62	4 male, 2 female
D	4	63	4 male, 0 female
E	6	84	3 male, 3 female
F	4	37	1 male, 3 female
G	4	36	3 male, 1 female
H	4	51	3 male, 1 female

The group interviews were analyzed through qualitative content analysis [41] involving the following steps:

1. Transcription of the group interviews, which were anonymized using pseudonyms.
2. Categorization of the students based on their previous experience with Minecraft. The students who declared that they had never played Minecraft before the school project were categorized as "novice"; those who declared that they at played for less than 1 year were categorized as "intermediate"; and the students who declared that they had played for more than one year were categorized as "experienced".
3. Iterative coding [42] of the utterances relevant to the research questions by two coders, focusing on:
    a. Types of boundaries associated with the instances of boundary crossing narrated by the students;
    b. Roles of the actors involved in boundary crossing;
    c. Possible interconnections between boundary crossing and the learning processes implicitly or explicitly represented in the students' speech.
4. Discussion within the research group concerning the utterances coded differently by the two coders until complete agreement was reached (see Table 2 for an overview of the final categories).
5. Quantitative analysis of the frequency of the codes and construction of summary tables and visual representations of the categories emerging from the coding
6. Interpretation of the data and in-depth qualitative analysis of a selection of relevant excerpts.

6. Results

Table 2 summarizes the final categories of analysis. The students' speech during the group interviews contains several utterances in which a movement across socio-cultural boundaries is described. In particular, the first category (see Figure 1)—crossing socio-cultural boundaries—contains excerpts in which the students describe how they could overcome some barriers or redefine elements of discontinuity associated with socio-cultural categories in a transformative way. These excerpts contain references to boundaries between social groups or remarks about differences between social identities or social representations of relevant elements of the pedagogical activity, which are overcome during the activity. The content in this category allows us to discuss how the emergence of boundary

crossing was intrinsically connected with the redefinition of some cultural categories by the students. As shown in Figure 1, the most frequent socio-cultural boundaries mentioned by the students concerned the perception of discontinuity between leisure and education (14 occurrences) and social barriers (13 occurrences). Interestingly, a relatively high number of students also mention episodes of boundary crossing across school disciplines (11 occurrences), allowing us to infer that the activity in Minecraft was perceived as interdisciplinary. To a lesser degree, the discontinuity between family and school (nine occurrences) and between leisure and education activities (eight occurrences) is relevant for boundary-crossing episodes. In six episodes, the students narrate boundary crossing involving discontinuity associated with gender. In addition, in some excerpts, the students describe the role of one or more actors playing a critical role in the boundary-crossing process, which was coded in the category labeled "brokers". Finally, the episodes in which the students' account allowed us to infer that boundary-crossing processes were associated with the emergence of learning opportunities were coded as "learning opportunity".

Table 2. Summary of categories and codes.

Category	Code	Description	Occurrences
Crossing Sociocultural Boundaries	Gender	Utterances in which it is possible to infer a boundary-crossing process that allows to overcome or redefine facets of discontinuity associated with gender categories.	6
	Family-education	Utterances in which it is possible to infer a boundary-crossing process that allows to overcome or redefine facets of discontinuity between the family and school context.	9
	Social barriers	Utterances in which it is possible to infer a boundary-crossing process that allows to overcome social barriers or redefine facets of discontinuity related to social interaction.	13
	Gaming-education	Utterances in which it is possible to infer a boundary-crossing process that allows to overcome or redefine facets of discontinuity between the culture of gaming and education.	8
	Leisure-education	Utterances in which it is possible to infer a boundary-crossing process that allows to overcome or redefine facets of discontinuity between pedagogical tasks and leisure time.	14
	School Disciplines	Utterances in which it is possible to infer a boundary-crossing process that allows to overcome or redefine facets of discontinuity between different disciplines.	11
Boundary Crossing Brokers	Brokers	Utterances in which the students provide information concerning one or more actors playing a crucial role for the emergence of boundary crossing.	19
Learning opportunities	Learning opportunity	Utterances in which the students' account allows to infer that boundar-crossing processes were associated with opportunities for learning.	35

Since the codes adopted in this study were not mutually exclusive, often more than one code was applied to several excerpts. For example, an excerpt might contain at the same time a narrative account of an instance of boundary crossing between family culture and school culture, a description of the role of a crucial actor triggering the boundary-crossing process, and a hint to a learning opportunity stemming from the boundary-crossing process. In this case, the same excerpt could be coded at the same time as (1) family-education, (2) brokers, and (3) learning.

