

PRODUCTIVE DISCUSSIONS FOR ONLINE COLLABORATIVE CREATIVITY

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Abstract

Actual research shows that important creative insights typically occur in collaborative groups, and highlight some collaborative processes that can further collective creations. However, it is necessary to have a better understanding of the processes whereby innovations emerge from groups. In order to have a deeper understanding of the multiple facets of collaborative creative processes in online discussion environments, it is discussed in this work a framework to analyze discourse in function of innovation, creativity, and knowledge production. Empirical data were qualitatively analyzed according to Hymes (1974) ethnography of communication. Qualitative content analysis evidenced that creative collaborative process is transactional and intertwines the divergent and convergent thinking. Despite it involves the generation of new ideas or the recombination of known elements into something new that relies on imagination, the divergent thinking, the random and considers multiple solutions and alternatives, it also involves the convergent thinking, that depends on a systematic search for solution and multiple evaluative actions.

Keywords: Collaborative learning; Creativity, Knowledge building; Dialogic; Dialectic.

Resumo

Pesquisas atuais mostram que a criatividade tipicamente ocorre em grupos em colaboração e destacam alguns processos colaborativos que podem promover criações coletivas. Contudo, é necessário ter-se um melhor entendimento de processos grupais pelos quais inovações emergem. Neste trabalho é discutido um



framework para analisar o discurso em função da inovação, criatividade e produção do conhecimento, com o intuito de obter-se um entendimento mais aprofundado das múltiplas facetas de processos criativos e colaborativos em ambientes de discussão *online*. Dados empíricos foram qualitativamente analisados de acordo com a etnografia da comunicação de Hymes (1974). Uma análise qualitativa de conteúdo evidenciou que o processo criativo colaborativo é transacional e entrelaça os pensamentos divergente e convergente. Apesar do mesmo envolver a geração de novas idéias ou a recombinação de elementos conhecidos em algo novo baseado na imaginação, o pensamento divergente, o randômico, e considera múltiplas soluções e alternativas, ele também envolve o pensamento convergente, que depende de uma busca sistemática para uma solução e múltiplas ações avaliativas.

Palavras-chave: Aprendizagem colaborativa; Criatividade; Construção do conhecimento; Dialógico; Dialético.

Introduction

Some researchers have investigated the social and collaborative dimensions of creativity (Amabile, 1983; Sawyer & DeZutter, 2009; Farrel, 2001). They have inspected how groups innovate using situated, collaborative knowledge creation activities, and how creativity is embedded in social groups. They have shown that important creative insights typically occur in collaborative groups, and how collective creations emerge from collaboration. However, it is necessary to have a better understanding of the processes whereby innovations emerge from groups. Despite the importance of fostering people's aptitudes regarding creative thinking and inventive problem solving, this issue has remained somewhat unresolved.

Online collaborative creativity has been approached in Computer Supported Collaborative Learning (CSCL). CSCL discusses the challenges of scaffolding in innovation focusing on scaffolders' strategies for motivating, recognizing, and understanding group processes (Jonassen, 1997; Chen, 2010; Bereiter & Scardamalia, 2003; Stahl, 2005; Jermann & Dillembourg, 2008; Puntambekar, 2005; Yelland & Masters, 2007; Lazakidou & Retalis, 2010). These authors and many others in collaborative learning believe that talk and discussion provide an opportunity to explain own ideas and to modify beliefs or self-presentation in response to feedback to others.



They have emphasized how students build on each other's ideas to jointly construct a new understanding that none participants had prior to the encounter. The students are expected to transcend their past ideas in successful collaborations.

Discussions play a central role in CSCL. Studies have provided ample evidence that the quality of talk has strong influence on the quality of learning (Mercer & Littleton, 2007), being in agreement with a historic-cultural point of view influenced by Vygotsky (1978), which claims that through dialogue, new conceptions are collectively constructed. Within this perspective, the creation of meaning is both an interpersonal and intrapersonal process, with ways of thinking being embedded in ways of using language (Wegerif & Mercer, 2006).

In CSCL, knowledge is seen to be a construction of participant's online discourse. However, there are significant differences between a discussion that promotes knowledge creation and a simple discussion. The discussion must be productive. For example, collaborative effort can help learning performance by means of testing arguments, and using other's reasoning to help move a person toward new perspectives and higher levels of thinking. The effective support for learning dialogues at a distance is one of the promises of electronic networks that has not yet been realized. There have been many studies on online collaborative learning but these show that the default remains unproductive and superficial conversation.

