Playing in the Classroom with a Virtual Globe for Geography Learning

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Abstract

This paper describes an empirical research about the uses of a virtual globe for geography learning in lower secondary school. It aims at discussing the roles that a virtual globe, such as Google Earth, can take for elaborating a didactical setting in order to implement a pretend game. The game, based on a real project in the north of France, consists in a study about land use planning. The students have to argue about their choices according to the role that they play.

The uses of the virtual globe take place during different steps of the game. (1) The students can access to information about their role and the rules of the game. (2) They can visualize and gather different data about the project. (3) They create their own set of data in order to argue their point of view. (4) They use the virtual globe to communicate with others participants.

The research questions focus on different aspects of the impacts of the uses of the virtual globe during the learning process. According to the idea that the activity of the player/learner is driven by exploration and discovery (Ahuja, Mitra, R, & M, 1995), one of the questions deals with the level of implication of students and their awareness about their role and the problem to solve. We also address the question of the relevance of the use of a virtual globe to cope with the complexity of the project. Therefore, we examine the value of Geotechnologies for implementing Game-Based-Learning situations in the classroom.

Introduction

A recent study supported by the Mac Arthur Foundation emphasizes that the uses of digital technology by young people have altered how they learn and socialize (Ito et al., 2008). The authors of the study conclude that this phenomenon must be taken in account by educators. The new habits of youth encompass the use of digital games. According to Prensky (Prensky, 2001), average college grads have spent over 10,000 hours of their lives playing video games. This phenomenon has been taken in account by national institutions, international organisations and firms that use serious games to communicate, to increase public awareness and to train employees.

Another aspect of the emergence of new practices relates to the use of geotechnologies. The professional uses of geotechnologies are increasing (Longley, Goodchild, Maguire, & Rhind, 2005) as a lot of sectors of activity need precise and situated information. There is

also a rise of the personal uses of geotechnologies. Nowadays, more and more, cell phones include a GPS and the virtual globes such as Google Earth have a great success.

Starting with these points and considering that there is a lack of useful digital games in the field of geography teaching we try to explore the interest of virtual globes for serious games designing. This paper aims at addressing the following questions:

- The level of implication of students and their awareness about their role and the problem to solve;

- The relevance of the use of a virtual globe to help the students to cope with the complexity of the project.

Therefore, we examine the value of Geotechnologies for implementing Game-Based-Learning situations in the classroom.

2 Playing for learning

There are a lot of definitions for the word *game* but the most useful is probably to have a set of criteria that helps to determine if the situation is a game or not. According to Brougère (Brougère, 2005), a game is a meta-activity as it is a model of an ordinary situation. As a result the consequences of the play are minimized. The player acquires freedom and autonomy. He/she is allowed to take decisions and the results of the play depend on these decisions even if there is always suspense about the conclusion. The freedom to take decisions is limited by norms and conventions that are the rules of the game. This set of criteria is valuable to implement Game-Based-Learning situations in the classroom and to distinguish such situations from Problem-Based-Learning and Project-Based-Learning that are different but close educational settings.

Playing is widely shared in the living world and there are natural links between playing and learning. The ethologists have demonstrated the importance of playing for the young mammal (Jacob & Power, 2006). Playing can be considered as a biological function which participates to the adaptation to the environment. For our specie, there is no doubt about the value of games for learning (Egenfeldt-Nielsen, 2006) and the literature emphasized two aspects: the power of the game to motivate students and the development of teaching methods such as “learning by doing” (Kirriemuir & McFarlane, 2004). Therefore, the activity of the player/learner is driven by exploration and discovery (Ahuja, Mitra, R, & M, 1995).

These studies are close to researches that have been carried out during many year to understand the process of experiential learning (Dewey, 1938). There are strong links between problem solving and knowledge. As a result, our research is grounded on the Piagetian hypothesis which states that the knowledge emerges from a process of adaptation. This approach is also based on the work of Vygostski (Vygotski, 1934). Thus, it relates to a socio-constructivist framework. According to this view, we consider that the learning process results from interactions: interactions between a learner and an object to be known, interactions with a didactic setting elaborated by the teacher and social interactions.

