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Becoming a tutor: student scaffolding in a game-based classroom

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Student interaction in school contexts is a topic that has been researched from many different perspectives. However, the role of students as tutors scaffolding other peers is not normally addressed, since studies are usually focused on the teacher. Moreover, considering the many technologies that can support students' work nowadays, studies describing specific practices are still needed in order to understand the many possibilities and constraints that can emerge from the use of these tools in the field of education. This exploratory case study aims to extend research on scaffolding between students, presenting data from an ethnographic study where a commercial video game was introduced as part of the curricular activities. Analytically, the scaffolding metaphor is the departing point to describe in detail how the scaffolding process took place, focusing on its purposes and on the role of students as tutors. Our findings reveal how students offered mostly procedural scaffoldings, performing tutor functions such as highlighting relevant features, reducing levels of freedom or controlling the frustration. Results highlight that students can perform scaffolds, and this should be considered as part of the classroom design, making this process visible. Moreover, specific features of the video game enhanced these interactions, which should also be considered when designing game learning environments in the future.

Keywords: classroom interaction; game-based learning; students as tutors; scaffolding

Introduction

With the increasing amount of technologies present in our daily lives, students' interaction mediated by technological tools has been a relevant topic for research. Different technologies can offer different possibilities, and therefore, it is important to pay attention to how they are being used in school contexts. In this study, the focus is on the social interactions that can take place in a classroom where a video game is introduced, as an educational resource, from the perspective of a particular theoretical construct: scaffolding.

This well-known concept was first introduced by Wood, Bruner, and Ross (1976) as an analytical resource to comprehend the support received by children from their parents in joint problem-solving. This metaphor remains as a relevant concept in educational research, as different special issues reveal (*Journal of*

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Learning Disabilities, 31(4), 1998; *Journal of the Learning Sciences, 13*(3), 2004; *Instructional Science, 33*(5/6), 2005; *New Ideas in Psychology, 23*(3), 2005; *Learning, Culture and Social Interaction* (2), 2013). Moreover, the metaphor has evolved to address also scaffolding processes between teachers and students in school contexts (Cazden, 1979; Van de Pol & Elbers, 2013), being defined as a support that responds to the current level of the student, fades over time, and is aimed at transferring responsibility from tutor to tutee (Bruner, 1983; Van de Pol, Volman, & Beishuizen, 2010).

However, previous studies on scaffolding revealed that, when interactions were portrayed, the research used to focus mostly on the teacher, whereas students in the role of tutors were not usually addressed. This was a reason for criticism of the concept (Davis & Miyake, 2004; Stone, 1998) since student interaction was mostly referred to as collaborative work, peer tutoring etc. (Howe & Mercer, 2010; Pifarre & Cobos, 2010). In that respect Pata, Lehtinen, and Sarapuu (2006) raised questions about the difference between defining the tutor's supportive interactions as scaffolding and similar ones carried out by peers as something else, although both actions have the same purpose.

In addition, support offered by technological devices has also been studied under the scaffolding framework (Kim & Hannafin, 2011a, 2011b; Raes, Schellens, De Wever, & Vanderhoven, 2012; Warwick, Mercer, & Kershner, 2013). In this respect, the role of technology as a cultural tool or mediating artefact (Daniels, 2001; Säljö, 1999) and its specific features need to be considered in order to acknowledge the complexity of scaffolding practices.

In view of these ideas, this exploratory case study aims to extend research on students as tutors, scaffolding their peers in a particular context where a technological tool (a video game) is incorporated in the classroom design as part of the curricular activities. Drawing attention to the students and, more specifically, to their interactions in a game-based classroom, the analysis was framed under scaffolding purposes and tutor functions. It is argued that video games can have some potential to facilitate the assumption of tutor functions by students, who 'scaffold' other students while they solve game-related problems. Hence, in the next section, different studies present scaffolding in a two-fold perspective. First, regarding the implications of scaffolding when mediated by technologies and second, on student scaffoldings and video games. Then, some methods and contextual cues will be provided along with the analytical framework, which will frame the results and discussion. Finally, conclusions and implications for classroom game-based design are presented.

Theoretical underpinnings

In this section, a review of the topics that constitute the foundations for the present study is introduced, focusing on scaffolding both in game-based scenarios and between students. After that, specific concepts are presented which, within this framework, were employed in an attempt to respond to the research aim of further studying student roles during game-based situations.