In collaborative learning, learners should transcend their past experiences and not merely demonstrate knowledge but rather put themselves in a position to extend their knowledge. But, the knowledge building does not occur whenever learners interact. When students engage themselves in a group discussion it is not necessarily productive. King (1999) noticed that students do not always engage themselves in high level discourse unless they are prompted to do so.

According to Koschmann (2003), the goal in CSCL is one of fostering productive argumentation in instructional settings. The teacher must therefore help the students to develop the collective ability to use dialogs for learning. Discourse must be facilitated aiming creative and innovative products. Jakobsson (2006) suggests that students in CSCL environments are not always active participants. Collaborations, which are not carefully prepared, result in superficial and unreflective products in most cases. The competence to use collaboration as a learning tool is not a quality that the participants automatically possess when they are asked to participate in online education (Amhag & Jakobsson, 2009). The ability to collaborate should be understood



as a collective competence that a group of participants must achieve when they are collectively engaged in an online course. There is evidence that working collaboratively may not be a spontaneous response to working in a group, and that teaching learners how to collaborate, and in particular how to work together to create meaning, is a part of the process of learning collaboratively which can enhance outcomes further (Nussbaum et al., 2009).

Collaborative and creative problem-solving skills involve more than just a mere application of a model. It's accompanied by associated thinking strategies and requires flexibility (Lazakidou & Retalis, 2010). Teaching thinking strategies is of prime importance to boost collaborative and creative problem-solving skills. In order to foster such skills, an important endeavor is to delineate what kind of thinking strategies should a teacher teach to students and how is an effective way to perform it.

The teacher must know creative processes underneath discourse in order to evaluate and promote productive discussions. In knowledge building discourse (Bereiter & Scardamalia, 2003), ideas, theories, hypotheses, and other similar intellectual artifacts are objects of inquiry. They are scrutinized, improved, and put to new uses as participants engage in progressive discourse. The knowledge building concept is related to the knowledge co-construction and advancement as well as the achievement of a deeper knowledge by means of discourse. But, this concept does not provide sufficient explanation for us to understand and design for collaborative knowledge creation. Scardamalia & Bereiter's characterize knowledge building as a dynamic system where ideas interacting with ideas lead the generation of new ideas. This characterization appears, to some extent, to be tautological in nature (Hakkarainen, 2009). Knowledge building theory has not fully been analyzed or taken account of the social and cultural transformations involved in knowledge advancement. Scardamalia & Bereiter's and other researches in CSCL have not fully analyzed the interactional processes that occur within groups. This failure to analyze collaborative processes is a significant lacuna in creativity research due to the fact that a wide range of empirical studies has revealed that significant creations are almost always result of complex collaborations (Sawyer & DeZutter, 2009). Thus, there is a need to expand the ways to understand creative processes underneath discourse.

By focusing on discourse processes in CSCL, it is discussed here a framework that extends the knowledge building concept with the goal of better understanding of mechanisms whereby collaboration helps students to collaboratively create knowledge.



The framework is based on John Dewey's philosophy of education, Hymes (1974) ethnography of communication as well as empirical evidence. It is provided here an example of the application of the framework in an educational situation.

Creating Knowledge in a Dialogical and Dialectical Perspective

Stahl & Hesse (2007) argue that people develop new knowledge and insights through collaboration in a learning community in which participants are involved in creating interpersonal meaning. The asynchronous and synchronous dialogues are a conversation in which participants are mutually dependent on each other since those who write and those who read are co-authors and shareholders in a common negotiation to develop meaning and understanding (Amhag & Jakobson, 2009). The most creative collaborative situation is characterized by complementarities in participants' talk and by inclusive utilization of each other's view (Eteläpelto & Lahti, 2008).

Wegerif (2007) proposes a dialogical perspective for education with technology. In this view, the focus of attention is away from abstract structures of thinking and towards the way people respond to each other in dialogues. This author proposes a more inclusive and flexible concept of reflective dialogue that can support both critical and creative reasoning. The dialogic approach to learning emphasizes that the main mechanism for learning is taking the perspective of another in a dialogue. It also suggests that induction into dialogue is a way of teaching general thinking skills such as creativity and learning to learn (Wegerif, 2005).

Here, it is evoked Dewey's notion of transactional inquiry to elaborate the knowledge building concept in a dialogical and dialectical way. Dewey (1938) defined inquiry as a set of operations by which an indeterminate situation is rendered determinate. When participants engage in inquiry together, new meanings are created as a co-production. For Dewey (1929), the term transaction emphasizes the transformative aspects of interaction. A mutual exchange is a transaction whenever a response to another's act involves contemporaneous response to a thing as entering into other's behavior, and this upon both sides. Dewey & Bentley (1949), stipulate that the transactional perspective concerns how behaviors are improvised, emergent, and dynamic within a developing situation, which is affected by the person's manipulative probes and tentative actions, expanding the interactional perspective.

