FROM CSCL TO VGSCL
A New Approximation to Collaborative Learning

N. Padilla Zea, J. L. González Sánchez, F. L. Gutiérrez, M. J. Cabrera and P. Paderewski
Videogames and E-Learning Research Laboratory (LIVE)-GEDES, University of Granada
Avda. Periodista Daniel Saucedo Aranda s/n,18071 Granada, Spain

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Abstract: In this paper we point out the advantages of CSCL (Computer – Supported Collaborative Learning) and technological media to improve the learning process. In particular, we are interested in using videogames as complement to traditional education. So, our main proposal is intended to introduce collaborative activities into educational videogames maintaining playability as pupils obtain benefits from both activities (play and learn). We have named this proposal as VGSCL (VideoGames-Supported Computer Learning). One of the biggest problems of including collaborative activities into learning process is assessing if collaboration is being made in an efficient way. To do this we are working in a method to detect, analyse and adapt interaction patterns. In this paper we present the first step in this process by proposing a messages classification. This classification is intended to determine which messages are relevant to the study and how important they are to the collaboration process. Also, we give some examples of using this categorization by using the educational videogame with collaborative activities "Leoncio and friends".

1 INTRODUCTION

In recent years, New Technologies have been incorporated into our everyday life: We work with our PC's or laptops and we work on-line from home, we exchange information by e-mail, our opinions are known by the world putting them in forums, maps have became GPSs, PDAs have replaced agendas,…

In particular, it is worth mentioning the progress of New Technologies into educational field and how it is prove that by incorporating these technologies into a pupil's educational development, it is possible to improve their cognitive skills, the time they spend learning, their motivation to learn, their concentration and their attention (Nussbaum, 1999).

Human beings are sociable for nature and this interactive aspect allows us to get new and different viewpoints and attitudes from our own. As a result, different skills are acquired and developed and attitudes of respect and tolerance are fostered. In the particular case of education, social interaction allows students to have different views about the concept being studied. As consequence, students don not simplify complex concepts during the learning process (Mendoza, 1998).

Although educational videogames do exist, these are often no more than "multimedia teaching units". While we can find many games which attempt to teach in a fun way, these often do not live up to the pupils' entertainment expectations. So, the child's attention and motivation quickly decreases because there is no game element in these educational resources (McFarlane, 2002).

The rest of the paper is organized as follows. First, we point out the difficulty of videogames design and how this difficulty grows when we want to introduce collaborative activities inside. The third section presents the interaction analysis and the fourth one shows how we can use this categorization by means of the educational videogame with collaborative activities "Leoncio and friends". Finally, we have some conclusions and further work.

2 CSCL AND EDUCTIONAL VIDEOGAMES

Following Piaget's theories (Piaget, 1971), thanks to collaborative learning individuals can obtain certain skills which they would not otherwise have due to the positive imbalance which occurs between pupils

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and which enables students to develop individual cognitive skills. In this sense, we can find research which has studied the improvement in the pupils' ability to learn into collaborative environments. These pupils learn from interaction with other group members and by reaching consensus. Since group members depend on each other, they help one another and assume responsibility for common success or failure (Jong, 2006). And according to Vygostky (Mooney, 2000), if we use educational videogames with group activities the game acts as a "mediator" in the learning process: Educational content is hidden in the game and the main activity for the child is the action of playing. As result of this process knowledge acquisition and cognitive skills are developed.

We have analysed the advantages of CSCL into educational videogames. One important conclusion is that videogames development is complex enough to need some specific guidelines (Mendoza, 1998; González, 2007) that ensure educational capability without losing playability. The use of guidelines is more important in the development of videogames with collaborative activities because complexity grows and elements needed are more difficult to design and to compose in the final game. Following these ideas, we have developed a set of design guidelines (Padilla, 2008; Padilla, 2009) in order to make the development of educational videogames with collaborative activities easier.

3 ANALYZING GROUP INTERACTION

It is important to analyze the interaction during the collaborative learning since several people around the same table working in the same task don't involve that collaboration exists (Collazos, 2007b).

From this point of view, we need to know the degree of collaboration occurring or that has been occurred during the group activity in order to:

- Determine if group is working collaboratively or not.
- Determine which messages are sent during the process and which is their aim.
- Find patterns in these messages that allow us to determine collaborative attitudes of quality and efficiency.

There are two main groups of methods which are combined to obtain more powerful ways of interaction analysis. These two methods are:

- *Qualitative*: Data for these methodologies come from questionnaires, interviews, observations… carried out by observers at the beginning, end or during the experience. In this data we can find opinions about quality, satisfaction, utility… referred to the collaborative process. With these data researchers can obtain results about the method and the learning achieved.
- *Quantitative:* In this type of methodologies numeric results are the most important data. By using them we can obtain one or more values about the quality of interaction during the experience.

We can find several methods according to these global methodologies. We would like to highlight several proposals that we find relevant to our research.

Into a quantitative framework we find works carried out by Collazos et al. (Collazos, 2007). These researchers have proposed a set of collaboration indicators to assess several properties of collaboration. Also, they have applied these indicators to several games, pointing out Chase-the-Chase (Guerrero, 1999).