In the following subsections, we present the analysis of a selection of representative excerpts that allow us to advance our understanding of how boundary-crossing processes taking place during the activities in Minecraft were experienced by the students and to account for their significance for learning processes. To avoid unnecessary fragmentation

in the presentation of the analysis, we organize the following subsections based on the codes belonging to the category "Crossing Sociocultural Boundaries" and discuss the boundary-crossing brokers and the learning opportunities when relevant in the analysis of the excerpts rather than creating additional subsections for the last two categories. Finally, we present the findings related to the fourth research question, which explores if and how the students' previous experience in Minecraft might affect boundary-crossing processes.

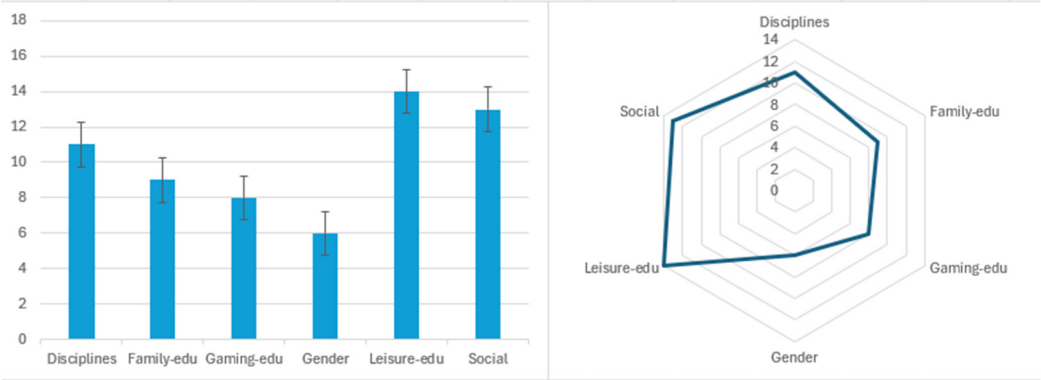

Figure 1. Occurrences of codes applied to the socio-cultural boundary-crossing events.

6.1. Crossing Gender Boundaries

This code was applied to six excerpts in which a few female students delineated a process of boundary crossing, wherein Minecraft was initially categorized as a "game for boys" (as described by Fabiola in Excerpt 1) or dismissed as a "stupid game" (as expressed by Chiara in Excerpt 2). However, as they engaged in the pedagogical activity, the students reevaluated their cultural perceptions, occasionally suggesting a potential shift in the way they represented their identity in discourse. For example, in Excerpt 1, Fabiola explains that when she was younger, she considered Minecraft as a game for boys and that for this reason she initially was not committed to using it for learning purposes. Interestingly, in her account, the first attempt at using Minecraft within the school project was not sufficient to change her perceptions concerning the game. Only thanks to the convincing arguments and the help of her brother did she change her mind and afterward she started to enjoy the game and use it often, both in school and in out-of-school contexts, as she clarifies in other excerpts of the same interview.

Excerpt 1 (Interview B)

> Fabiola: Minecraft... I had heard of it and in reality, at the beginning, I did not like it, a lot of people made me try it, but I never liked it because they said there were some... I mean... a game for male guys... when I was younger. Then, when you [teachers and researchers] gave the passwords I tried but... after... during the pandemic my brother convinced me, thanks to him I engaged more with Minecraft and now I like it and I play often...

In our interpretation, Fabiola's narrative suggests that she reshaped the boundaries of a cultural categorization (distinguishing games for males from games for females), which had previously hindered her involvement in the task. This passage is noteworthy because it shows how boundary crossing can not only be conceptualized as the movement of individuals across socio-cultural realms (in this case, delineated by gender-specific categories), but can also involve a subsequent transformation of the boundary at stake. Indeed, after she "crossed the boundary" between games for males and games for females as she originally perceived it, she appeared to no longer view Minecraft as belonging to the former category, thereby redefining the boundary at stake. In this way, boundary crossing also displays its learning potential, not in terms of acquiring disciplinary content but in terms of participation in social practices that were not precluded because of taken-for-granted cultural categories.