Beyond teacher scaffolding: students as tutors in technological settings

As previously introduced, this article claims that peer support resembling scaffolding should also be considered as such instead of resorting to other analytical

frameworks. By all means, this implies less consideration to these approaches, but studying this type of interaction from the lens of scaffolding allows us to better fulfil the research purposes, since the focus is on the role of students as tutors in a game-based activity in the same way that the literature has addressed teacher roles. In this respect, Littleton's words are embraced when, in a special issue dedicated to scaffolding, she wrote: '… educational researchers are in the business of constructing particular accounts and representations of teaching-learning and the metaphors we choose mediate the construction of our understanding in powerful ways' (2013, p. 55).

Following Pata and her colleagues' proposal (2006), it is important in this study to pay attention to the mutual adjustment and appropriation of ideas between the teacher and the students and among the students themselves, rather than the simple transfer of information and skills from teacher to learner at the time of playing. In that regard, these authors highlight the connection between the concept of scaffolding and the concept of the learner's zone of proximal development (ZPD) introduced by Vygotsky (1939/1978) and enlarged by Forman (1989) to include bi-directional teacher–learner and learner–learner ZPD. The idea that learning in the ZPD can occur through peer interactions has also been defended by other authors (Hedegaard, 1990; Mercer & Fisher, 1998). However, since there is a tendency to conceive the tutor as the leading figure and the students as the task performers, empirical studies that report on the role of the student as a tutor from a scaffolding perspective are still few, but they do report research that took place in technological settings. One example is the work of Wu, Farrell, and Singley (2002), who identified different strategies used by teachers but also by peer tutors to scaffold challenging mathematical problem situations in an online environment. They note that peer tutors used similar strategies and also that 'novice' students interacted with the peer tutor in a similar manner as they did with the teacher. These results lead to the conclusion that peer tutors can perform teacher tutoring activities, offering their knowledge to guide others.

Pata, Sarapuu, and Archee (2005) also stressed the importance of considering several scaffolding actors in collaborative scenarios (tutors as scaffolding actors, students as scaffolding actors and students as task performers), presenting results that again show similarities between the strategies used by the teacher tutor and the student tutor. In the same manner, Kim and Hannafin (2011a) also paid attention to other types of scaffolds in everyday classroom settings rather than only the ones introduced by the teacher. Their findings show a case where student and teacher scaffolds as well as technology-enhanced ones were crucial to support scientific inquiry. In this study, peer scaffolding allowed the students to confirm answers, confront and reconcile conflicts, encourage and challenge further thinking and share perspectives. However, the authors studying student actions focused mostly on the type of scaffold offered, and do not necessarily employ similar frameworks when assessing teacher or technology scaffolds.

Considering previous studies, research on student scaffolding still needs to be defined and studies on the topic could take advantage of the key concepts employed to study teacher scaffolding in order to gain more knowledge about student interactions resembling that practice.

Student interactions in game-based scenarios: to be or not to be a tutor

In recent years, technologies have played a major role in educational scenarios, being used in many different ways. Among the many technologies available nowadays, this research is particularly interested in video games as cultural tools or mediating artefacts (Daniels, 2001; Säljö, 1999). Following Vygotsky (1939/1978), learning is considered here as an interactive process of participation in various cultural and social practices. Therefore, technologies such as video games are considered as tools that are part of those practices (Arnseth, 2006; Squire, 2003). Following that perspective, this article is not interested in the game itself or its potential learning applications; instead, the focus is on the context of the gaming situation and on how students participate and interact there.

As Egenfeldt-Nielsen (2007) pointed out, games have been introduced in education by following different paradigms and therefore, they have enhanced specific interactions between the participants. In this respect, as highlighted by Abbott (2007), technologies and games can be used for different purposes in school scenarios, namely to train and rehearse, to assist learning or to enable it. Advocating for the last one, Abbott supported a collaborative use of technologies rather than individual support, a holistic rather than skills-based approach, inclusive rather than separatist (Abbott, Brown, Evett, Standen, & Wright, 2011), where the classroom is seen as a community (Rogoff, 1998).

