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Methodological Guidelines Catalog to Support the Collaborative Learning Process

Catálogo de lineamientos metodológicos para apoyar el proceso de aprendizaje colaborativo

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ABSTRACT

The use of modern information and communication technology, it has become in one of the most promising ideas to improve teaching and learning. An example is the computer-supported collaborative learning, which is concerned with studying how people can learn together with the help of computers and that if implemented appropriately, can provide an ideal environment in which interaction among students plays an important role in this learning process. However, development activity in a group with the use of a tool does not ensure a right collaboration and in addition, another problem apparent is: for the educators is easier to follow accepted practices than to carve out new paths replacing the traditional lecture-tutorial model with something radical as group work with the help of computers. For this reason, it is necessary to have elements that say what and how to support the collaborative learning process for improving the collaboration and the actions of teachers. In this paper, we propose a methodological guidelines catalog for solving these problems, which are a recurring solution to a standard problem that helps to communicate and reuse knowledge in this context, providing great benefits for the development of reusable, flexible, and customizable collaborative learning activities. According to the validation, it can be considered that our proposal is useful, applicable and ease of use in the application of collaborative activities and with its use, the collaboration improve.

Palabras clave:
Aprendizaje colaborativo soportado por computador
lineamientos metodológicos
actividad colaborativa
mejorar la colaboración

RESUMEN

El uso de las modernas tecnologías de la información y la comunicación se ha convertido en una de las ideas más prometedoras para mejorar la enseñanza y el aprendizaje. Un ejemplo es el aprendizaje colaborativo apoyado por computadora, que se ocupa de estudiar cómo las personas pueden aprender en conjunto con la ayuda de computadoras y que, si se implementa de manera adecuada, puede proporcionar un entorno ideal en el que la interacción entre los estudiantes juega un papel importante en este proceso de aprendizaje. Sin embargo, la actividad de desarrollo en un grupo con el uso de una herramienta no garantiza una colaboración correcta y, además, otro problema aparente es: para los educadores es más fácil seguir las prácticas aceptadas que abrir nuevos caminos que reemplacen el modelo de tutoría tradicional, con algo radical como el trabajo en grupo con la ayuda de las computadoras. Por esta razón, es necesario tener elementos que

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digan qué y cómo apoyar el proceso de aprendizaje colaborativo para mejorar la colaboración y las acciones de los maestros. En este documento, proponemos un catálogo de lineamientos metodológicos para resolver estos problemas, que son una solución recurrente a un problema estándar que ayudan a comunicar y reutilizar el conocimiento en este contexto, proporcionando grandes beneficios para el desarrollo de actividades de aprendizaje colaborativo reutilizables, flexibles y personalizables. De acuerdo con la validación, se puede considerar que nuestra propuesta es útil, aplicable y fácil de usar en la aplicación de actividades colaborativas y con su uso, la colaboración mejora.

1. Introduction

The issue of how collaborative learning supported by technology can enhance peer interaction and work in groups has attracted considerable attention in recent years (Lipponen, Rahikaine, Lallimo, & Hakkarainen, 2003). This area of research is referred as Computer-Supported Collaborative Learning (CSCL), its uses have become, at present, an important part of students' activities in some better-equipped classrooms, has been considered as an important strategy supporting the teaching-learning process (Roberts, 2005). There is empirical evidence indicating the benefits of CSCL, among them are, facilitate task-oriented and reflective activity (Scardamalia & Bereiter, 1996); (Hakkarainen, Lipponen, Järvelä, & Niemivirta, 1999), complex reasoning and levels of argumentation (Hoadley & Linn, 2000), progress in use of conceptual models (Bell, 1997), mathematical problem solving (Enyedy, Vahey, & Gifford, 1997), and the learning of complex scientific concepts (Roschelle, 1992) and among many other benefits. However, just putting a group of people around a task does not guarantee a real collaboration, so it is necessary to structure activities and tools convey cooperation among group members (Collazos, Padilla-Zea, Pozzi, Guerrero, & Gutierrez, 2014), on the other hand, on the part of the teacher, at the moment of designing and executing a collaborative activity, he might need to be a chair, host, lecturer, tutor, facilitator, mediator of team debates, mentor, observer, participant, co-learner, assistant, community organizer, or some combination of these (Roberts, 2005), in addition to dealing with equipment that often does not work well and dealing with their common problems (Graham & Misanchuk, 2005). This points to the fact that the skills required on the part of the teacher are more complex and diverse than those required for a face-to-face lecture, and exist the need to have elements that say what and how to support this collaborative learning process for improving the collaboration, the actions of teachers and obtain the benefits of the collaboration process (Felder & Brent, 2001). For this reason, in this paper, we propose a methodological guidelines catalog for solving these problems, which are a recurring solution to a standard problem that helps to communicate and reuse knowledge in this context, providing great benefits for the development of reusable, flexible, and customizable CSCL activities. According to the validation, it can be considered that our proposal is useful, applicable and ease of use in the application of collaborative activities and with its use, the collaboration improve.