Excerpt 2, narrated by Chiara, tells a similar story to Fabiola's (see Excerpt 1). Chiara initially describes Minecraft as a stupid game but discusses how during the educational activity, she discovered that she liked it and found it useful, also thanks to her cousin.

Excerpt 2 (Interview E)

> Chiara: well, if I have to tell you the truth, in the beginning, I mean, I had heard of it [meaning Minecraft] but I. . . I thought it was a stupid game like. . . where you could not do anything useful, but then I discovered that it was nice, and you can do a lot of things, and the creativity is really. . . well you can create anything, any object or palace. . . and my cousin who is very good helped me, but at the beginning, also watching the YouTubers as also Elvira said, I did not understand anything, I thought I was stupid, but then I discovered a new reality where you can free your imagination.

What is noteworthy in this excerpt is that after a trajectory of boundary crossing like that described by Fabiola in Excerpt 1, which also involves the contribution of a family member, Chiara adds some additional reflections concerning her perception of self-efficacy. While in the beginning, despite her efforts, she was not able to understand the game to the point that she thought she was "stupid", afterward she discovered a "new reality" where she could express her creativity, overcoming her initial feeling of low self-efficacy in relation to the game.

It is worth noting that in both these excerpts, a family member played a significant role in the students' account of their appropriation of Minecraft, so these family members can be considered as boundary-crossing brokers. Fabiola's brother acted as a "boundary-crossing broker" since his intervention is described as crucial for the whole process of change described in the excerpt. In this sense, the cultural inputs coming from the family in Fabiola's case are intrinsically connected with her changing her categorization of games for males and indirectly provide valuable learning resources for the educational activity.

In the next section, we will further discuss the connections between the school culture and the family culture that emerged from the students' account of their educational use of Minecraft, while in the subsequent subsections, we will also provide an excerpt to discuss the role of the teacher as a boundary-crossing broker.

6.2. Boundary Crossing between School Culture and Family Culture

This code was applied to nine excerpts in which the students' narrative shows how the boundaries between the different cultures experienced at school and within the family environment are permeable and allow for significant processes of boundary crossing. In all of the excerpts included in this category, some osmosis between family and school cultures is described by the students as they narrate their perspectives on the activities in Minecraft. In the previous section, we mentioned how family members can act as boundary-crossing brokers promoting students' engagement in gameful educational activity and aiding in the transition across socio-cultural boundaries. However, the data also include excerpts in which the boundary crossing is experienced by the students' family culture thanks to the participation in the school project in Minecraft. A good example in this sense is the case of Natale (Excerpt 3), who explained that during the project, his mother became so fond of Minecraft that she decided to buy him an expensive edition of the game, even though she had previously been very "strict" about the fact that she should not buy any other videogames for him.

Excerpt 3 (Interview D)

> Natale: In my opinion, the only not-so-great thing about Minecraft, but it's not really about the game itself. . . but external, is that you have to pay for it. But my mom, even though she was strict about not buying more games for the computer, not buying them. . . then getting to know Minecraft, which is an awesome game for her too. . . she got it for me. She got me the best version, the Java Edition!

Excerpt 3 is noteworthy because witnessing the learning experience at school during the project triggered a boundary-crossing process in which some changes concerning the meaning-making of gaming occurred within the students' families, to the extent that Natale's mother reconsidered her opinion about videogames and the possibility of buying one for her son.

Excerpt 4, meanwhile, is significant because it shows how a student (Elisa) engaged in an activity in Minecraft that was specifically aimed at creating a bridge between the school culture and the family culture. Indeed, in Excerpt 4, Elisa describes how she used Minecraft, which she learned to use at school, to realize in the virtual world a construction that she defines as "her mom's wish".

Excerpt 4 (Interview B)

> Elisa: Some time ago, I made my mom's wish come true. She really wanted houses for the three of us sisters, all close to each other. So, I did it in Minecraft. . . and it's really cool because it allowed me to create things that you might imagine but you can't always have.

In our interpretation, Excerpt 4 shows an instance of boundary crossing in which Elisa uses Minecraft as a boundary object between school and family. Rather than being conceived by Elisa only as a game for entertainment and/or as a tool for learning, Minecraft in the event described by Elisa becomes a boundary object appropriated at school but also adopted to mediate family relationships.

In the next section, we will focus on the excerpts from the interviews in which the students describe social boundaries and the processes through which they were able to overcome them during the project.