There are plenty of studies highlighting how video games can enhance participation in school contexts (e.g. Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012; de Freitas, Ott, Popescu, & Stanescu, 2013; Echeverría et al., 2011; Gee, 2007; Lacasa, 2013), but there is a lack of studies focusing on the roles of students. Studies pointing out participation opportunities in video game activities have focused on student–teacher interaction, highlighting changes in student participation encouraged by specific activities carried out by the teacher (Silseth, 2011) or in comparison with regular activity during traditional lessons (Watson, Mong, & Harris, 2011) where games were not introduced. Moreover, in game-based scaffolding, some studies conceive them as external scaffolds that can help students to make connections between knowledge acquired from the game and the one coming from the discipline studied (Barzilai & Blau, 2014; Mayer, Mautone, & Prothero, 2002). In these cases, it is possible to see how student participation also changes, but authors focus on the external tools that function as scaffolds instead. Moreover, participation around game-based situations has also been quantified, showing increasing levels of engagement (Annetta, Minogue, Holmes, & Cheng, 2009) but without paying attention to how students interact with each other at the time of playing.

In this respect, the role of technology as a cultural tool or mediating artefact (Daniels, 2001; Säljö, 1999; Vygotsky, 1939/1978) needs to be considered in order to acknowledge the complexity of scaffolding practices. Video games as technological devices are not neutral when they enter the classroom, and, as Säljö (2010) pointed out, technologies have implications for social activities. The specific features that video games present could be relevant since they can add specificity to the type of interactions that will be analysed. Sim City, the game used in this research, is considered to be an 'open-ended' game (Juul, 2005) with no clear goal to indicate that a player has won. Therefore, our study will shed some light on student interaction and, more specifically, on students in the role of tutors in scenarios mediated by a simulation open-ended video game. In this respect, Van de Pol and Elbers (2013)

stated the need to explain what scaffolding processes look like when they involve new mediational means, going beyond traditional studies that focus on dyadic interaction in well-structured tasks to consider how the concept can be extended to novel settings.

Methodology

This study endeavours to explore the role of students as tutors, guiding their peers in a context where a video game is incorporated as an educational resource in the classroom design. Hence, the research questions were the following:

What are the purposes of scaffolds that take place when students solve problems in a game-based educational scenario?

- Which tutor functions do students employ while playing?
- What is the role of the video game within the classroom practice?

Since there is a lack of studies devoted to student scaffolding in game-based practices, an exploratory case study (Yin, 2003) following ethnographic techniques (Atkinson, Coffey, Delamnont, Lofland, & Lofland 2007; Walford, 2008) was our methodological choice, aiming to provide an initial research that could serve as an example that would guide us to hone our future work on the topic.

Context and participants

For the purpose of the study, high school students were considered to form the most suitable age group, since research on the use of video games in Spain reports that between 45% and 59% of teenagers aged 14–19 years old used them frequently during 2004–2009 (ADESE, 2009). Moreover, the research aims were twofold: (1) to know to which extent video games could contribute to transforming the classroom in order to solve learning problems among students and encourage collaboration; and (2) to identify what certain commercial video games teach and how to learn from their hidden curricular programme.

Therefore, the study was conducted at a secondary public school and involved different teachers and subjects (Lacasa et al., 2009). Data presented here is part of the activities that were carried out within one-hour social science classes of the third year of compulsory education, where the video game Sim City Creator was used as an educational resource. Participants were ten students (five girls and five boys) aged 16–17 who were used to traditional guidance in the school, more direct instruction and static tasks. The teacher wanted to use video games to introduce concepts related to urbanism and geography that were part of the school agenda. Moreover, he also intended to create a more flexible and dynamic class. In order to achieve this, a video game workshop was designed to be carried out in the class sessions which are presented in Figure 1.

The first moment of the workshop is related to planning. Preparation sessions include previous meetings with the entire staff that took place to introduce the project, and also one training session where teachers played with each other, becoming familiar with the different platforms and games. The next four sessions were dedicated to playing the game and took place in the computer room, where students played around a Wii console with a screen and a remote controller, sitting next to