This article is structured, section two: the definition of the methodological guidelines catalog proposed, section three show the needs for computer-supported collaborative learning that explain why it is important to have guidelines to take into account in the execution of a collaborative activity, the section four show the application of this catalog through a case study and finally the section five the conclusions and further work are presented.

2. Needs for computer-supported collaborative learning

CSCL is regarded as a promising educational approach. A key reason for this is that many studies have demonstrated that combining the use of information and communications technology (ICT) and collaborative learning can be effective, efficient, and enjoyable. Lou et al. (Lou, Abrami, & d'Apollonia, 2001) have, for example, shown that combining small group learning with the use of ICT is more effective for learning than combining individual learning with the use of ICT. Furthermore, CSCL seems to increase student motivation (Fjermestad, 2004). Despite these positive effects of CSCL, many studies have also identified possible pitfalls when using CSCL (Kreijns, Kirschner, & Jochems, 2003). Examples of these problems are escalating conflicts among group members (Hobman, Bordia, Irmer, & Chang, 2002); free-riding behavior and unequal participation (Lipponen, Rahikaine, Lallimo, & Hakkarainen, 2003); (Savicki , Kelley, & Ammon, 2002); and discussions that lack depth, high-quality reasoning, and argumentation (Munneke, Andriessen, Kanselaar, & Kirschner, 2007).

Additionally, to these problems, are added that the development activity in a group with the use of a tool does not ensure a right collaboration, so it is necessary to have methodological elements that supporting the collaborative learning process. A way to look for a possible solution is initially to define an outline of cooperation

which permits the leader of the activity to know when and how to intervene in order to improve the collaborative learning process, also, it is necessary to follow certain recommendation like the definition of the roles in the group of students (Collazos, Padilla-Zea, Pozzi, Guerrero, & Gutierrez, 2014). Katz and O'Donnell (1999) mentioned, one of the main problems the teacher must solve in this collaborative framework consists of identifying when to intervene and knowing what to say. This kind of interactions could influence the individual learning and the development of collaborative skills (help, feedback, solve conflicts and disagreements (Dillenbourg, Baker, Blaye, & O'Malley, 1995). It is important to mention that how and when to intervene is just as important as how to evaluate. In order to evaluate the effectiveness of a group, we can monitor and observe the interactions between the group members while working together (Fjermestad, 2004). The observation will allow the teacher to obtain an understanding of the quality of the interactions between every member and the process of accomplishment of their task. As a complement to this possible solution it can consider, the importance of developing activities where the interaction sequences can be analyzed, for example, when a student is failing within the group, the environment can allow analyzing this situation. Johnson et al. (Johnson, Johnson Holubec, & Johnson, Advanced cooperative learning, 1992), mention that identifying, teaching and practicing skills are important but not enough to assure that students develop high levels of interpersonal and small group learning skills. Students should receive feedback about how they use some skills. This feedback and reflection should be based on carefully gathered information about how students use their skills when they are working with others (Janssen & Bodemer, 2013). Therefore, it is important for teachers to observe students' use of interpersonal learning skills during the group work, which would be of great help realize it with a software tool that supports this process, giving the relevant information to the teacher and the student. Skillful observation is essential to the discipline of using cooperative learning skills (Johnson, Johnson Holubec, & Johnson, Advanced cooperative learning, 1992). If the collaboration process is improved, the quality and quantity of topics learned by the group will be increased. As Ewing and Miller (Ewing & Miller, 2002) mention, it is necessary to know more in detail the process that occurs when a group of people is trying to solve a problematic situation in a collaborative way. Analyzing the previous problems and the possible solutions presented, it can be determined that is necessary to provide support for the design of educative activities, and to have a set of appropriate elements for the development of educative frameworks, especially elements that say what and how to support the collaborative learning process to improve the collaboration and actions of teachers (Katz & O'Donnell, 1999). For this reason, this paper presents a methodological guidelines catalog that provides some actions, elements, and activities in order to support the collaborative learning processes and would provide great benefits for the development of reusable, flexible and customizable CSCL activities.

3. The methodological guidelines catalog

This section presents some methodological guidelines which try to characterize the most common situations when collaborative learning activities are used. For our project, a methodological guideline is a piece of information that suggests how something should be done (Fagerholm, Kuhrmann, & Münch, 2017), seeking to solve a problem that may arise when a computer-supported collaborative learning activity is executed. The structure we have used is based on Alexander's work (Alexander, et al., 1977), which includes: The guidelines name, we can use to describe a problem in the collaborative learning process, its solutions, and consequences. The problem, which describes when to apply the guidelines, explains the problem and its context. Sometimes the problem will include a list of conditions that must be met before it makes sense to apply the guideline. The solution, which describes the elements that make up the design, their relationships, responsibilities, and collaborations. The solution does not describe a concrete design or implementation, because a guideline is like a template that can be applied in many different situations, provides an abstract description of a problem and how a general arrangement of elements and a set of activities solves it.

3.1. Guideline for the activities

According to Johnson et al. (2004) a collaborative activity consists of a group task development with a single final objective, exchanging ideas and materials, a subdivision of tasks and group rewards. In short, students working in groups who exchange ideas, ask questions, all listen and understand the answers and help each other. For defining the CSCL activities, it is necessary to specify the group of people, the required conditions of

collaboration, the nature of the activity, the type, and the mechanisms that provide positive interdependences and coordination.