6.3. Crossing Social Boundaries

The third category we discuss contains the speech in which the students discuss how the activity in Minecraft allowed them to overcome some kind of social barriers. We identified 12 instances in this category. For example, in Excerpt 5, Alba states that many other games did not allow her and her classmates to play collectively. In contrast, playing Minecraft was a positive experience for her because the activity involved the whole classroom, so she was able to "have fun" with all of her classmates.

Excerpt 5 (Interview C)

> Alba: I really loved the fact that you could play at it with friends because. . . well there are many games. . . mhh. . . that run. . . obviously but Minecraft, Minecraft is. . . well let's say that many times we were not able to play together with friends in other games, but Minecraft since it was a thing for the whole class we were able to have fun all together

Excerpt 5 allows us to discuss how some participants considered the activity in Minecraft as a collective activity, allowing them to engage in social interaction that they considered significant. In the excerpt, Minecraft is compared to other games that on the contrary did not allow Alba to play with her friends. Interestingly, in the excerpt, Alba seems to conflate the concepts of friends and classmates.

In Excerpt 6, we can gain further insights concerning some processes that facilitated the overcoming of social boundaries during the activities in Minecraft. In this excerpt, Chiara reflects on the fact that the activities in Minecraft helped her to develop a closer relationship with some of her classmates. Indeed, she remarks that before the project, her interactions with some of her peers were limited, as she did not engage in extensive conversations with them. However, thanks to the composition of the groups designed by the teacher, she could interact and get to know some of her classmates better. This excerpt also demonstrates the importance of the design work undertaken by the teacher to promote the transformation of the game into an educational resource.

Excerpt 6 (Interview E)

> Chiara: Minecraft also had this function ((gesture-making air quotes)) in the sense that the teacher created some groups and she did not put together the children who so to say you knew the best with whom you spoke more but she put me with people with whom I did not speak much and then anyway I rediscovered these people because I did not speak much with them I mean yes Hi, good morning, or... in the whole class group but not so much so I think that it was also an activity to allow us to socialize, in my view really beautiful...

The two excerpts discussed in this category allow us to discuss how some of the students reflected on the social processes taking place during the project. In particular, Alba seems to attribute the possibility of overcoming some preexisting social boundaries to both the technical features of Minecraft (since unlike other games it allows one to play in multiplayer mode) and the fact that the project involved the whole classroom (so that they "could have fun all together"). Chiara, instead, depicts the teacher as a boundary-crossing broker, since she noticed that it was exactly the rationale that the teacher adopted for creating the groups that allowed her to "socialize" with some of her classmates.

In the next section, we will briefly examine two excerpts that allow us to discuss how the students' work took place at the boundary between the community of Minecraft gamers and the school context.

6.4. Boundary Crossing between School Culture and Gaming Culture

The first excerpt from this category, Excerpt 7, illustrates how the activity in Minecraft involves the integration of the school culture and the gaming culture that in the interviews is often symbolized by the YouTubers who share tutorials and game sessions that become useful resources for the participants. During the group interviews, eight students explicitly mentioned YouTube videos as useful resources for learning to navigate Minecraft and for engaging with the tasks that the teacher assigned. In a different section of the interview, Elvira mentioned that while playing Minecraft, she gained knowledge through mutual advice exchange with her friends, and in Excerpt 5, she places significant emphasis on how videos from YouTubers played a crucial role in shaping her learning journey.

Excerpt 7 (Interview E)

> Elvira: so I had never played Minecraft before the teacher told us... I had heard a lot about it. And when the teacher made us know it, I became passionate about it, I so to say started watching the videos of the YouTubers on Minecraft also in order to learn some techniques and stuff, and now I also have Minecraft Java edition because I liked it too much and I also created my own server in order to play with my friends and so...

What makes Excerpt 7 particularly intriguing is that it highlights the learning opportunities embedded within boundary-crossing experiences. Elvira, who had no prior experience with Minecraft before the school project, deliberately crossed the boundaries between school culture and gaming culture. She did this to enhance her technical abilities to the extent that she managed to create her own server—a rather complex task that many of her peers struggled to achieve. In a different part of the interview, Elvira further clarifies that she used her own server to host her classmates in her world during the school project.

Excerpt 8, meanwhile, is interesting because Rita narrates how she learned about the existence of communities of gamers sharing their gaming experiences through "Let's Play" videos, which are video recordings of digital gameplay as it occurs, created by the players themselves. They often feature a commentary recorded by the player and constitute a hugely popular genre with millions of children watching Minecraft gameplay on YouTube every day [43].