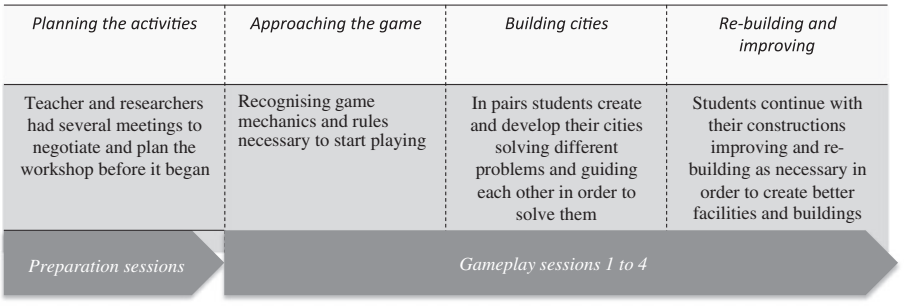

Figure 1. A brief review of the classroom activities during gameplay.

each other by forming a 'U'. Students build and rebuild in pairs formed randomly, improving different features in their cities such as commercial and residential areas, electricity and water supply etc.

Unstructured interviews with the teacher of social sciences were scheduled prior to the beginning of the workshop and during the gameplay sessions. Based on open-ended questions, interviews served to negotiate goals, clarify doubts, share feedback and set the main activities that were going to be the core of the sessions. These interviews revealed that he had some basic knowledge about the game. Moreover, the students revealed during the sessions that none of them had played this specific video game before. Some students knew other games from the Sims series, and all of them played with video games at home, even though not everybody had video consoles like the ones used in this study. Permission to record and use material for publications was granted in writing by the school and the students. The names have been changed in order to ensure the anonymity of participants.

Data collection and analysis

The data set comprises different materials, mostly in audio-visual format (Pink, 2007) as shown in Table 1.

Since it was important to observe the events taking place during the gameplay, we resorted to different camera recordings: one fixed on the screen recording game activity and one mobile, capturing classroom actions. Additionally, interviews and dialogues with the participants were collected as audio recordings that, together with the pictures taken of researchers and students and the researchers' diaries, allowed us to reconstruct the sequence of events for interpretation and analysis.

A case study (Yin, 2011) and discourse analysis (Gee & Green, 1998) perspective was followed to approach the data and study the different interactions between the participants when they played Sim City during the workshop. For this purpose, all the audio-visual recordings were processed with the aid of Transana software (Wood & Fassnacht, 2010), enabling different phases for the interpretation and analysis process: the narrative phase, where most significant moments of the workshop were transcribed using times codes, and the analytical phase, where transcriptions were classified into a system of categories, as will be explained in the next section.

Table 1. Overview of the data corpus.

Sim City Creator Workshop, 3rd year of secondary school					
Session	Video recordings	Audio recordings	Researchers' diaries	Pictures	Students' material
Preparations		Interview with teacher		74	
1	- Fixed camera - Mobile camera		4	67	
2	- Fixed camera - Mobile camera	- 2 interviews with teacher - Small group interaction	3	10	
3	- Fixed camera - Mobile camera	- 6 groups brief interviews - Interview with teacher	3		44 pictures taken by students
4	- Mobile camera	- Brief interview with teacher	3	12	42 pictures taken by students
Total	5h 36 min	38 min	13	163	86

Analytical categories

In the narrative phase of the analysis the data revealed episodes where peer interaction resembled what was usually addressed as teacher scaffolding. We identified these particular moments and conducted an in-depth analysis based on categories presented in Figure 2 that came from a literature review on scaffolding. The novelty here is that they have been employed to study different aspects of teacher scaffolding, but not peer scaffolding.

Considering student interactions as scaffolds, we want to gain in-depth knowledge about the different types of scaffolds, since this distinction also allows us to study how they can be related to some features of the technological tool also present

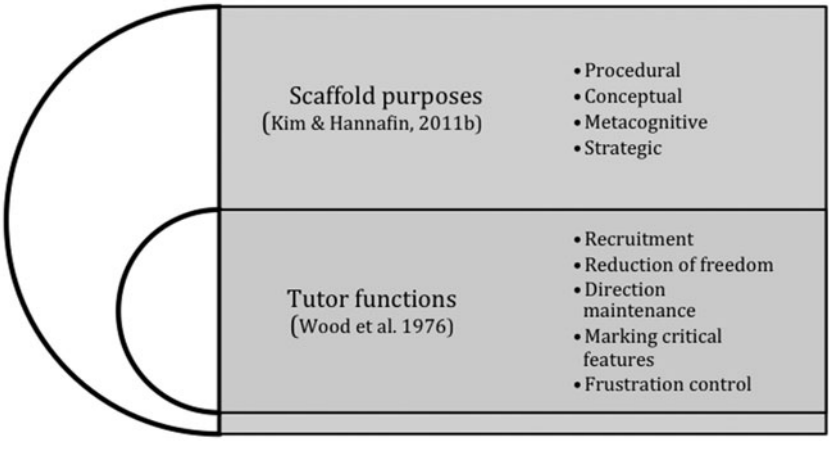

Figure 2. Analytical categories.

