

COLLABORATIVE CREATIVITY PROCESSES IN A WIKI: A STUDY IN SECONDARY EDUCATION

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ABSTRACT

This paper explores how wiki may be used to support secondary education students' collaborative creativity processes and how such interaction can promote critical and creativity thinking. A science case-based project in which 81 secondary students participated was designed, implemented and evaluated. Students worked in the science wiki project during two weeks. We scaffold students to be collaboratively engaged in purposeful critical and creative discourse in order to solve collectively science challenges and construct meaning about topics related to environmental challenges.

Through the analyses of students' contributions in the wiki we have characterized collaborative creativity processes in science inquiry that includes performance (processes to develop a novel way of approaching and understanding the problem) and collaboration (peer collaboration, dialogue). The significance of the paper relays on the operationalization of the collaborative creativity processes in the wiki within four overarching learning to learn together skills, which are: distributed leadership, mutual engagement, peer evaluation and group reflection.

Our findings showed that the wiki environment afforded the development of an effective and creative online collaborative learning community. In student's wiki contributions, the four learning to learn together skills took place. However, not all the groups displayed the four learning together skills during their collaboration in the wiki and there were differences among groups in relation to the presence and proportion of these skills. We discuss the contribution of these four learning to learn together skills for the collaborative creativity processes and the relation of the presence of the above mentioned skills with the level of creativity showed in the collaborative writing product students produced in the wiki project.

Besides, the paper discusses a series of issues that instructors should consider when wikis are incorporated into teaching and learning for creativity. We claim that embedded scaffolds to help students to argue and reason creatively in their contributions in the wiki environment are needed.

KEYWORDS

Wiki, Creativity, Collaboration, thinking skills, secondary education.

1. INTRODUCTION

Collaboration is a central tenet of the new Social Web. In Web 2.0 technologies, users are active participants who dynamically and collaboratively create new content of new solutions for common problems. In the case of wikis, this technology allows participants to create a collective document by editing, discussing, and sharing information about a topic of common interest (Wichmann & Rummel, 2013). Educational professionals are increasingly interested in understanding the conditions needed for successful collaboration in creative web 2.0 endeavors. Eteläpelto & Lahti (2008) claim that for successful collaborative creativity participants need to build on each other's ideas in order to reach an understanding that was not available to any of the participants initially. Besides, the participants need to be committed to shared goals, and have sufficient trust in each other to join in the shared endeavor. Furthermore, the participants must also enter into critical and constructive negotiation of each other's suggestions and well-grounded arguments and counter-arguments need to be shared and critically evaluated through collective talk. In this paper, we claim that all of these processes included in collaborative processes can be developed using purposely wiki technology.

Thus, for understanding creativity in collaboration we need to study the dynamic processes of co-construction. Some researchers claim that this understanding requires qualitative studies which focus on the group processes, group dialog characteristics and how common work unfolds over time. Our research falls down in this line of research by analyzing the mechanisms students develop to solve creatively and

collaboratively an environmental problem in a wiki. The main aim of our study is characterize the features of the learning to learn together skills student develop during wiki-supported group work and that are capable to support collaborative creativity in a wiki community.

2. UNDERSTANDING COLLABORATIVE CREATIVITY

In the context of knowledge and technological age, most knowledge creation is conducted by teams working with and around technology. In these learning situations the development of learning to learn together skills (for hence, L2L2) to solve a problem collaboratively and creatively are crucial. This paper will focus on understanding the mechanisms that can trigger creativity in collaborative endeavors. We will study some collaborative creativity mechanisms in the context of solving a social and complex science problem using a web 2.0, a wiki.

Recent educational research has pointed out the difficulties to define creativity, and empirical researchers have employed different operationalization of the term, conceptions of creativity usually agree that creativity means novelty and socially valued (John-Steiner, 2000; Sawyer, 2003).

Sawyer, a leading creativity researcher exemplifies collaborative creativity by a jazz performance which requires an entire jazz ensemble; performance emerges from the interactions of four individuals working collaboratively. Group's creativity is greater than the sum of its parts and to understand group creativity, we have to focus on the processes of collaboration among members (Sawyer, 2012). This author claims that to understand collaborative creativity research is needed form the "process approach" or "mechanism approach". This approach with qualitative research approach examines the group processes, group dialog characteristics and how common work unfolds over time. Our research falls down in this line of research by analyzing the mechanisms students develop to solve creatively and collaboratively an environmental problem in a wiki. Different researchers have already paid attention to some mechanisms that might promote collaborative creativity, next we revise some important studies for our research purposes.