Excerpt 8 (Interview A)

> Rita: I know many YouTubers who do Minecraft... actually for my buildings I took inspiration from some of them... well, like, I know a YouTuber who is

> very good at creating, he creates some works of art. . . like. . . well, so I got some ideas to create my own buildings and so to say I discovered them [meaning the youtubers] because while watching videos on YouTube then they appeared and so I watched a video.. and started watching some videos, and I liked them and so I subscribed and now I watch all of their videos.

Notably, in Rita's case, the YouTube algorithm effectively recognized Rita as a potential audience for "Let's Play" videos and subsequently recommended a selection of such content to her. Rita casually started watching some of these videos, and she found herself drawn to them to the extent that she opted to subscribe to several YouTube channels hosted by these Youtubers, eagerly watching all the videos they produced. This noteworthy sequence of events transpired as she clarified in a different part of the interview, well in advance of the start of the school project and prior to Rita's initial direct engagement with the Minecraft platform. Consequently, when the teacher introduced the Minecraft project, Rita had already acquired a substantial familiarity with the game through these videos, making her enthusiastic about embarking on the school project involving Minecraft. Therefore, it is possible to infer that her familiarity with the "Let's Play" genre developed over an extended period mediated her engagement with the school project.

6.5. Boundary Crossing between School and Leisure

This category contains 14 excerpts in which the students discuss how they perceived a sense of continuity or discontinuity between playing Minecraft for pedagogical tasks and for leisure purposes and explain how continuity across the activities carried out in these different situations was created. In Excerpt 9, Valerio's discourse shows that the activity in Minecraft led him to rethink his prior assumptions about the boundaries between schooling and gaming. Indeed, he starts his turn of speech by stating that he never expected that a game could be part of a school activity. Then, both in this excerpt and in other parts of the interview, his description of his experience of Minecraft is focused mainly on the sense of freedom and absence of "limits" perceived when playing the game, which seem to be opposed to what is usually experienced by him at school.

Excerpt 9 (Interview E)

> Valerio: For me, it was cool because I didn't think that school would introduce a topic that was about something like a game. I mean, it's not like. . . that the school. . . usually do something like this. It was very interesting for me because there weren't limits to our imagination. You could do whatever you wanted, and it was fun.

In Excerpt 9, Valerio emphasizes the openness of the activities in Minecraft ("there weren't limits to our imagination"). This perception is probably connected both to the open and flexible environment provided by the game and to the open-ended nature of the tasks assigned by the teacher. This interpretation is supported also by the fact that in a different part of the interview, in disagreement with some of his peers who claimed that the tasks assigned by the teachers changed their experience of the game, Valerio emphasized a sense of continuity between playing Minecraft for educational purposes and for leisure, stating explicitly that in his view, there were no differences between playing for leisure and engaging with a school task in Minecraft.

In Excerpt 10, Carla describes her first approach to Minecraft, stating that initially, it did not capture her interest, but that the presentation of the game by the teacher made her change her mind as she discovered that Minecraft is a "creative" game in which you have to build and put a lot of dedication to complete the buildings. Her speech concludes with the statement that before the school project, she did not understand why her peers liked the game so much, but thanks to the school project she finally "understood". We also know from other parts of the interview that she enjoyed playing Minecraft for leisure purposes.

Excerpt 10 (Interview H)

> Carla: well in reality Minecraft... well, I had heard about it almost... by many people, but in reality it never got my interest, but then when the teacher presented it, then, well... then I understood that it is a game in which you have to build and you need a lot of commitment for that and anyway it is a creative game and in reality I like these creative things, and so I liked the game... also because before I did not believe it was... I mean in reality before the people I know got crazy about this game and I said: but why? I mean... I did not understand why with a with a game they got crazy... and then I understood...

Excerpt 10 offers insights for two reasons. First, we place this excerpt within the "Brokers" category, specifically to underscore the pivotal role assumed by the teacher within the boundary-crossing process, as narrated by Carla. Her initial acquaintance with Minecraft stemmed from the widespread discussions among her peers who used the game for recreational purposes and expressed fervent enthusiasm for the game ("with a game they got crazy"). This interpretation is also validated by the fact that none of the students involved in the project had previously participated in any educational activity involving Minecraft. However, a transformation occurred, primarily attributable to the mediating influence of the teacher. Thanks to her teacher's presentation of Minecraft, Carla recognized the educational value of Minecraft within the school setting and understood the reasons behind her peers' intense enthusiasm for the game. This transformation suggests a notable shift in Carla's perception of Minecraft, indicating that she started considering Minecraft as being valuable for both education and leisure.