Based on Dewey's ideas, it is described here a knowledge building cycle with



the aim to understand knowledge creation under a dialectical and dialogical viewpoint. The cycle that depicts how knowledge evolves is described following:

1. *Joint and individual concrete and symbolic experience implies reflections, thinking in action occurs.*
2. *Reflections cause interpretations and re-interpretations, resuming a transaction.*
3. *Interpretations and re-interpretations can involve uncertainty or clear interpretations at individual level, as well as, divergence of opinions or intersubjectivity at group level.*
4. *Both uncertainty and divergence of opinions make continuity in transaction, the cycle is restarted.*

Dewey's transactional view of inquiry is related to reflective dialogues, in which thinking does not represent something mechanic, but something creative. According to Wegerif (2007), Dewey's transactional view of inquiry is dialogical due to the fact that the student's reasoning operates on the reasoning of another student. Dewey's transactional view of inquiry is also dialectic, because knowledge is multi-layered, socially negotiated, continuously subject to re-evaluations, and involves situations, where problems are controversial and evoke dialectical aspects of reasoning. In this work, it is considered that dialectical thinking is mainly characterized by changes and looks for contradictions inside a problem and possible solutions as the main guide.

Aiming to complement the knowledge building cycle, it is considered in this work a framework that embraces the notion of transactional inquiry and proposes a refinement of the concept of reflection in cognitive abilities related to critical, logical and evaluative thinking. Also cognitive processes related to discovery processes are embraced. Both convergent thinking and divergent thinking are regarded. Thus, the reflection step of knowledge building cycle is seen as a constructive and creative thinking process containing divergent and convergent cognitive activities underlying.

The framework focuses knowledge building related to innovation besides creativity, considering problems that allow different plausible unknown solutions and uncertainty. The educational main goal it is not knowledge transfer or recreation, but knowledge creation.



Framework to Understand Discourse in Function of Collaborative Knowledge Creation

A framework to analyze discourse in function of innovation, creativity, and knowledge production was unveiled from a communicative situation via Web, where empirical data were qualitatively analyzed according to Hymes (1974) ethnography of communication. Hymes (1974) conceptions about communication were evoked to approach symbolically the reflective and transactional process in the knowledge building cycle, describing how thinking in action is depicted in the online discourse. Hymes defended the argument that the language is constituted by social acts, being a cultural product and communication tool. Hymes incorporated the concept of communicative act in his scheme for the ethnography of communication, and went further than communicative acts, defining a nested hierarchy formed by units of analysis. Hymes called the units in this hierarchy: communicative situation, communicative event, and communicative act. Communicative acts are part of a communicative event and communicative events are part of the communicative situation. Communicative situations describe the context where the communication is immersed. Communicative acts categories described in the framework are elaborations of reflective thinking. Communicative events categories described are representatives of transactions among students.

Observations of the online discourse inductively derived categories of communicative acts and events described in the framework. Qualitative case study was repeatedly performed during four years (2005, 2007, 2008, and 2009) under the same conditions. In these case studies, qualitatively analyzed asynchronous discussion groups ran during 1 (one month). The students' interaction processes were performed by means of the discussion forum tool available in the Moodle educational environment. The students analyzed were in the fourth year of a computer science under-graduate course (age 21 and 22) and the students were mostly male. Students from one class (approximately 35) were immersed in problem solving activity. They were subdivided in groups composed of 3 to 6 students. Approximately 200 (two hundred) online messages were analyzed each year. Students were asked to formulate an informal user interface specification. Only two restrictions have been imposed over the user interface: it had to be a graphic user interface, and the interface had to be original.

The following passages depict productive collaborations that triggered students'



knowledge creation.

Example 1

Student 1: "I have an idea. I was wandering that we could design a radio studio. We could design a 3D software with many buttons to control the equipment".

Student 2: "I think that your idea is interesting, but the users in potential are too restrict. Today I visited the university's radio. Student 1's idea and the visit to the radio helped me to imagine an 3D interface for cinema, in which the number of users is greater. The program could allow the users to choose different films from many 3D different screens and also to have different options to change the video and sound configuration".

Student 2 considered a different perspective after having analyzed the potential users of Student 1's interface. This communicative event is classified as a joint exploration. Student 2 performed communicative acts classified as comparison, consideration of different points of view, and application.

Student 3: "I don't see why the Student 2's interface has to be 3D".

Student 4: "I agree with Student 3, Student 2's 3D feature seems to be a luxury item".