In a learning group discussion to solve a community problem, novelty means that new and alternative ideas are suggested in respect of the problem at hand. Nevertheless, the novelty of the idea alone is not sufficient for collaborative creativity; in addition the novel idea must be in some way reasonable and sensible in the situation concerned. This means that to be creative an idea must be socially appropriate and thus be recognized as socially valuable in some way (Sawyer, 2004; Sternberg, 2003).

Furthermore, Eteläpelto and Lahti (2008:227) suggests that in a peer-group learning community neither the emerging problems nor their solutions are known in advance, but the group needs to work together in order to define the problems and find solutions to them. Thus, creativity in collaboration can be understood to emerge within dynamic processes of co-construction; these will produce novel – and appropriate – ideas regarding the problems faced in collective learning endeavors.

Wegerif et al (2010) in a research in which a dialogic perspective of analyzing creative thinking in online dialogues was adopted; claims that the creative process in a collaborative learning situation depends more on a tension between different perspectives rather than a shared framework. Thus, creative thinking emerge when further entails opposing ideas and disagreements being thoroughly discussed, in such a way that differing opinions and conceptions are related to each other. In such a process of collective learning an elaborated understanding of the learning topic can emerge.

The communicative and social dimension of collaborative creativity is also highlighted by Sonnenburg (2004) theoretical framework for creating in collaboration. Participants have to be mutually engaged in the process of communication during the collaborative resolution of a task and they have to present a working style distinguished by a serious of dispositions that can favor the emergence of creativity in collaboration. This author highlights an open and free communication in which all collaborators have the same chance to contribute to the course of performance, and the same right that his contributions are taken seriously. Mutual trust and risk-taking are other key dispositions in collaborative creativity.

Taking into account previous arguments and research in the topic of collaborative creativity we argue that the reality of Internet mediated learning and creativity implies to develop learning how to learn together (L2L2) with others and this type of learning combines the dimension of task management with the dimension of social relationships. Learning to learn together is a complex competence requiring that all the group members are able to coordinate, regulate and plan the learning task, balancing issues of individual ability,

motivation and expectations through constant dialogue. From this point of view, one main issue is how to support our students to create and be engaged in powerful, critical and reflective dialogues using web 2.0 technologies that help them to co-construct new knowledge and create novel solutions to relevant social problems through online interaction with others.

3. WIKI AFFORDANCES TO PROMOTE COLLABORATIVE CREATIVITY PROCESSES

Wikis are collaborative and participatory tools. Researchers have already described the broad range of potential pedagogical applications for wikis (Lund and Smordal, 2006).

Wikis have three major functions to facilitate collaborative creativity processes:

(a) Editing function that supports multiple users to create a common text in which dynamic and creativity processes of co-construction the common text may appear.

(b) History function that records all edits, by means of color coding, allowing users to trace all revisions being made. The history log enables edits to be traced to the users.

(c) Discussion page that enables asynchronous written communication between users by providing explanations and posting comments on various issues related to the common text. In our study, we have designed a pedagogy model to reinforce the use of wiki functions to promote collaborative creativity processes. Thus, the discussion page has been emphasized as a dialogic space in which students should propose new ideas, new and different perspectives to face the science problem they should solve together. In the discussion page, students were encouraged to argue and reflect their thoughts.

Although the features mentioned above are characteristics of wiki design that may enhance the collaborative processes, it remains unclear which pedagogical approach contributes most to successful collaborative learning processes using wikis. Besides, there are still relatively few studies on the use of wikis to promote collaborative creativity processes in secondary education.

In this paper we claim that participation in a wiki for enhancing creativity and collaborative activity requires that participants develop learning to learn together skills that combine task management with peer-group learning skills. To support this claim, we designed, implemented and evaluated a science project in which secondary students used a wiki environment, with the specific aim of establishing and supporting collaborative creativity interaction, while engaging in a collaborative writing task. The aim of our research study is characterize the features of these learning to learn together skills capable to support collaborative creativity in a wiki community.

With our study, we hope to contribute to the discussion about the pedagogical parameters that need to be considered in the design of Web 2.0 supported collaborative learning environments in Secondary Education, in order to support students to open up, widen and deepen dialogic spaces for thinking and creating new solution together, in the new global communication era.

4. OBJECTIVES AND RESEARCH QUESTIONS

In this study we aim to operationalize creative collaboration in a wiki taking into consideration the aspects of collaboration that combines the dimension of task management with the dimension of social relationships. These aspects have been included in the next four overarching learning to learn together skills:

a) Mutual engagement

Mutual engagement ensures the coherence of a community over time and is an essential component of any practice. Shared object, artefacts or content provide a rich repertoire of referential anchors for mutual engagement and understanding.