in the case: the video game. In order to do this, we resorted to the categories presented by Kim and Hannafin (2011b), since they also consider the importance of paying attention to the different actors involved in the scaffolding situation when solving problems. These authors present the following *scaffolding purposes*:

- Procedural scaffolds: they guide the student in addressing operational aspects of the learning environment rather than investing cognitive resources in negotiating routine procedures navigation.
- Conceptual scaffolds: they help students to identify essential knowledge gaps between what they already know and what they need to know. They guide students' understanding of the problem content, provide support to enhance their understanding of the problem and related knowledge, and gradually fade as students negotiate the knowledge and skills needed to solve the problem.
- Metacognitive scaffolds: they assist students in assessing the state of their understanding, reflect on their thinking and monitor their problem-solving processes.
- Strategic scaffolds: they help students to consider alternative approaches to addressing problems based on preliminary or tentative solutions.

Moreover, we narrowed our analysis to further study the student as a scaffolding actor resorting to the work of Wood and his colleagues (1976), also employed by many others (e.g. Booth, 2012; Hsin & Wu, 2012; Kim & Hannafin, 2011b). These authors highlight the *functions* that a tutor could assume when offering a scaffold, also fundamental to study students' actions. They are as follows:

- Recruitment: to enlist the problem solver's interest and adherence to the requirements of the task.
- Reduction in degrees of freedom: this involves simplifying the task by reducing the number of constituent acts required to reach a solution.
- Direction maintenance: Learners lag and regress to other aims, given the limits in their interests and capacities, so that the tutor has the role of keeping them in pursuit of a specific objective. Past successes usually serves to distract them from the ultimate goal, so an efficient tutor also maintains direction by making it worthwhile for the learners to risk a next step.
- Marking critical features: a tutor marks or accentuates certain features of the task that are relevant by a variety of means, providing information about the discrepancy between what the tutee has produced and what he or she would identify as a correct production.
- Frustration control: this is generally achieved by helping problem solvers pursue the goal without excessive reliance on tutors.
- Demonstration: 'modelling' solutions to a task, which often involves an 'idealisation'. The tutor is 'imitating' an attempted solution tried by the tutee, expecting that the learner will then 'imitate' it back in a more appropriate form.

These theoretical constructs allow focusing on the scaffolding-specific features during gameplay and problem-solving situations. Therefore, *scaffolding purposes* and *tutor functions* were the analytical categories to approach students' social interactions. From this model, the article explores how these aspects were intertwined and how they appeared in the data, which is presented in the next section.

Results and discussion

In order to comprehend how student scaffolds took place in this particular case, the first results presents a brief description of the workshop activities and the different problems that participants encountered while building their cities, the results from the first phase of the analysis. Since it is not possible to present all these interactions in the limited space of this article, different examples are displayed and discussed in the second part of the results since they reflect and represent the generality of the class interactions around the gameplay.

Mapping participant interactions and narrowing down our scope: student scaffolding in a game-based context

As presented before in this article, the focus is on the interactions between students that took place while playing a video game. Results show how participants guided each other in order to solve different problems that arise from building the city.

None of the students knew the game, but some had played similar ones or others from the Sim saga. Therefore, problems in the first session were related to navigation of the game menu and use of the Wii controller, an instrument that sometimes made it difficult to build some of the elements of the city. After that, participants started to solve problems, creating and developing neighbourhoods, institutions and services in their cities. Every time they faced a new construction decisions were made, and different actions were set in motion to achieve that goal (Monjelat, Méndez, & Lacasa, 2012). This process was not simple, and required the students to help each other. Table 2 summarises the excerpts that serve as case examples introduced in the next section, highlighting some of these problematic situations where students assume different tutors functions by offering scaffolds.