Other very important approximations to quantitative methodologies are these which use Social Network Analysis (SNA). Social networks represent interaction between group members both numerical and graphically. Moreover, we can operate with them easily because they have a broad mathematical background. So, once we have represented relations in a matrix or a sociogram, several tools can be used to obtain results. Several researchers have used SNA to analyze interaction in several situations. Some of them are (Nurmela, 1999; Palonen, 2000; Avit, 2003; Welser, 2007).

Joining both quantitative, qualitative and Social Network Analysis, we highlight the proposals made by researchers at the University of Valladolid (Martínez, 2006, 2008; Harrer, 2009), including some tools that support the research (Martínez, 2003).

Following this ideas, we can find other proposals where SNA is used as checking method (De Laat, 2007) or as main tool to assess interaction in the collaborative process (Dawson, 2008). Usually, these proposals use SNA as triangulation method.

In a last group of approximations, we find Artificial Intelligence (IA) as a supporting tool in the interaction analysis. Some of these proposals use *fuzzification* processes to establish values for variables (Barros, 1999; Molina, 2003), although the most important contributions are intended to

introduce intelligent agents (Soller, 2001; Duque, 2007) into the collaborative learning, in order to help pupils automatically and to send information / suggestions to the teacher.

In our opinion, for the analysis to be effective, indicators must be as quantitative as possible. However, collaboration is complex and it affects many aspects of learning process. So, it is necessary to start from a deep analysis of collaboration assessing and a categorization of activities that can take place during the process.

We think that the best way to assess collaboration is to analyze messages sent between partners. These messages are not only those written by players and sent by communication systems (chat, e-mail…), but those hidden in actions and decisions taken during the process.

Following this line of thinking we propose a messages categorization from a general point of view to include complex collaboration processes.

The first categorization level is made according to the classic classification of messages in CSCW (Computer – Supported Collaborative Work): communication, collaboration and coordination. Then, we have sub-classifications according to activities observed into a collaborative videogame process. Next you can see this categorization:

- *Communication:* These messages are used by group members to interchange general information, related to the learning / playing process. With these messages we can evaluate active participation of group members.
  - Question / Answer: Partners ask questions to the group and they must answer. Some questions and answers can be found until the question is completely solved. If a new conversation is derived from this one, this sub-conversation has less weight.
  - Sharing information: A learner shares information discovered about the game process with the group. This type of message can produce a conversation about that scope. An evaluator can assess the degree of engagement and the success of the sender by using this kind of messages.
    - Error detection: It is a particular case of sharing information in which a group member points out that a mistake has been detected: a bad solution, a wrong plan…
  - Checking: These messages are intended to check if group members are working well or if they have some problem. These messages will occur when group score does not enhance, group life is decreasing too quickly or they cannot find a resource needed.
  - Social context: They are not related to the task but they are used to interact during the learning process. For example, they are messages like “After class we could go to the bar to have meal”.
- *Collaboration:* They are messages occurred in a situation that requires collaboration. In these messages collaboration is proposed or supported.
  - Proposal: They are messages in which users propose something to the rest of the group members, if the proposal is related to the task which the group is facing.
    - Posing the proposal: It is the first message about the collaboration proposition.
    - Negotiation: Group members use this type of messages to discuss about the actions they must carry out. All group members must take part in order to participate in the group task
    - Counteroffer: It is a message where a new proposal is made, related to the previous one, but with some conditions or changes.
  - Help: A group member uses these messages when he/she cannot carry out the task he/she must face to.
    - Asking for: It is the first message, sent by the pupil in difficulties.
    - Negotiation: Messages sent during the negotiation of help. Partners must offer solutions and help.
    - Solution: By using this type of message partners agree what they are going to do and how is going to help in the task solution.
  - Resources: These messages appear when a group member needs a tool to face the task and he/she does not have it. Then, he/she needs to ask for it to the rest of the group in order to know if some of them have it or they must obtain it to solve the problem.
    - Asking for: It is the message starting the search of the resource needed.
    - Owner / user identification: Users who have the tool must send messages to

tell the previous one that they have this tool.
        - Negotiation: These messages are produced to decide who is going to lend the tool, if there is more than one who has the tool needed. Also, they must discuss about when the tool will be available and the order of use, if there is someone more waiting for this resource.
        - Solution: It is the final message in which group members finish the conversation and agree if the user can use the resource or not.
- *Coordination:* The group uses this kind of messages to decide strategies and methods that will be used during the collaborative learning process.
    - Making decisions: They allow group members to decide what, when and how they are going to carry out group actions along the learning process.
        - Identification: It is the first message, in which a user indicates to the group that a decision must be taken.
        - Negotiation: They are messages that each pupil/player sends to the group showing his/her opinion about the discussion. In these messages group members try to persuade the rest.
        - Voting: Each member has a vote about the discussion. If agreement is not achieved, they can vote again.
        - Agreement: The message in which result is announced.
    - Group identification: Group members can send messages to identify the rest of the group, to know their skills, interests… The group must be aware of itself.
    - Planning tasks: When a group of tasks must be carried out, in a sequence way or not, group members decide who is going to do anything, which is the best order to achieve the best result, who is the most capable to do something,…
        - Identifying tasks: They messages are sent by any group member to point out the tasks found.
        - Negotiation: In these messages the group members tell the rest of the group which their preferences and skills are, or any other relevant information. During this process a vote can be started if group members cannot achieve consensus.
        - Distribution of tasks: This kind of messages can appear during the negotiation process. They will be messages in which an assignment is made, whether it is about order or the person who must take it.