Name of the guideline: Collaborative activities.

Problem: not all the activities executed by a group can be carried out by the collaboration of the participants (Chávez & Romero, 2014).

Context: In the collaborative learning process, diverse activities are proposed so students can achieve the desired results, that is, acquire knowledge through the development of a collaborative task, with the help of a software tool that allows the interaction between the participants (George, Easton, Nunamaker, & Northcraft, 1990).

Description: In order to get collaboration, it is necessary to structure activities to achieve this objective, specifying the work that group members must do during the collaboration task (Kreijns, Kirschner, & Jochems, 2003). These activities can be designed in order to ensure true collaboration with methods that promote a collaborative learning environment using computer tools (Gallardo, Guerrero, Collazos, Pino, & Ochoa, 2003).

Solution: To plan and design the activities for the students to change from an individual perspective to a group one. That is, move the group of students from an exploration and analysis scheme to a scheme of sharing information, discussion and consensus. The activity must be designed so that the only way to solve it is through the collaboration of all the members of the group, in addition, must allow this collaboration to be promoted through the monitoring and evaluation of the activity by the teacher. Therefore, its design has to imply elements that will guarantee positive inter-dependence and good collaboration schemes. It is necessary to specify and clearly define the activity, describing its nature, type, people in charge, roles and desirable conditions of collaboration.

3.2. Role definition guideline

The roles inside the collaborative learning groups must be carefully defined, each member of the group must have roles that are interconnected and that give specific responsibilities so that the group can complete a task (George & Leroux, 2001). Teachers must assign each student complementary functions to achieve a high quality of learning (Black, Harrison, Lee, Marshall, & Wiliam, 2004).

Name of the guideline: Roles definition.

Problem: Being a member of a group is not sufficient to promote good learning interactions, there is a likelihood that some students will adopt a passive, or dominant, attitude in the group and this does not help to have a collaboration to get the objective of the collaborative activity (Collazos Ordoñez, Guerrero, Pino, & Ochoa, 2003).

Context: In CSCL activities, groups of people are associated with the functions undertaken to execute an activity, where it is necessary to consider the actions that students must take within the groups to maximize their learning, through the assignment of specific responsibilities (Collazos Ordoñez, Guerrero, Pino, & Ochoa, 2003).

Description: What needs to be done in this component is to analyze how to define or identify effective mechanisms that can help in the selection and distribution of the work teams (Malone & Crowston, 1990). The importance of the definition of roles in collaborative environments resides in that different users possess different levels of knowledge, as well as access to different information sources, where each member of the group, acquires certain knowledge about a determined domain starting from the different perspectives as the collaborative process develops (Sawhney, Verona, & Prandelli, 2005).

Solution: For the collaborative activity to be successful, it is essential to clearly define the tasks to be undertaken by each one of the members of the activity. It is necessary to define coordination policies in order to provide different interface mechanisms to each type of user for effective decision making, also specific awareness mechanisms must be specified for each type of actor of the activity. These mechanisms are to provide the necessary information about the development of the activity and about the performance of each member making it possible to intervene if necessary. Another important aspect that needs to be considered is the characteristics of the group that participates in the collaborative activity, for example, the size of the group, gender, and group members' differences.

3.3. Monitoring and evaluation guideline

Monitoring participants within a group activity can be very useful to identify people with low participation or groups with an unbalanced distribution of tasks (Juan, Daradoumis, Faulin, & Xhafa, 2009). This process of identification, in turn, will allow the activity coordinator to intervene when it deems appropriate and in this way to be able to improve the collaborative process; therefore, one way to assess the effectiveness of the groups is to monitor and observe the interactions among group members who work together (Dillenbourg, Baker, Blaye, & O'Malley, 1995); (Kale & Singh, 2007).

Name of the guideline: Monitoring and evaluation.

Problem: The collaborative learning work teams should keep in mind that they are part of the task, that they must reach consensus, negotiate and develop social and team skills (Carroll, Rosson, Convertino, & Ganoe, 2006). This most of the time does not happen naturally, and there is a risk that the collaborative process will not be achieved and as a result, the learning objective will not be got (Prince, 2004).

Context: In a collaborative learning process, the facilitator plays a key role in the design and execution of collaborative learning activities, is who must structure the activities and must be able to monitor the group process, in such a way that it intervenes when necessary to direct the process (De Laat, Lally, Lipponen, & Simons, 2007).

Description: The monitoring of the activity goes from defining the initial work conditions, planning the activity and their objectives, defining the conditions of success, until the definition of some strategies for increasing the collaboration (Joyce & Showers, 2002). In general, the facilitator is the one who creates interesting learning environments and activities that link the new information to the previous knowledge providing opportunities for the collaborative work and offering the apprentices a variety of real tasks. The facilitator is the person that must have the ability to determine when and how to intervene (Collazos, Guerrero, & Vergara, Aprendizaje Colaborativo: un cambio en el rol del profesor, 2001).