3 The uses of geotechnologies for eductionnal purposes

There is a lack of useful digital games to elaborate a didactical setting in the field of geography teaching and it is necessary to imagine how to use usual tools to design such games. Our proposition is to consider that virtual globes can provide relevant tools to implement games activity in the classroom. Indeed, the value of Internet-based GIS and virtual globes for students' inquiries has been highlighted by different works (Baker, 2005; Kerski, 2008; Sanchez, 2008a). Kerski (Kerski, 2008) reports the link between the use of Geotechnologies in education and the development of spatial literacy, the awareness of how decisions are made about the environment and the impact of human as change agents. Virtual globes are virtual worlds that allow to access to information which is, on a hand, about individual and personal dimension and, on the other hand, about a worldwide dimension.

The success of virtual globes is demonstrated by the rise of uses for secondary education (Donert, 2007; Sanchez, 2008b). Though, virtual globes offer new opportunities for teaching/learning geography and geology. They make possible to deal with an embedded knowledge by taking in account the complexity of the world. The concepts that are taught are linked with concrete problems to be solved. Models are linked with empirical evidences (Sanchez, forthcoming). These opportunities relate also to the teaching design that is permitted by the use of virtual globes. Fieldwork, Project-Based-Learning, Inquiry-Based-Learning and collaborative learning are fostered by the uses of these geotechnologies.

Another aspect which can be taken in account is the fact that, for a virtual globe, the frontier between the roles of provider and consumer of geographical information is blurry. Everybody can geolocalize a picture, a text or a video on Google Earth and share them with other people on the Web. The virtual globes are virtual worlds that belong to the Web 2.0, a digital space which enables to share and mutualise information. The content is partly user-generated and Turner (Turner, 2006) points out that we assist to the birth of a neogegraphy. For our project, it means that teachers and students can adapt the use of virtual globes for their own purposes. The teacher should be able to elaborate a useful set of data and instructions to develop a didactical setting that can provide useful feedbacks for the students. The students should be able to use this set of data and instructions as a virtual world in which they find the information to assess the effect of the strategy that they have adopted.

4 A pretend game about land use management

There are some important points to take in account to design a game for educational purposes (Malone & Lepper, 1987). One of these points is that the topic must arouse curiosity and interest. Another important aspect is that the level of difficulty of the goal to reach has to be adapted to the capacities of the learner who must be encouraged by a clear and encouraging feedback. The other aspects relate to the necessary freedom of the learner and the necessity to include emotional and social dimensions.

Our choice was to design a pretend game: a high speed railway loop designed for the test of high speed train (TGV) is going to be built. During 4 hours (2 weeks), 20 students from a lower secondary school (ISCED level 2A-13/14 years old) were asked to play the role of different characters: citizens living close to the project, citizens who do not want their envi-

ronment being partly destroy, citizen looking for a job, local political authorities, factory directors… The game has been describe in a previous paper (Jouneau-Sion, 2008). The project is based on a real land use management plan. The students' task consists in convincing the other characters that this project should be or shouldn't be set up. It also consists in finding a location for the implementation of the project. The students are given access to a set of data set up in Google Earth, a virtual globe. This set of data helps them to decide and to convince the others.

To be a success, the task has to be reachable. The student must understand the situation, understand the data and manage to use the tools. That is why the game is organized in 4 steps and a previous session is devoted to teach the students the core concepts that are useful to solve the problem. The first step consists in a guided-tour of the kmz file with precise questions that help the students to use Google Earth, to read the maps, texts and other data, and to understand the railway project. In the second step, the students are more autonomous: by using the data in kmz files and their character card, they have to decide, individually or by joining interest groups, of their point of view about the project. They must also prepare a meeting where they will have to argue about their choices according to the role that they play. In the third step, they present their point of view and use their own kmz file to argue. They also have to answer to other character's questions about their point of view. The fourth step appears to be necessary at the end of the discussion: all the players have to negotiate to find an issue to the project, another place or another way to build it.