All these types of messages must be detected in the activities generated during the learning process. To do this, it is important to analyze videogames and to find mechanisms that provoke messages activation. As an example, we can think in a player who has to solve a challenge and need a resource he has not. Then, he looks up to the common inventory to check if it is there. If tool needed is there, he checks if it is being used by some partner. These actions can be interpreted as messages of *asking for* and *owner/user identification* of resources.

Another example: If characters in our videogame have additional information that can be read by placing the stylus on it, we can take this action as an *identification of the group* message.

4 USING MESSAGES CATEGORIZATION

Once we have presented the message categorization, we want to show how we can use it. To do this, we are going to use the educational videogame "Leoncio and friends" (Padilla, 2009; González, 2007) as starting point. In any case, this messages categorization can be used in any educational videogame, whether it is purely collaborative or with some collaborative activities inside the individual learning process.

4.1 "Leoncio and Friends"

"Leoncio and friends" is an educational videogame with collaborative activities to learn the vowels.

In this videogame, Leoncio is the main character which pupils identify with. Their friends have been kidnapped and he has to travel from an island to other to rescue them. The name of each of Leoncio's friends starts with a different vowel. So, the activities linked with each friend's rescue will be related to this vowel. Leoncios' team has 5 players. The team's goal for this videogame is to rescue Leoncio's friends by defeating evil Perfecte.

In order to maintain group awareness each needed tool is filled up with colour gradually,

according to the degree of achievement. Background colour is according to T-shirt's colour of each Leoncio. We can see it in Figure 1a, upper screen.

At the end of each phase of the game the group must win a Perfecte's friend jointly. To do it, each member of the group must prove what he/she has learnt along the levels. By doing this, we expect to evaluate the individual learning process: each player must write his/her vowel taking into account the randomly proposed sequence. Moreover, the members of the group must "validate" their tools in order to contribute to the common work. In this videogame, the members of the group must build together a means of transportation to travel to the next island. To do this they have to decide in which order the tools must be used. Then they must use his/her own tool when corresponding. When this common challenge is overcome, the phase is overcome too. Then, the group travels to the next island. See Figure 1b.

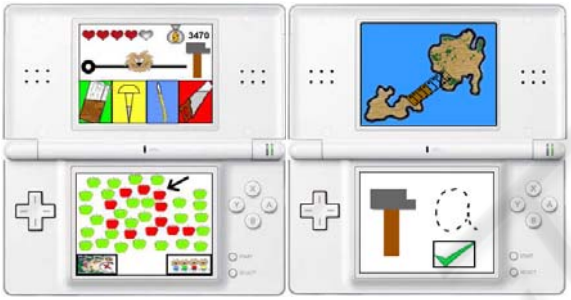

Figure 1: (a) Group feedback. Writing 'a' vowel. (b) Building the bridge to the next island.

4.2 Identifying Messages

Against one could think and according to our theories, messages do not need to be written, overall if we are working with children: We can take into consideration the intention of the actions carried out by the players as implicit messages. In this section we show some examples about this communication by using the videogame "Leoncio and friends".

Let's think about a player who has lost all his hearts (lives). We know group must achieve common goal together, so here we have an implicit *ask for help* from this player to all group members. In this case, it is more important the answer of group member, because the request is implicit in the game process. We can show *answers to the help* requested when a pupil gain access to the menu to share his/her life or go to voting menu to participate in a decision about this issue.

In a similar way, we can find messages about *making decisions* during a process of asking for help or resources. When the player has formulated the request, group members can vote if there is no one to share the requested object (lives, tools…). A *voting* in this videogame is quite simple, because there is not negotiation process. Group members only have to vote yes or not about the question made. The result from the voting is the *agreement*.

Finally, we can take into account the time taken to start the challenge resolution and the time taken to solve it to assess the quality of the interaction.

5 CONCLUSIONS AND FURTHER WORK

In this paper we have shown several items encouraging the use of educational videogames with collaborative activities in classrooms. As part of our work, we have presented a message categorization. This categorization is intended to help the researchers to assess the interaction occurred during the learning / playing collaborative process. We have used this proposal in the videogame "Leoncio and friends".

Finally, we want to remark our future lines of work. Now we are working on an interaction analysis method that can be used in VGSCL. One of the systems of this method is the message categorization. The first step to achieve our goal is to study how these messages can be found into videogames and which actions we have to take into account during the learning / playing process. We think that information must be presented in an easy way. So, SNA (Social Network Analysis) can be a good choice to get measures and present results properly.

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