In our wiki project, the next four features are included in this skill: i) joint attention to the ideas and contents written in the wiki common text; ii) mutual and shared participation with the ideas proposed in the wiki text; iii) shared opinions and iv) explicit support (see Figure 1).

Our pedagogical model emphasizes the use of the discussion page of the wiki as a dialogic space in which students propose, argue and make explicit new ideas and perspectives. For this end, students

were taught in the use of specific thinking together language and values in order to make more feasible that creative thinking could emerge.

b) Distributed leadership

We view leadership as a reciprocal social process instead of the property of an individual, leadership responsibilities are shared within the group, and there may be no sharp boundary between leaders and followers. All students should be able to constantly negotiate the distribution of leadership according to situational and social change. This awareness of distributed leadership around particular topics breaks down dominating coalitions, hierarchical relationships, social exclusion and isolation.

In our wiki project, the next three features are included in this skill: i) students' explicitly taken responsibility of some aspects of problem solving ii) explicit organization of group work and iii) role distribution (see Figure 1)

c) Peer assessment

Evaluation of the ideas and contents proposes by their peers and the products proposed by the different members of the group. Our pedagogical model emphasizes the use of the discussion page of the wiki as a dialogic space in which opinion and evaluation of others' ideas should emerge. For this end, students were taught in the use of specific thinking together language and values in order to give students' support to give opinion and evaluation to others' ideas both in the discussion and in the editing pages of the wiki.

In our wiki project, the next two features are included in the peer assessment skill: i) make explicit individual differences in terms of different points of view, contradictions about how to solve the science problem; and ii) evaluation of the product or the solution (or partial solution) of the problem.

d) Group reflection

As a shared object, a representation of a group learning process constantly evolves and students' shared understanding of the object can be considered as a process of knowing. To make this process of knowing explicit to the group, we identified three distinctive orientations for group reflection in the wiki project:

i) Reflecting on problem solving processes; ii) Reflecting on learning atmosphere, emerging roles, norms and gaps between individual and collective outcomes; and iii) group regulation processes (see Figure 1)

The Figure 1 present the representative features of each skill and short example extracted from students' collaboration in the wiki

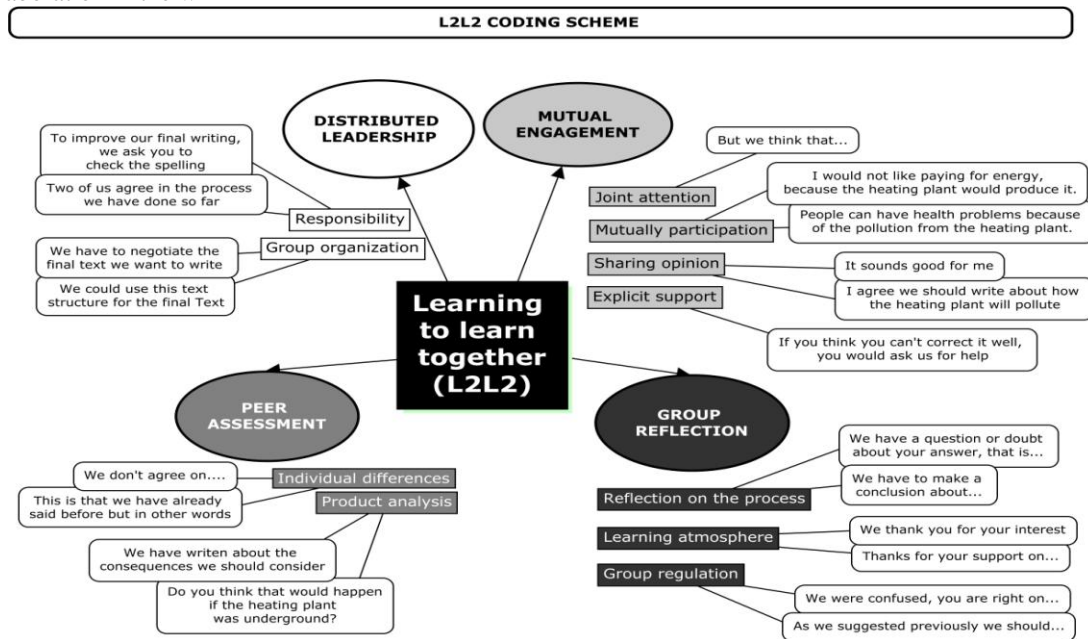


Figure 1. Features of collaborative creativity skills

4.1 Research Questions

The research questions of the study can be specified as follows:

1. What features of students' collaboration in a wiki can be operationalized as:
 - a) Mutual engagement
 - b) Distributed leadership
 - c) Peer assessment
 - d) Group reflection
2. Can we find a relationship between the presence of the four L2L2 and the collaborate creativity solution of the science problem and showed in the collaborative writing product students produced in the wiki project?