Student scaffolding: becoming a tutor

In the first part, excerpts regarding the first constructions are presented, since that is where the scaffolding process started. After that, excerpts from more advanced constructions are introduced which required more guidance and particular advice from the student-tutors leading to more independent play from the tutees.

AQ1 Table 2. Examples of student-tutors' actions and scaffolding purposes in game problems.

Problem	Tutor functions	Scaffolding purposes	Excerpts
Navigate through the menu and establish goals	- Marking relevant features - Reducing levels of freedom	- Procedural - Conceptual - Strategic	1, 5, 6
Build electricity system Build water pipes	- Frustration control - Marking relevant features - Reducing levels of freedom	- Procedural - Metacognitive	2, 3
Place roads and highways	- Marking relevant features - Reducing levels of freedom	- Procedural	4
Build railway system	- Marking relevant features - Frustration control	- Procedural	7

Building from scratch: initial elements of the city

One of the first challenges that groups encountered was to learn how to navigate the game menu and use the controller. This basic aspect of the game was crucial in order to create any construction. The menu was organised around different icons they had to interpret and choose depending on the desired construction. This first approach to the game was not simple, as we can see in this excerpt where two students (Peter and Mary) start playing:

Excerpt 1: Navigating the menu and establishing goals

Mary:	Which button should I hit, Peter?
Peter:	Erm… Free mode.
M:	((selects it))
P:	And now it has to load. Hit button A.
M:	((presents difficulties locating the cursor on top of the load icon)) It's not loading, I already hit it…
P:	It's on the right, that little square.
M:	So I should hit this? This is difficult, isn't it? ((The city is loading in the game)) All my friends have this thing, but me…
P:	My sister has it too.
M:	Well, take it, Peter ((she hands him the controller)), I just can't do it.
P:	Let's see ((stands up, takes the controller and approaches Mary)), now we have to create the city, ok?
P:	The first thing you have to do is to provide what people want: water, electricity and all that.
M:	((nods affirmatively))
P:	OK? And it's here ((shows the icons on the screen, navigating the game menu)), see? Power lines, power station… Now we have to look for the power station.
M:	Pretty cool, huh?

In this excerpt, we can see that Mary is not familiar with the use of the Wii controller, and therefore, it is hard for her to navigate the menu. Her partner Peter guides her in this first step into the game, assuming a tutor role and showing her the goal of the game and how to reach it using the menu icons.

Mary initially asks for directions (Turns 1 and 7), but because of how difficult it is to control the remote (Turn 7), she delegates the activity to Peter (Turn 9). Peter then takes control of the situation (Turn 10) and provides *procedural and conceptual scaffoldings* since he is not only showing her how to play by pointing at the location of the icons (Turn 13), but also seeks to guide her in understanding the content of the problem by highlighting the objective of the game (Turn 10), crucial in order to know what to do next. Meanwhile, Mary places herself in the position of an observer, paying attention to what her partner says and to what happens on the screen. Figure 3 shows this sequence of actions illustrating the transfer of control made by Mary to Peter, who assumes a guiding role in this first problematic situation.

Continuing the analysis, the following excerpt shows how this group interacted around one of the steps of the electricity construction mentioned above by Peter: setting up the power lines. In this case, Peter tried to *transfer control* of the activity to Mary, but this did not happen at that moment:

Excerpt 2: Student-tutor tries to transfer control while building the water system

P:	Do you want to create the power lines?
M:	No way, Peter, I just can''t…

Figure 3. Students interacting in the scaffolding processes.

Mary does not know how to play by herself and remains in the position of an observer. That is why Peter continues to support her and provide information while he builds the elements needed. A similar situation occurred in Eva and Alba's group, where one of them took the lead but the other was not only an observer since she had the controller. In the following excerpt, they are providing water to the population (see Figure 4):

Excerpt 3: Building a water system

Eva: And now what? A water pump?
Alba: No, we already set that. Pipes are like electricity lines, now you have to, let 's say…take them there, sort of.
Eva: Oh…
Alba: Make it big, here, the pipes.
Eva: Ahm?
Alba: Do it big, like a square, like a square ((she draws in the screen)), you know?
Eva: A straight line, like this?
Alba: From here to there, and from there to here ((points different parts of the city map in the screen)) Like a square, do you know what I mean?(Eva nods and follows Alba's instructions)

Figure 4. Alba and Eva setting the water pipes.