Solution: It is necessary to define a collaboration scheme that allows the instructor to know when and how to intervene in order to improve the collaboration process. The facilitator is responsible to define the groups and the roles, also responsible for monitoring, evaluating the group process, encouraging types of interaction that influence the individual learning, and the development of the collaborative skills like give and receive, help and obtain feedback, identify, solve conflicts and disagreements. That is why the facilitator must have access to all the shared objects in the activities of those that are participating. The type of help provided by the facilitator must not be the solution of a problem, but to provide mechanisms that encourage the creation of an ideal state of collaboration inside the groups and among groups.

3.4. Positive interdependence guideline

Positive interdependence is the heart of collaborative activities (Laal, 2013). This interdependence makes that the students worry about stimulating learning and the achievement of their peers (Brewer & Klein, 2006).

Name of the guideline: positive interdependence.

Problem: In a collaborative learning activity just putting people around the activity not imply a collaboration activity among people; it is necessary to structure the activity incorporating elements like positive interdependence (Siciliano, 2001).

Context: Positive interdependences are a fundamental aspect in the Collaborative Learning scenarios, unfortunately, there is a lack of support in order to determine the best way to include them in those kinds of scenarios.

Description: Being a member of a group is not enough to promote higher achievement; there must exist positive interdependence among all the group members (Johnson & Tjahjono, 1993). Which is the mechanism to achieve and encourage collaboration within the working groups, encouraging the group to achieve its objectives and thus maximizing individual learning, because if there isn't an interaction between the members of the group there isn't communication and therefore learning will be more difficult (Cooper, 1990).

Solution: To design activities that permit to foster different kinds of positive inter-dependencies among members of the group (Collazos, Guerrero, & Pino, 2003). High positive interdependence within a cooperative group means the group members feel personally responsible for contributing their efforts to accomplish the group goals. Johnson et. al, (Johnson & Tjahjono, 1993) define some recommended activities:

- Using only one set of materials for the group giving each member a separate job or role, giving all group members the same reward or giving each person only part of the information.

- Redirect instructor-directed questions posed by individual students back to the students' team.
- Have teams seek help from other teams before asking it to the instructor.
- Let the last team receiving help provide it to the next team requesting support.
- Let students consistently use team language in the classroom ("we" and "us" vs. "I" "me" or "mine"), among others.

3.5. Nature of the task guideline

The task characteristics define the degree of interaction that can exist among the group members (Wageman, 1995).

Name of the guideline: Nature of the task.

Problem: In a collaborative learning activity the lack of information about the objectives, the rules, and the collaboration environment can result in that a given task not be properly undertaken (Brindley, Blaschke, & Walti, 2009).

Context: In a computer-supported collaborative learning environment, the purpose of the proposed tasks must be that a group undertakes them as a collaborative effort (Laurillard, 2009).

Description: It is necessary to specify the characteristics of the collaborative activity because these define the degree of interaction that can exist among the group members (Soller, 2001). The collective development of activity requires the integration of all participants, and therefore, it is necessary that the apprentices be very aware of the steps that are needed to be followed to achieve the objectives and know their role within this process (Barkley, Cross, & Major, 2007).

Solution: When defining the nature of the task, the following aspects must be taken into consideration: (a) Period of collaboration: Specify the time interval in which the collaborative activity will occur. (b) The setting of collaboration: It is the place where collaborative activity will be held. (c) Type of activity: Specify the type of activity that will be performed by the members of the group, for example, puzzle solving, editing a newspaper, writing a letter, etc. (d) Rules: Specify the rules of the group activity, the explicit and implicit regulations, norms and conventions that constrain actions and interactions (Farnham, Chesley, McGhee, Kawal, & Landau, 2000). (e) Nature of Collaborators: Specify the types of interaction that occur. (f) Goals: There are activities performed by the group corresponding to the main goal, and others by every member of the group, thus, must encouraging everyone in the group to participate, all people should feel they are individually accountable for the success of the group. (g) Conditions of collaboration: Specify the kind of mediation.

3.6. Shared Objects guideline

Shared objects represent the space where the participants exchange information and represent an important element in CSCL scenarios (Dillenbourg & Traum, 2006).

Name of the guideline: Shared objects.

Problem: In a collaborative learning activity it is very important to understand the activities the other members of the group are performing and many times it is not considered to achieve the objectives of the collaboration (Hutchinson, 2007).

Context: Collaborative learning environments allow students to work together, sharing virtual spaces where to interact (Wheeler, 2009).

Description: Shared objects represent the space where the participants exchange information (Dourish & Bellotti, 1992). That is why collaborative learning environments must provide the means to facilitate the necessary information for effective decision making (Kanuka, 2007). Awareness is a concept related to the mechanisms that guarantee that people can understand or be aware of the process itself and of the interaction among all the participants of a given activity (Gutwin & Greenberg, 2002).

Solution: It is necessary to provide a representation of the group members within the working space, so all the group can have the following information: Where are the other members of the group? What are the other members doing to complete the task? What have the other members do? What will the other members do to solve the task? This representation can be graphic, an icon or through elements of virtual reality.