In the next section, we will illustrate how several students perceived the project in Minecraft as an interdisciplinary activity, intrinsically connected with different domains of knowledge.

6.6. Crossing Disciplinary Boundaries

The last category of our findings concerns the fact that Minecraft was experienced by several students as an interdisciplinary learning environment, where they felt they could acquire knowledge and skills spanning across diverse domains and disciplines. Indeed, when exploring how they understood the educational value of the activities in Minecraft, in 11 excerpts the students displayed a high degree of metacognitive thinking, connecting their activities in Minecraft with their learning path in different disciplines, even though the project pertained mainly to the history curriculum. In Excerpt 11, we present three speech turns from the same interview, in which two students discussed their interpretation of the role of Minecraft as an educational tool. First, Rosanna explained how she made sense of the links between Minecraft and the disciplines taught by the teacher leading the project. She claimed that the activities in Minecraft related to all the three disciplines of history, geography, and science taught by the teacher. Then, a few speech turns later, Graziano intervened, explaining how he used the stars in Minecraft to orientate as the shepherds used to do in the past, and Rosanna further explained that in her view, Minecraft also involved mathematics because it is possible to use coordinates to move in the virtual world.

Excerpt 11 (Interview B)

> Rosanna: I understood that Minecraft involved all the three disciplines of the teacher because anyway it could involve geography as we needed to orientate in the space we had available, history also looking at caves and how ancient populations lived and ancient types of buildings, and the sciences experimenting also with potions and creating many scientific things, so I think it was a form of didactis more... I mean... it helped me to understand some things about history, science and geography
>
> [...]
>
> Graziano: so, I used the stars as a shepherd, that is, many times I remembered the position of my building because I looked at the sky and counted the stars many times, the stars if you notice the stars many times, that is, there are... some

> numbers. . . I counted them because they are not, they are not thousands, they will be about ten, sometimes even a twenty above you, as you walk the stars either increase or increase or they decrease, I knew how many stars there were now, it's not really a good explanation, but I wanted to explain. . .
>
> Rosanna: In my opinion, ehm, you can also do this, and. . . well. . . ehm. . . it also includes mathematics by putting the coordinates, because you can also see the coordinates, that is, where you are to track down. . . ehm. . . you can also use Italian, because there are also signs where you can write.

In sum, Excerpt 11 effectively represents the sense of interdisciplinarity that was communicated by some of the students during the interviews. While a few students connected the project to a single discipline (either history, science, or technology) and some others did not mention any explicit connection between the school curriculum and the activities in Minecraft, the findings show that the project had for many students the potential to engage with activities that were relevant for their learning and not restricted to the boundaries of a single discipline.

6.7. Differences Depending on Previous Experiences

To examine potential differences among the six codes in the Crossing Sociocultural Boundaries category based on participants' previous experience in Minecraft, a contingency table (Table 3) was constructed, and subsequently, the chi-square test was performed.

Table 3. Occurrence table of the six codes in the Crossing Sociocultural Boundaries category according to the level of expertise in Minecraft.

	Categories	**Disciplines**	**Family-Edu**	**Gaming-Edu**	**Gender**	**Leisure-Edu**	**Social**	**TOT**
Expertise	Occurrences							
Novice (n = 16)	Observed	7 (64%) [25%]	3 (33%) [11%]	6 (75%) [21%]	1 (17%) [4%]	6 (43%) [21%]	5 (38%) [18%]	28
	Expected	5.05	4.13	3.67	2.75	6.43	5.97	
	Residual	0.87	−0.56	1.21	−1.06	−0.17	−0.40	
Intermediate (n = 9)	Observed	3 (27%) [15%]	4 (45%) [20%]	0 (0%) [0%]	5 (83%) [25%]	2 (14%) [10%]	6 (46%) [30%]	20
	Expected	3.61	2.95	2.62	1.97	4.59	4.26	
	Residual	−0.32	0.61	−1.62	2.16	−1.21	0.84	
Expert (n = 12)	Observed	1 (9%) [8%]	2 (22%) [15%]	2 (25%) [15%]	0 (0%) [0%]	6 (43%) [46%]	2 (15%) [15%]	13
	Expected	2.34	1.92	1.70	1.28	2.98	2.77	
	Residual	−0.88	0.06	0.23	−1.13	1.75	−0.46	
TOT		11	9	8	6	14	13	61