4.2 Method

A case study was designed in which eighty-one secondary students participated in this study (13-14 years old). Students worked together in pairs and in groups of 6 students, first at a computer-based science task (Webquest). The wiki environment was used to create a joint informative text about the science topic, together with two other pairs.

4.2.1 The Task

The students participated in a science project, spanning 8 one-hour lessons, which were divided into three different phases with distinctive learning objectives. The first phase was two-hour lessons with the specific aim to prepare students to collaborate in the wiki environment and to enhance their collaboration process using a "Thinking Together" approach (Dawes, Mercer & Wegerif, 2000). Students were taught to improve their discussions in the wiki by using sentence openers as a scaffold to enrich and diverse students' contributions in the wiki. Students were taught about five kinds of openers: 1) giving information (e.g., in my opinion); 2) asking for someone else's point of view (e.g. What do you think about; could you give an example) 3) expressing disagreement (e.g., I do not agree with; because); 4) expressing agreement (e.g., I agree with; because) 5) give reasons and summaries the discussions (e.g., to synthesize; we think; so).

In the second phase, during the next three class sessions, students researched the topic they would write about later, i.e., environmental issues about the construction of a heating plant next to your city. Working in pairs, the students undertook a web-based inquiry activity, which was a new topic for them. In the activity, students had to search, select, integrate and argue about different types of information on the web about heating plant. At the end of this stage, each pair wrote an initial propositional text in which they had to present their ideas about pros and cons of construction a heating plant next to their city.

In the third phase of the project, three pairs of students were grouped together in the wiki environment in order to write a collaborative text about students' arguments in favor or against the construction a heating plant next to their city.

4.2.2 Data Collection and Analysis

In order to inform about our first research question – what features of students' collaboration in a wiki can be operationalized as: mutual engagement, distributed leadership, peer assessment and group reflection- we carried out detailed content analyses of the students' contributions in the wiki. A coding scheme was used to characterize students' contributions. The coding scheme is presented in Figure 1.

This coding scheme has been built by revising the educational research made in the area of individual meta-learning promoted by computer-supported collaborative learning (e.g. James, 2006) and the revision of research studies in which enabling and scaffolding group work supported by technology can promote learning processes where students move from an individual process to a process where students can support each other's intellectual engagement by sharing knowledge, learning through interaction and co-construction knowledge (e.g. Stahl, Koschmann & Suthers, 2006; Scardamalia & Bereiter, 2006)

The coding process consisted of two steps: a) dividing the wiki contribution into meaningful units, and b) assigning a code to each unit. We decided to segment the notes into units of meaning by using semantic features such as ideas, argument chains, and discussion topics, or by regulating activities such as making a

plan, asking for an explanation, or explaining unclear information. Validity and reliability aspects were considered in the study.

In order to inform our second research question - can we find a relationship between the presence of the four L2L2 and the collaborative creativity solution of the science problem and showed in the collaborative writing product students produced in the wiki project?, a rubric for creative writing texts was elaborated.

Two investigators used the rubric to rate 25% of the texts and after solving minor disagreements, the rubric was finally created.

In order to determine the level of creativity showed in the collaborative text, the proposed rubric contains 4 different levels marked from 1 to 4. The 4 levels are described below:

- First level, "listing information". Texts in which students do not solve the problem or contribute anything new, do not come to a conclusion, do not define whether they are for or against and offer no solution. They just made a list / text with factual information about the problem.

- Second level, "Divergence Processes". In these texts students take into account others' information about the problem. Besides students present and discuss different points of view, however students do not reach a conclusion or provide a solution for the problem.

- Third level, "Convergence Process". Texts in which students besides to present and discuss about each other's point of view, students converge in a conclusion and solution for the problem..

- Fourth level, "Creative solutions", in these texts besides the presentation of divergence and convergence processes, students present a brand new, original and realistic solution for the problem. Students reach this creative solution consulting and developing new information or new ideas.

4.2.3 Results and Discussion

The preliminary results of our study are presented in Table 1. Our findings showed that the wiki environment afforded the development of an effective and creative online collaborative learning community. Students write an average of 10 contribution per group and were actively engaged in discussing and writing the common text.