3.7. Coordination guideline

In a collaborative setting, it is important to define mechanisms to organize the work that must be performed by the group members (Benson, 2009).

Name of the guideline: Coordination.

Problem: In collaborative learning environments, that have an educational objective, coordination must serve as the help to define the types of work, allowing all members to have access to the shared knowledge or carry out the collaborative activities (Kreijns, Kirschner, & Jochems, 2003).

Context: Coordination is a term used to describe several actions or mechanisms available in a shared environment, whose objective is to manage the interdependence among the participants (Malone & Crowston, 1990).

Description: Coordination is related to the support, the definition and the execution of the group and individual tasks. In executing the tasks, assistance is required not only in terms of instruments but also regarding information and concepts (Farnham, Chesley, McGhee, Kawal, & Landau, 2000).

Solution: The environment must allow the establishment of rules of cooperation and of procedures among the individuals, guaranteeing that all participants share the knowledge or are committed to the task. The environment must help the participants in the sense that to develop a task also implies to acquire, share or work in the construction of some type of knowledge. Guidelines must be provided that serve as help mechanisms; analyzing and interpreting actions, messages and all kinds of situations with the idea of providing the necessary information (Johnson D. , 1991).

3.8. Integration guideline

In the collaborative setting, it is important to define mechanisms to provide cohesiveness aspects to the work performed by group members (Van den Bossche, Gijselaers, Segers, & Kirschner, 2006).

Name of the guideline: Integration.

Problem: In collaborative learning environments non-integrated groups do not fully reach their objectives (Schreurs, et al., 2014).

Context: The means used by the individuals to integrate into a group will characterize their relationship (Crown & Rosse, 1995).

Description: Integration can be measured by the degree of cohesion to operate in a coordinated way (Gully, Devine, & Whitney, 1995). The first step for the integration and establishment of common goals is a mutual understanding among all group members (Chow & Chan, 2008). An integrated group is one in which its members are committed to work and feel responsible for the group (Benson, 2009).

Solution: To provide mechanisms that facilitate understanding of the group's objectives and the means to keep participants of the collaborative activity informed of the objectives and responsibilities of each activity.

3.9. Conflicts and making-decisions guideline

Conflicts are very important in CSCL scenarios in order to assimilate the shared knowledge within a group (Buder & Bodemer, 2008).

Name of the guideline: Conflicts and making decisions.

Problem: In the context of collaborative learning environments, negotiation is an auxiliary mechanism related to the coordination that forces apprentices to make decisions about the execution of some tasks, forcing them to elaborate a solution for a proposed problem, thus promoting learning (Bono & Melo-Pfeifer, 2011).

Context: During the collaborative learning sessions, conflicts may arise among the group members, creating problems in the execution of the tasks (Burnett, 1991).

Description: Negotiating implies discussing and deciding. In this type of interaction, people express their opinion and allow others to accept it. This process implies several cognitive mechanisms such as inference, logic, deduction, etc. (Bono & Melo-Pfeifer, 2011). The decision-making requires defining and analyzing different alternative solutions proposed, identifying several possible alternatives for the execution of a collaborative work (Van den Bossche, Gijselaers, Segers, & Kirschner, 2006).

Solution: The model must be flexible to allow negotiating mechanisms where the participants can communicate and participate in the making of decisions. It is necessary to define mechanisms to support communication among members of the group, such as chat boxes, messages boxes, etc. It is important to define mechanisms

where students can understand what they have heard, read and to express themselves in relevant tasks. The negotiation is an essential component of collaboration, through the negotiation of knowledge, a group of knowledge workers or collaborative apprentices determine what knowledge they must build and accept as a group. The idea is to define scenarios, where members of the group have the same opportunities to participate in order to solve the problematic situation. The complexity of the activities must be designed in a way that the work performed by every member of the group at least must be the same.

3.10. Evaluation guideline

The evaluation must function as an instrument that gives the possibility to the teacher to analyze in a critical way the collaborative activity (Baylor & Ritchie, 2002). Also, must provide the possibility to detect the main weakness of a certain group, in order to define some mechanisms to support them (Barkley, Cross, & Major, 2007).

Name of the guideline: Evaluation.

Problem: There are a growing number of experiences in qualitative evaluation in CSCL environments (Wasson , Guribye, & Mørch, 2000). However, there are some open-end questions regarding its application. The first one is the high cost that these methods imply. Additionally, it has become necessary to adapt qualitative methods to new space-time situations and interactive ways that appear while using CSCL environments (Martínez, Dimitriadis, & De la Fuente, 2003).

Context: Evaluation in collaborative learning involves several actions organized with the purpose of obtaining information about the knowledge acquired by the apprentices (Siciliano, 2001).

Solution: The mechanisms that allow the recording of all the activities should be provided so that they can be reconstructed after an in-depth analysis of messages, actions and all kinds of events that have occurred. Besides, the collaborative applications need to provide with a way to visualize the information due to different points of view that can be had of the same data by different kinds of users. The teacher can determine what kind of data he needs to evaluate an aspect. This meta-object should have certain features or information such as date of creation of the object, the name of the examiner, the name of participants, addressee, the sender of messages, the text of the shared message, time of the delivery, and actions carried out indicating which object performed a particular event.