Figure 1. The forming of interest groups

The uses of the virtual globe take place during different steps of the game. (1) The students can access to information about their role and the rules of the game. (2) They can visualize and gather different data about the project. (3) They create their own set of data in order to argue their point of view. (4) They use the virtual globe to communicate with others participants.

5 The students' involvment into the game

One of the most impressive results of this research was the involvement of the students in the game. They manage to fill their task by themselves and to use most of the notions that they have learned during the previous geography lessons. Some concepts such as technopolis, unemployment, transport network, were used by the students to argue their point of view and they usually used them in the right way in their presentations. The game gave them the opportunity to use embedded knowledge and to give meaning to the tasks that they have to do. Embedded knowledge and meaning are probably two key points to explain the involvement of students. However, a difficulty result from the fact that students of this age are not able to deal with the complexity of the situation. Furthermore, they are not able to understand and to take in account all the relevant information.

The students' involvement in the game results also probably from the topic that has been chosen as well. The high speed railway loop project is close to the students' preoccupations. Most of them heard about it as the debate was mentioned in all the local newspapers and on TV screens. Furthermore, the "not in my backyard" reaction is easily understandable, even for a child. As a result the topic provides a motivating problem to be solved and finding a solution implies to deal with concepts that are the objectives of the teaching. The importance of hiding the objectives of the teaching has been discussed in previous works (Ahuja, Mitra, R, & M, 1995; Brousseau, 1986). This is also a key point to explain why the students are involved in their activities and not in a play that consists in trying to determine the purpose of the teacher.

Figure 2. The presentation of the students' arguments during the "meeting"

The implementation of collaborative work is another point of the game. The students are allowed to form interest groups and they develop the awareness that cooperation is important to face the task. They are also involved in social interactions and develop key competences for the success of the project: tolerance, capacity to listen to the others, and capacity to be organized as an individual or as a group. They also have to be confident with the others, and they must be able to help them when necessary. The students appreciate this aspect of the game as they see the opportunity to show their competences and to express their own opinions. On the other hand the liberty offered to the students is difficult to be controlled by the teacher.

As a game is a meta-activity which is a model of an ordinary situation, the consequences of the play are generally minimized (Brougère, 2005). Playing has no consequence even pleasure and every player - even the teacher - was convinced that the decisions taken in the classroom will have not effect in the "real world". The contrary was observed. The results of the debates were published online and the citizens concerned by the location chosen by the students posted violent and tragic reactions on the website. It means that the use of Game-Based-Learning for land use management implies, for the teacher, to take care of the consequences when students communicate the results of their debates.

6 The interest of Virtual Globes for games designing

In which way the properties of a virtual globe are relevant for the design of a pretend game? What are the limits of this kind of tools for implementing a Game-Based-Learning setting in the classroom?

One of the results of the research is that a virtual globe allows the teacher to create a relevant set of data to design a pretend game. This set of data encompasses the data that are available online and also the data that the teacher has decided to add according to the topic of the game. These data relate to two different categories. (a) The geographical data give information about the different elements that have to be taken in account in order to take the best decision (location of inhabitants and firms, economical information…). (b) The game information is the *character cards* that describe the roles of the different characters. They articulate the rules that define how decisions must be made. This is possible thanks to the fact that the virtual globes are based on a user-generated-content. The content can be adapted by the user to create a set of data which fits his/her own purposes. Nevertheless, it is important to be aware that this set of data is a simplified model of the real situation which results from the choices of the game designer. It means that important elements could have been missed and that the complexity of the situation cannot be modelled as a whole. This model result also from the data that are really accessible and the gathering of these data takes a long time to design the game.