Once again, another student assumes *tutor functions* highlighting relevant issues, and in doing so *reduces the levels of freedom* departing from the game options. In this fragment, it is possible to see different purposes of the scaffolds. On one hand, Eva is guiding Alba with *procedural scaffolding* that shows her how to go through the menu, find the right icon and later place it in the city. On the other, she offered *metacognitive scaffolding* as presented in Turn 2. In that interaction, she connects with previous knowledge learned by solving another problem (building the electricity system) helping the student-tutee to understand why now they don′t need another water pump and instead, they need to connect the water system using pipe lines. Without that connection, water will not run through the city, so this comment from Eva is totally necessary for them to understand the nature of the system and build it properly. As we can see in the excerpt, Eva was a little lost, and the support from her student-tutor was needed.

In both excerpts there are *procedural and metacognitive scaffoldings* offered by Peter and Alba that allow both Mary and Eva to form a first representation of the game mechanics and rules and also of the city functioning in terms of fulfilling basic needs. While offering these scaffolds, they also assumed *tutor functions* such as highlighting relevant issues, control frustration and reducing the levels of freedom.

More elements to build: from shared action to taking over control

Moving forward in the game, there were situations where students were faced with building elements that were more complicated. As the following excerpt shows, students have created a roundabout and a highway as Figure 5 shows, but they are having some problems. A student from another group, Sebastian, noted this situation.

Excerpt 4: Building roads and highways

Sebastian:	How are you doing, Peter? Is that the same city as the other day?
Peter:	Yes.
S:	So you still have that mess with the roads.
P:	Yeah... ((he moves the map and show that part of the city to Sebastian)) ((both laugh))
S:	Connect that road.
P:	Which one, this one?
S:	That part of the road ((the small not connected part of the road next to the roundabout))
P:	I′ve done that.
S:	No, you haven′t. Let′s see, hit ‘B’ ((he points to the controller)) and don′t make it straight. Hit ‘B’ for a moment, now ‘A’, on the left, and there you go, now they are connected ((Peter has selected a curvy road on the menu and connected both roads))

In this excerpt, the students are looking for a way to connect a recently built highway with a previously built roundabout, as shown in Figure 5. In this dialogue, Sebastian not only sums up a previous issue, but also offers different resources to fix it, as we see in Turns 6 and 10. With this, he is offering *procedural scaffoldings* that allow Peter to navigate the menu and select the proper tool to connect the roads. Additionally, he is *marking relevant features* by pointing out the need of that type of road instead of the other, and *reducing the levels of freedom*, guiding him to find the right option on the menu. Sebastian was also aware of other difficulties, and he approached other students in need of guidance:

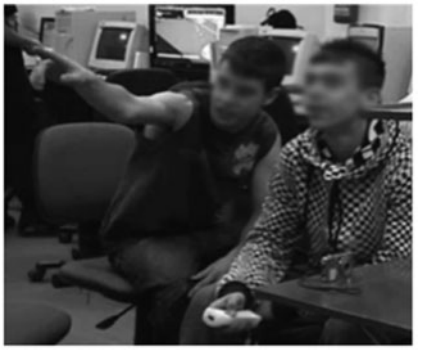

Figure 5. Building the roads and roundabout with extra guidance.

Excerpt 5: Summing up basic features

Sebastian: Move a little bit away, don't place the controller so close to the screen.
Anna: Like this?
S: There you are.
A: Where can I place the school?
S: Well… That's a good option, since you don't have a playground yet ((he points to a specific area on the map))
A: So is it ok if I place it here?
S: Yes, place it there.

In this interaction, Sebastian approaches Anna, who was playing alone since her partner was absent that day. This student has some issues with the controller, which is a task already achieved by the other groups. In the video recordings we could see how she was standing up and sitting down again a couple of times, trying to use the controller without success. Sebastian saw this and that is why he intervened and gave her some tips to dominate the controller that could be interpreted as *procedural scaffolding*. She takes advantage of that, and also asks him where to place the school, and in this case, he offers *strategic scaffolding*, since it is based on the premise that she also needs to create a playground next to the school. Another interesting episode took place when the teacher required help from Sebastian too, as we can see in the next interaction:

Excerpt 6: A student guiding the teacher

Teacher: Sebastian…this…house
Sebastian: The worship house?
T: Yes, that one, where was it? ((He means in the menu))
S: Under 'Rewards'
T: Oh, I see, thanks!