3.11. Process Outcome guideline

A collaborative learning process is typically composed of several tasks that must be developed by the cognitive mediator or facilitator and it is necessary to analyze the final result (Collazos Ordoñez, et al., 2007).

Name of the guideline: Process Outcome.

Problem: In a collaborative activity a series of steps occur in order to reach the final goal and isn't an easy job to identify if the objective was achieved (Palloff & Pratt, 2010).

Context: In order to understand the collaborative process, it is necessary to define, show and evaluate it (Guerrero, Alarcón, Collazos, Pino, & Fuller, 2000); (Benson, 2009).

Description: A cooperative learning process is typically composed of several tasks that must be developed by the facilitator, and by the group of apprentices. In order to evaluate the cooperative learning process, we divide it into three phases according to its temporal execution: pre-process, in-process and post-process (Collazos Ordoñez, et al., 2007). Thus, pre-process tasks are mainly coordination and strategy definition activities and post-process tasks are mainly work evaluation activities. Both phases will be accomplished entirely by the facilitator. The group members will perform the tasks concerning the in-process phase. It is here where the interactions of cooperative work processes take place.

Solution: A group of indicators has been defined that allow the collaborative process evaluation (Collazos Ordoñez, et al., 2007). These indicators are the following: (a) Applying Strategies: Capture the ability of the group members to generate, communicate and consistently apply a strategy to jointly solve the problem; (b) Intra-group Cooperation: The application of collaborative strategies previously defined during the process of group work; (c) Success criteria review: Measures the degree of involvement of the group members in reviewing boundaries, guidelines and roles during the group activity; (d) Monitoring: Is a regulatory activity, where oversee if the group maintains the chosen strategies to solve the problem, keeping focused on the goals and the success criteria; (e) Performance: Measures the quality of the proposed solution in terms of Quality, Time and Work. That is why it is necessary to provide with as many elements and needed information as possible to enable the accurate evaluation of the collaborative process, based on the indicators mentioned above.

3.12. Feedback guideline

All the collaborative activities require receiving information about the work performed (Gutwin & Greenberg, 2002).

Name of the guideline: Feedback.

Problem: In a collaborative activity it is necessary to define a mechanism that permits to understand the activities performed and have information of errors committed so as not to make them again (Brindley, Blaschke, & Walti, 2009).

Context: In a collaborative learning environment the feedback that is given is essential for the success of collaborative activity (Joyce & Showers, 2002).

Description: Feedback allows one to identify the weak points of each group with the intention to improve them (Juwah, et al., 2004).

Solution: Once the collaborative process analysis has been done, the environment should provide the information needed about the weak points of the group. When applied correctly, the feedback encourages the student's interest to take constructive measures to improve their performance. To give feedback according to Johnson et al. (Johnson, Johnson, & Karl A., 1998) the teacher should: Focus the feedback on the students' behaviors (not on their personality traits), give descriptive feedback (not judge), give feedback immediately (do not delay), focus on positive actions, present feedback visual (by means of a graph or diagram) and orally. Consequently, it is necessary: the participation of the teacher during the collaborative learning process and the inclusion of a strategy that generates conflicts among members of the group (Munneke, Andriessen, Kanselaar, & Kirschner, 2007).

3.13. The relationship among guidelines

For the construction of a collaborative learning process that has the desired benefits, it is necessary to define a collaboration scheme that allows an active participation of the students within a collaborative learning activity, besides, several important aspects must be analyze and certain guidelines that should not be isolated,, since the union of them will allow having the true collaboration and the desired learning to the activity participants, that is why we show an existent relation among the presented methodological guidelines, for that all be taken into account and in this way full and efficient collaborative activities can be carried out.

The Fig. 1 depicts the model of the guidelines catalog presenting the relationship among different guidelines we have proposed.