An initial descriptive analysis reveals that, with increasing experience, there is a general decline in the enactment of reported boundary-crossing events. Particularly noteworthy is the observation that novices predominantly display more boundary crossing, especially in the Disciplines and Gaming-education areas, while the Gender code is assigned to 83% of cases with intermediate experience in Minecraft. The Leisure code is evenly distributed among novices and experts (43%), but much less so among intermediates (14%).

More specifically, novices exhibit a higher amount of boundary crossing between different Disciplines (25%), between Gaming and Education (21%), and between Leisure and Education (21%), while intermediates primarily narrate boundary-crossing events related to the Social boundaries (30%) and Gender categories (25%). Experts are predominantly coded for boundary crossing between Leisure and Education (46%) and do not engage in Gender-related boundary crossing (0%).

The results of the chi-square test, conducted using SPSS software (version #29.0.2.0), confirm a non-uniform distribution of occurrences based on expertise level ($\chi(10) = 19.513$; $p < 0.05$). Notably, residue analysis emphasizes that the Gender attribution for participants with an intermediate level of expertise deviates most significantly from expectations (residual = 2.16).

7. Discussion and Conclusions

In this article, we have discussed how the use of Minecraft at school provided several occasions for crossing different kinds of socio-cultural boundaries, each bearing implications for learning.

First, we examined instances of boundary crossing in which some female students initially perceived Minecraft as a "game for boys" or dismissed it as a "stupid game," but later reevaluated their cultural perceptions and engaged in the pedagogical activity. Our study reveals how engagement with Minecraft played a pivotal role in challenging and transforming genre expectations and stereotypes, especially among female students. Encouraging the active participation of female students in video games that feature strong scientific elements, like Minecraft, holds great potential to stimulate girls' interest in STEM subjects, which in turn can have profound implications for their career choices [44].

Second, our findings suggest that Minecraft can facilitate a process of osmosis between family and school cultures. Indeed, the study identified instances in which family members acted as boundary-crossing brokers, promoting students' engagement in the gameful educational activity, and aiding in the transition across socio-cultural boundaries. The data also include excerpts in which the boundary crossing leads to a transformation of sociocultural barriers within the family context. Bearing in mind the specificity of the school and the family contexts, previous boundary-crossing research has shown how in homework situations students can experience how school and home norms may conflict or how particular subject matters are not necessarily valued at home (e.g., [45]). Thus, the osmosis across the school and home contexts is not self-evident, and people may come to face contradictions between the various participations and perspectives typical of each context, leading to the experience of discontinuity. In such cases, what one experiences and learns in one context cannot be easily related to and may even conflict with what one experiences and learns in another context [16]. Interestingly, in our findings, the narration of the project in Minecraft included several episodes in which the contradictions between the cultural values and beliefs associated with the two contexts were overcome during the educational project, suggesting that the open-ended collaborative activities in Minecraft allowed for a fruitful osmosis despite profound cultural differences.

Third, we explored how the students' interactions with Minecraft in an educational setting revealed episodes in which social barriers were overcome. Some students highlighted the significance of both the game's features and the teaching strategies employed by their instructors in helping them to overcome social barriers encountered in various contexts. In this sense, as claimed by Thomas and Brown [46], the educational use of games such as Minecraft can contribute to creating dialogic spaces. This aspect was particularly relevant in the present study because it took place during the COVID-19 pandemic, which generated several barriers to the students' social interaction [47,48]. Notably, in some of the excerpts within this category, the teacher emerged as a pivotal figure, effectively acting as a facilitator of social interaction. In general, our study underscores the significant role of teachers in the students' narratives involving the overcoming of different types of socio-cultural boundaries. This observation aligns with the concept proposed by Oonk and colleagues [49], advocating the incorporation of a "broker" role within the multifaceted profile of contemporary educators. Brokers, according to these authors, are required to possess a skill set centered around boundary-crossing competence, which entails the capability to proficiently handle, transition between, and combine various discourses and practices across social boundaries. In particular, when addressing the educational use of games, teachers have a crucial role in framing the computer game as a learning resource [50], thus bridging the boundaries between school and leisure which will be discussed as follows.