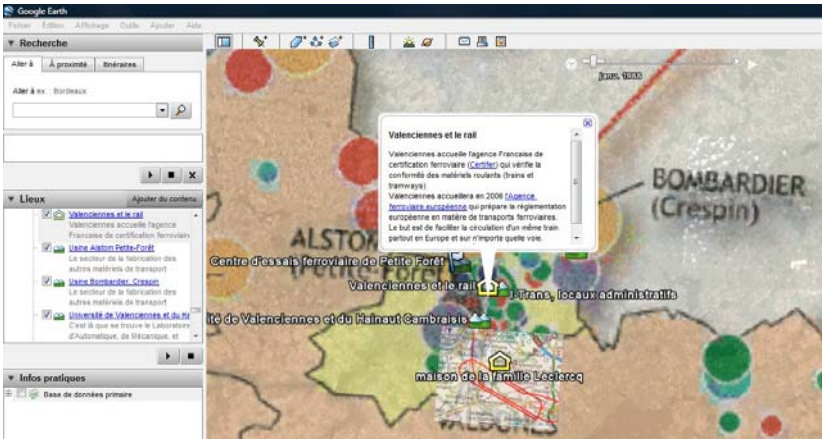

Figure 3. The available data on Google Earth

As a result, the virtual globe and the set of data added by the teacher consist in a source of information for the students. During all the session, they can get the different useful data for the game: geographical data, objective to reach, roles and rules. It means also that the shape of these data must take in account the level of the students. Afterwards, it is possible for the students to cross data by using the different layers and to select those that are useful among the complexity of the provided information.

The virtual globe also allows the students to make basic data analysis. The measure of distances can be used in order to decide whether or not the location of the project is too close from houses. The itinerary determination is useful for the choice of the location of the place for the project according to the distance of a factory which is involved in the project. The tools that are accessible in a virtual globe are easy to use by a secondary student. However, these basic tools cannot fit all the purposes. A Geographical Information System (GIS) should be more appropriate as it offers useful functionalities for data analysing.

At the end of the session the uses of the virtual globe is changing. The students create their own set of data to communicate their opinion to the other students. They can use the power of geotechnologies to design a set of information to convince the others about the pertinence of their choices. At this step of the game, they can become aware of the power of geotechnologies to create pictures that have the power to persuade citizens.

Conclusion

This case study shows that a virtual globe can be used to design a didactical setting which can provide useful feedbacks for students engaged in Game-Based-Learning. This result mostly from the fact that virtual globes are virtual worlds based on Web 2.0 technologies partly based on user-generated-content. They allow implementing activities that are more authentic and, thus, have the power to motivate the students by giving them the opportunity to be active and to give meaning to the tasks that they have to do. It also means that the teacher can keep the control on the knowledge implemented in the game that the students use and can avoid the problem that is faced when the content of ready-made games is not relevant (Sanchez & Prieur, 2009). On the other hand it means that it is a lot of time for the teacher to create his/her own game.

The virtual globe can be used at different level during the session: Geovisualization to get geographical information but the students are also involved in editing and analysing data. They also use the virtual globe as a tool to communicate their opinions and to convince the others about the choices that they have made.

The capacity to handle digital geographic information should be a part of the digital culture of the XXIst century citizen. The stakes of the integration of geotechnologies into the curriculum consist in a better understanding of geographical/geological concepts and in the development of the capacity of the students to develop relevant uses of these tools (e.g. critically read, interpret or produce cartographic display). The awareness of the source and the quality of information - to avoid disinformation - and the knowledge of the domain of validity of these tools for the processing of data are also some dimensions to take in account (Sanchez, forthcoming). This goal can be reached if the students are given the oppor-

tunity to use geotechnologies for carrying their own investigations. The use of a virtual globe for Game-Based-Learning is probably one of the solutions to reach this goal.

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