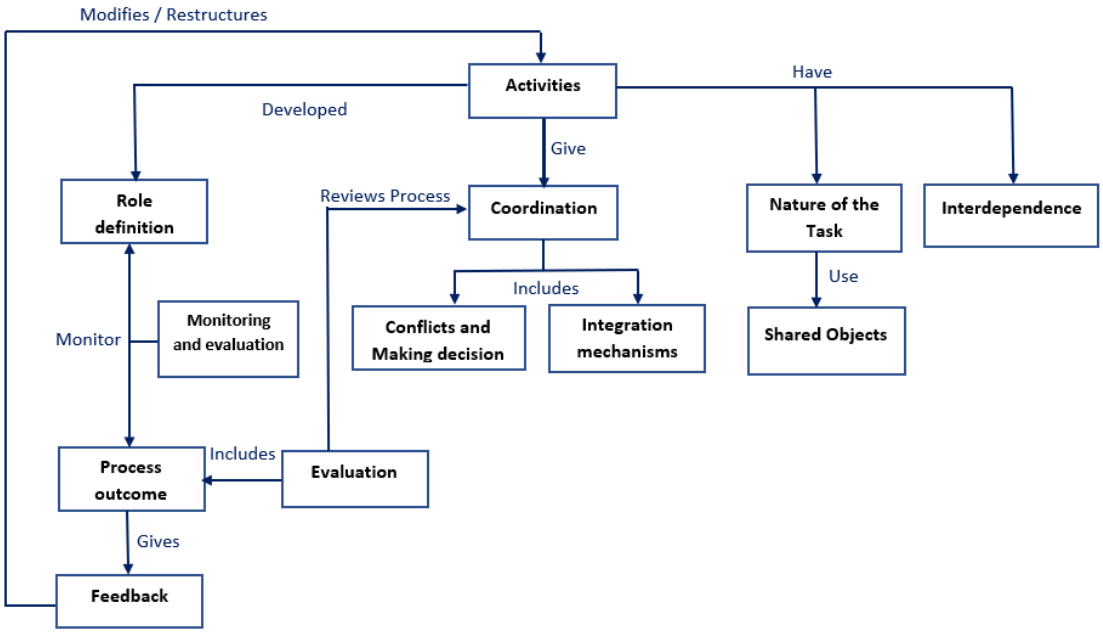

Fig. 1. The relation of the methodological guidelines catalog that supports the computer supported collaborative learning.

The idea of associating the above guidelines is to seek that the collaborative activities obtain better results of collaboration, and, the subsequent activities can reuse certain designed elements, be more flexible and their customization is easier.

4. Application of the methodological guidelines catalog through a case study

Initially, in order to verify that the catalog proposed was adequate and complete, an evaluation was made by experts where they were requested that each guideline is given a score: 1 - 5 considering the relevance and completeness that each one of them (1 is little relevant and 5 highly relevant, in the same way, 1 is not complete and 5 highly complete). In addition, it was requested that for each guideline suggestions or appreciations be given. With the results obtained by the experts, the arithmetic calculation of these values is applied, those guidelines that have an inferior value to those defined in the limits, they were discarded in the final proposal of this work.

In order to analyze, compare and draw conclusions about the data obtained in the surveys, the Arithmetic Mean (X) is applied, and by means of the following expression, the values obtained from the qualification given by the experts are averaged for each of the guidelines proposed.

$$X = \frac{\sum_{i=1}^{n} Xi.Fi}{N}$$

Where,
It is the middle point of the class
Class frequency
Product of the midpoint and frequency
= Number of sample data

Table 1 shows the results of the surveys made to the experts and calculates the value of the average for each of the recommendations. Each expert has been represented with the symbol E and has been listed from 1 to 5, and R for the value of the relevance and C for the value of the completeness.

Guideline	E1		E2		E3		E4		E5		X - Relevance	X – Completeness
	R	C	R	C	R	C	R	C	R	C		
Activities	5	3	5	4	3	4	3	5	4	4	4.3	4.1
Role definition	5	3	5	4	5	4	4	5	3	5	4.5	4.2
Monitoring and evaluation	4	2	5	2	5	4	3	4	4	4	4.3	3.9
Positive interdependence	5	3	4	4	5	4	4	3	4	3	4.4	4
Nature of the Task	5	2	4	2	5	3	4	5	5	4	4.5	3.9
Shared objects	4	3	5	4	5	5	5	2	4	3	4.5	4.1
Coordination	4	2	5	3	5	2	4	3	2	2	4.1	3.5
Integration	4	3	5	4	5	4	4	4	2	5	4.2	4.6
Conflicts and making-decisions	5	3	5	4	5	4	4	5	3	3	4.4	4.1
Evaluation	5	4	5	4	5	5	4	5	3	5	4.1	4.6
Process Outcome	4	4	5	5	4	5	3	4	2	4	3.9	4.5
Feedback	5	2	5	3	4	3	4	4	5	3	4.6	4.1

Table 1. Average of recommendations.

Under the criterion of Statistical Fashion (Sf), can find the value that has the highest frequency in the distribution of data, and thus define the threshold with which it is statistically determined which recommendations

remain in the new version of the catalog and which are not will include. The arithmetic expression that defines fashion is:

$$Sf = Li + \frac{F_i - F_{i-1}}{(F_i - F_{i-1}) + (F_i - F_{i+1})} \cdot \alpha_i$$

It is the lower limit of the modal class.
It is the absolute frequency of the modal class.
It is the absolute frequency immediately below the modal class.
It is the absolute frequency immediately following the modal class.
It is the amplitude of the class.

With the values presented, the threshold value 3.72 is defined. Guidelines that have a value lower than this, are not considered to be included in the new version of the catalog. With this defined value, we can see that all the guidelines are taken into account according to defined by the experts, some of them were required to be completed and improved according to the recommendations given, the catalog that is shown in this article contains all the improved guidelines.

We can also determine with the results of the experts that the catalog presented is complete and is relevant to computer-supported collaborative learning.

4.1. Case study

According to the catalog that was shown above, a collaborative activity was design, where the catalog was applied allowed to support the teacher in the collaborative learning process. The objective was to validate the catalog. Therefore, the question for this case study is: Does the methodological guidelines catalog is useful, applicable and easy to use, in collaborative activity?

The catalog was applied in the activity CCuento called, helps a group to collaboratively write stories. Four participants work four stories at the same time.