In this episode, another group is trying to build that house, which is an automatic request that appears sometimes in the game coming from the neighbours. The game menu is wide and has so many options that even the teacher needs guidance. In this case, he turns to Sebastian looking for his expertise. Again, it is possible to see *procedural scaffolding* where he *remarks important features* and *reduce levels of freedom.*

Interactions like the ones presented above allowed students from different groups that initially functioned as tutees to achieve more control over the game. In the following excerpt, there is an example of situations of that kind where Mary, who didn't want to use the controller before, is now navigating the menu and building elements:

Excerpt 7: Building a railway system

M:	Well, this one will have everything. Which one under transportation? ((She searches the menu herself, not waiting for his answer)) Train station, right? Where should I build it, right here?
P:	Wherever you want.
M:	Oh ((she gets lost in the menu)) Metro line, train station… What should I do, Peter?
P:	Build the railway, right? The train…
M:	Oh my… I'm making a mess. I'm going to place it here.
P:	Make a big curve to cover it all.

In this excerpt, Mary is constantly looking for Peter's confirmation of her actions, acknowledging his expertise. However, she is controlling the game, gaining responsibility and control of the activity. At the same time, Peter is trying to delegate the decision-making process (Turn 3), but whenever she needs help, he offers indications that allow her to move forward in the construction (Turn 4) and strategies to solve the problem (Turn 6). By doing this, Peter is scaffolding her, since at first he pays attention to the moments where she needs guidance and offers extra support, but later he withdraws this help, which starts to fade.

As the students solved different problems with the guidance of their peers it was possible to see how they started to be more independent in their actions, taking control and creating elements without much scaffolding needed. In this respect, and since each group was creating different constructions, the previous excerpt serves as an example of how this process took place in the workshop.

Concluding remarks

The purpose of this study has been to extend research on scaffolding between students in a school context where a commercial open-ended video game was introduced as part of the curricular activities.

Focusing on the scaffolding process, results showed that student guidance was based mostly on procedural scaffoldings, usually related to the mechanics of the game that helped the tutees to understand its rules. When doing this, students assumed different tutor functions, such as pointing out relevant features of the game menu that showed how to build constructions, controlling frustration when needed, and also reducing levels of freedom by narrowing down the options in order to choose the right icons to create and build. Moreover, the results discussed above show that the nature of the video game used in the workshop is crucial here to understand student interactions. The open-ended context of the game allowed the students to face problems at their own pace, moving forward and backwards when needed, taking time to interact, discuss, recalculate and establish goals.

Based on these results, it is possible to argue that, in this case, the video game has mediated the participants' interactions generating a collaborative scenario where students assume tutor functions scaffolding each other to solve problems together.

In this respect, this study supports previous research where students were considered as scaffolding actors (Pata et al., 2005) guiding and supporting their peers, but also highlights the importance of accounting for the digital technology mediating these scaffolding processes. Although previous research has focused on the link between scaffolds and technologies (Raes et al., 2012; Zhang & Quintana, 2012), and scaffolds and games (Barzilai & Blau, 2014; Mayer et al., 2002), in this case the particular features of commercial open-ended video games were considered, providing novel insights in that matter.

Moreover, scaffolding processes took place spontaneously around the gameplay, since students were not told to do so. In this respect, this study shows that students can effectively guide each other and it could be useful to point that out to them, so they can reflect upon their actions. This could improve their experience in the classroom, making them more responsible for their learning process, resulting in more active participation. Moreover, when introducing technologies in the classroom it is important to recognise students' knowledge for them to scaffold peers more effectively.

Further studies are needed in order to confirm the results of this exploratory case study, and in that respect, research should focus on the design of game-based experiences that allow students to recognise scaffolding purposes and tutor functions so they can offer other types of scaffolds aimed not only at procedural aspects, but also at a more reflective gameplay leading to metacognitive ones. In this respect, the role of the teacher is crucial to make this possible, embracing the pedagogical possibilities of video games as educational resources to enhance collaborative and innovative practices. Therefore, the teacher role in game environments should also be studied in depth as other studies also concluded (Hämäläinena & Oksanen, 2014).

Disclosure statement

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