Besides, eleven out of the fifteen groups presented the four overarching learning to learn together skills proposed in our study, which are: distributed leadership, mutual engagement, peer evaluation and group reflection. Therefore, we can conclude that the proposed characterization of collaborative creativity processes may be useful for understanding how a group orchestrates their collaboration processes in order to find a novel solution for a science problem.

Table 1. Results in the different variables studied in the research

Group	Number of wiki contributions	Numbers of meaningful units	Creativity in the wiki collaborative text	L2L2 skills (in percentage)			
				Leadership	Engagement	Peer-assessment	Group reflection
1	10	62	4	11%	46%	22%	21%
2	5	12	3	18%	0	55%	27%
3	10	85	2	11%	50%	17%	22%
4	3	17	2	12%	65%	23%	0
5	9	72	3	20%	36%	14%	30%
6	3	19	2	5%	53%	32%	10%
7	3	33	2	6%	53%	38%	3%

8	9	28	1	Leadership Engagement	18% 19%	Peer-assessment Group reflection	56% 7%
9	7	32	3	Leadership Engagement	0 87%	Peer-assessment Group reflection	13% 0
10	8	27	0	Leadership Engagement	0 65%	Peer-assessment Group reflection	26% 9%
11	13	114	3	Leadership Engagement	13% 37%	Peer-assessment Group reflection	42% 18%
12	19	54	3	Leadership Engagement	19% 31%	Peer-assessment Group reflection	37% 13%
13	22	103	2	Leadership Engagement	15% 33%	Peer-assessment Group reflection	26% 26%
14	10	47	2	Leadership Engagement	4% 75%	Peer-assessment Group reflection	19% 2%
15	16	117	3	Leadership Engagement	27% 33%	Peer-assessment Group reflection	31% 9%

Features of the four skills are displayed in the students' wiki contributions. In table 2 an example of a wiki contribution is presented, it belongs to a contribution made in the wiki negotiation page. It can be seen how students move smoothly among the features of the four L2L2 skills. Besides, it can be seen how the wiki function that let students to share different digital objects (initial pair proposal for the text, negotiation page and writing page) in which students make their ideas and argument explicit contribute that students assess and reflect about the appropriateness of mates' ideas (lines 1, 2, 3, 4 and 5).

Moreover, students are mutually engaged in processes related to task performance (line 6) and student takes the lead to start writing a specific section of the text (line 9).

Furthermore, this student rises group reflection about the main conclusions reached by the group so far (line 3) in the wiki negotiation page and s/he launch a group reflection about a key process to follow up with finding a novelty solution for the science problem (line 4).

Table 2. Example of a wiki contribution and the features of L2L2 skills

	Students' contribution in the wiki negotiation page	L2L2 skill
1	We think that the text written by Ferran and Gerard is really good	Peer-assess
2	and their arguments are convincing and elaborated	Peer-assess
3	All of us think that the heating plant would be a benefit for our community	Group reflection
4	This idea could be used of our initial proposal text?	Group reflection
5	Besides, the text written by Marc and Pepe is also good	Peer-assess
6	because they argue that non-renewal resources pollute more than renewal resources because	Engagement
7	those only use natural resources	
8	We agree with the previous contributions	Peer-assess
9	At this point what do you think if we start writing the text in the wiki	Leadership

However, not all the groups displayed the four L2L2 skills during their collaboration in the wiki and there were differences among groups in relation to the presence and proportions of these skills. Besides, we could not find a relationship between the presence of features of the L2L2 with the quality and creativity of the final collaborative text.

Therefore, our findings suggest that there is not a direct relation between collaborative creativity processes and creative products produced by the group. Although our research objectives focused on the promotion of collaborative creativity processes in a wiki environment, we expected a positive incidence of these creative processes on the collaborative text written by the group. More detailed qualitative analyses are needed to explain these preliminary findings.

5. CONCLUSION

Our findings showed that the wiki environment afforded the development of an effective and creative online collaborative learning community. Through the analyses of students' contributions in the wiki we have characterized collaborative creativity processes in science inquiry that includes performance (processes to develop a novel way of approaching and understanding the problem) and collaboration (peer collaboration, dialogue). In student's wiki contributions, the four learning to learn together skills took place. The collaborative use of the wiki in our study promoted the creation of a collective product in which the users get the sense that they were creating a truly shared digital artefact as the product of their collaboration. In doing so, the collaborative processes developed by the students encourage them to share their perspectives, to take into account other's opinions, to reflect on other's opinions and to give a value and an assessment to other's ideas and, subsequently, create new knowledge.

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