Activities: The goal of this game was to write a story in a collaborative manner.

Group of Apprentices: This game was played by four persons selected in a random way.

Facilitator: There was a person who oversees the activity design and was responsible for the monitoring and evaluation of the activity.

Apprentice: Four participants worked four stories at the same time. Each story had four phases: introduction, body A, body B, and conclusion. Each member had to write a different section of every story. In the first stage, every participant wrote the introduction of one of the stories.

4.2. Metrics and indicators of the case study

The indicators detailed description and its metrics are the following:

- Utility: The utility is defined as the property by which the catalog achieves the improvement objectives for the collaborative and support the collaborative learning processes. The metrics that have been established to calculate the utility are:
- The range of students who approve the activity must be between 80% and 100%. Grades are assigned to groups that complete the task adequately, grades of 3 or higher, mean the approval.
- The percentage of the number of questions that have a positive impact obtained from the perception of the teacher between level four and five (five being the highest degree of utility) must be greater than or equal to 80%.

Applicability: Applicability is defined as the property by which catalog can be easily employed to obtain favorable improvement objectives for the collaborative and support the collaborative learning processes. The metrics that have been established to determine the applicability are:

- The answers average about applicability obtained from the teacher perception must be greater than or equal to 80%. With values between four and five, where five is the highest degree of applicability.
- The effort to applying the catalog be on average, by collaborative activity about 4 to 5 hours.

Ease of use: Ease of use is defined as the degree of ease with which a person can understand and apply the catalog. The metrics that have been established to determine the ease of use are:

- The average from the teacher perception of ease of use obtained that is between 1 and 5 (5 being the highest degree of ease of use) must be greater than or equal to 80%.
- The number of explanation questions for using that the teacher made to the formulator of the catalog to apply the elements should be below 3 questions per hour.

4.3. Results

As a result of the case study execute, we obtain the following values for the indicators defined:

Utility:

- The percentage of the students who approved the activity before the apply the catalog in the activity was 70.8%, while after the application of the catalog the percentage was 88.2%. Bearing in mind, that the activity carried out before the catalog and afterward was the same, to compare the obtained grades.
- 80% of the questions answered by the teacher determine that the catalog is at a high level of positive impact on the activity.

Applicability:

- The teacher perception regarding the applicability of the catalog is 85%.
- The effort involved in the application was on average 6 hours per person.

Ease of use:

- The perception of the teacher with the ease of use was in 20%.
- The number of explanation questions by the teacher per hour was 2.

4.4. Discussion

In summary, the results show that the application of the methodological guidelines catalog is simple; the terminology used is very close to the teaching environment, considering the perception of the teacher. The results also show that these guidelines are useful to increase the student's good performance in the collaborative learning process. From the teacher perspective, it is possible to classify the catalog as useful taking into consideration the positive impact that was generated on the activity performed, and the positive impact that generates its use to guide collaborative activity definition and execution. Regarding the level of applicability, the results specify that catalog is not classified as applicable because it requires a lot of information to follow each of the activities and their specifications and consequently the time to use it is very high, however, despite the time, according to the teacher's perception, it is applicable for its good results. Likewise, from the perspective of the teacher, the catalog is easy to use, and according to the number of questions it asks for its application, they show that it is simple and allows a collaboration activity to be designed without help.

5. Conclusions and further work

According to the results of the evaluation of the catalog by the experts, it was possible to obtain that, the catalog is complete and is relevant to computer-supported collaborative learning since it is necessary to know what and how to have collaborative activities that generate better collaboration results. After its application, it can be defined that the catalog is useful to achieve the goals proposed according to the teacher and for the satisfactory results obtaining a positive impact of activity execution. In addition to being applicable to the collaborative learning processes area. Although the teacher requires a considerable time amount the first time it is applied, due to

the knowledge lack of collaborative activity needs and of inexperience in its definition. The teacher doesn't need an explanation of the use of the catalog for that reason it is easy to use since it has several elements that define when and how to use each guideline.

Several conditions regarding group work have been investigated, such as its composition, individual pre-requisites, characteristics of the task at hand, and the context of collaboration. However, it has been analyzed in this research that these conditions do not have simple effects on learning results, but rather interact with others in complex ways. It is necessary to pay special attention to these interaction aspects –i.e., to carefully observe the collaborative activity. Thus, it is important not only to consider the design of the structure of the collaborative environment and the sum of activities that define the collaborative task but also to understand the process of collaboration that takes place when developing a collaborative activity. On the other hand, one of the most important aspects of evaluating a collaborative learning process is defining clear criteria for evaluating such process. An improvement in the collaboration process should provide higher quality about the learned knowledge. Based on this premise, this paper presents a methodological guidelines catalog that include elements related to the collaborative learning improvement and the way to relate them among themselves to obtain better results, increasing collaboration, allowing the monitoring of the process by the facilitator to achieve the proposed objectives and other actions and elements to consider when performing a collaborative activity.

As future work is necessary to execute more case studies in order to refine the catalog and in this way improve the collaborative learning process in order aspects, considering the teacher and student roles.

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