Fourth, regarding boundary crossing between school and leisure, the study found that Minecraft can create a sense of continuity across the activities carried out in these different situations. Some students reported a sense of freedom and an absence of "limits" when playing the game, communicating a sense of continuity between its usage for education and leisure. The previous literature concerning this finding is mixed. Indeed, as shown

by Squire [51], some students can feel uneasy when having to perform in school identities that are usually enacted during gameplay in settings outside school. Nevertheless, Bergin [52] identified that school experiences can give rise to leisure interests that students independently pursue outside of the school environment. In line with the previous literature [11,25], our findings suggest that Minecraft can be considered as a flexible artifact that can be transformed into a learning resource. The project in Minecraft provided the students an opportunity to reconsider their sensemaking about what kind of activities can be associated with school activities, also thanks to the open-ended nature of the tasks assigned by the teacher. Indeed, our data show that the students perceived this kind of task as meaningful and engaging.

Fifth, our study sheds light on the intersection of school and gaming cultures within the context of Minecraft, particularly the influence of YouTubers and online resources on students' learning experiences. The excerpts analyzed in this category emphasize the evolving role of digital media, YouTubers, and gaming communities in shaping students' perceptions and abilities related to Minecraft. They also illustrate how online resources (such as Let's Play videos) and gaming content can extend beyond recreational entertainment, contributing to educational experiences. Our data show that Let's Play videos provide opportunities for knowledge and skill exchange. These videos allow players to see how others play the game, learn new strategies, and gain insights into the game's mechanics. Additionally, Let's Play videos can foster a sense of community and belonging among players, which can be important for social and emotional learning. Indeed, as suggested by Dezuanni [43], watching a Let's Play video can be perceived as watching over a friend's shoulder as they play a game and having fun in a social setting in which a friend's gameplay fun is your fun. Let's Play videos thus reflect the social nature of most video gameplay. Accordingly, Let's Play videos and other forms of digital media may play a key role in shaping the participatory practices that take place around Minecraft and contribute to the ongoing scholarship on participatory culture.

Sixth, our data show that many students experienced Minecraft as an interdisciplinary learning environment, where they could acquire knowledge and skills spanning diverse domains and disciplines. This category highlights the potential of Minecraft to promote interdisciplinary learning and foster connections between different subjects. Even though the previous literature suggests that educational activities based on games such as Minecraft might promote the acquisition of a variety of soft skills and competencies, including 21st-century competencies [6,7,9], further research is needed to examine how the students make sense of their learning and deliberately draw trajectories of participations that cross the boundaries of the disciplines around which teaching is usually organized.

Finally, the analysis shows that different types of boundary crossing are associated with different levels of expertise in Minecraft prior to the educational activity. Even though this study presents several limitations, especially due to the small size of the sample, this result is interesting because it shows that the students' previous experience has the potential to affect the boundary-crossing processes taking place during the educational use of Minecraft. Indeed, in our case, the female students who had overcome cultural categories associated with gender typically had had the opportunity to engage with Minecraft prior to the educational experience but had initially dropped it because of their perception of a cultural boundary. This boundary was afterwards then reconceptualized during the school project, triggering a process of boundary crossing. In addition, the fact that expert students often mention boundary crossing between leisure and education can be explained considering that during the pedagogical activity, these students have revisited their opinions about Minecraft only as an entertaining game and transformed the social positions enacted while playing (playing as a gamer vs. playing as a student).

To conclude, digital games can be considered flexible artifacts that may take on many different meanings when taught and played across different contexts [25]. According to Atkins [53], games exist only in their dialogic relationship with a player, so the meaning of games is not static and given a priori. When the students make sense of the educational

use of a game, both a sense of continuity and discontinuity can be perceived. The literature shows that discontinuity can have negative consequences for educational trajectories in terms of potential disengagement and drop-out. Hattam and Smyth [54], for example, describe the alienating experiences reported by students for whom maintaining an academic identity proved to be impossible given their background, also leading to dropping out of school early. The present research, meanwhile, shows how the long-term use of Minecraft allowed for the emergence of many opportunities for boundary crossing, allowing the students to overcome many barriers and to socially construct a sense of continuity across contexts and practices taking place in and outside of school.

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