Student 3 and Student 4 criticize Student 2's interface 3D feature, searching for a plausible motive. The communicative event is classified as an attack. They perform the communicative acts feature specification, validity checking, and comparison.

Student 2: "What do you think about putting together my idea and Student's 1 idea? We could adapt his idea of radio studio to a video studio. The software could make the user feels in a video studio without leaving home".

Student 2 is led to reflection after the critics from Students 3 and 4. Student 2 proposes an integration of his proposal and Student 1's interface, implying a knowledge evolution. This communicative event is classified as integration. Student 2 evokes a communicative act also classified as integration.

Student 3: "Combining these ideas sounds good, because we could take advantage of your interface functionalities and to keep the 3D interface proposed by Student 1. You were able to unify the best of the two proposals.

Let's start the implementation of the interface”.

Student 3 agrees with Student 2. Student 3 visualizes an explanation for the 3D feature of the graphical interface. This communicative event is classified as an defense. The communicative act is classified as an interpretation.

Student 5: “Following the Student 1’s proposal we could imagine a more complex platform. We could propose something like social communities instead of a single user“.

Student 4: “Well done Student 5! The interaction among users turns the interface into a more interesting one. I was thinking about to allow users to exchange text messages”.

Student 5 avoids a premature convergence to the solution implementation and proposes a more complex interface. Student 4 elaborates Student 5’s proposal. This passage is classified as a communicative event advancement, that contains communicative acts elaboration and consideration of different points of view.

Student 5: “Message texts are not in context, because the interface deals with audio-visual components”.

Student 5 disagrees with Student 4, performing a communicative event attack.

Student 3: “I think that message text is in context. They are a form of interaction among participants that could include also audio-visual messages”.

Student 3 defends Student 4, presenting an argument. Student 3 argumentation is classified as communicative event defense.

Student 1: “This interface will be very difficult to implement. I prefer Students 2 idea that involves a single user”.

Student 5: “We can implement a single prototype and specify the interface functionalities abstractly”.

Student 1 arguments in favor of Student 2 proposal. Student 5 counter-argument Student 1.

In this example, communicative events describe transactions where students engaged critically, but creatively into other student’s idea. Convergent thinking contributed to divergence of idea, leading to the formulation of new ideas.



Communicative events express transactions that cause knowledge broadening and deepening.

Example 2

Student 9: "An interface that allow houses interiors modeling possesses a wide range of applications".

Student 8: "This idea is well know, I prefer something different".

Student 10: "I think that a 3D menu is interesting. The user could navigate into corridors".

Student 7: "I don't know. I can't imagine a 3D menu! Besides it is very boring to the user".

Student 8: "I am the one that loves a shortcut and hates navigate through menus. In my opinion it could be a waste o time to users".

The previous passages reflect communicative events where convergent thinking was used to reduce the number of possible solutions. But, based on previous critics, student 6 had an idea satisfying all pointed criteria.

Student 6: "I have thought about something original, viable, simple, and useful: an application to manage 3D object inside a box. It would be useful to supermarkets, transporters, and so on".

Student 7: "I believe that is very complicated, because there are many geometric forms to be considered".

Student 8: "I liked Student 6's idea. It could be used in entertainment like an educational game for children. The problem is the complexity. Drawing and fitting many different forms takes a long time and it is tricky".

Student 6: "We dictate the complexity. We could restrict the geometric shapes to simple ones like spheres or cubes".

Student 9: "If we restrict the possibility of manipulable shapes it will be no application".

Student 7. "Absolutely not. An educational game for children at early age could have only basic geometric forms".

This communicative event reflects is an example of the communicative events

joint exploration and advancement. The ideas advanced in another direction after critics. There have been the communicative acts relevance analysis and re-directing. It was raised criteria of relevance related to the feasibility of the interface was raised. The criteria was applied and accepted by the criticized student, transforming his initial idea. In this way, the students converged before diverge causing knowledge improvement.

Example 3

Student 11: "I was wandering the implementation of a balance to teach mathematical equations to children".

Student 12: "It is not clear for me. How do you intend to do this? How mathematical equations will be represented in 3D space?"

Student 11: "I intend to build three-dimensional balance, in which each side is one side of the equation. If there is some value in one side, the children must put the same value in the other side. For example, if there is a 2KG object in one side, the children must put four 500g objects on the other side".

Student 12: "Which objects are going to use to exhibit the equations?"

Student 11: "I was wandering to use cylinders".

During this communicative event, the group obtained knowledge advancement. The group performed joint explorations, where other's idea has been contemplated. At individual level the students performed the communicative acts speculation followed by communicative acts concept formation. The students engaged themselves in a transaction that transcends and includes concepts, advancing ideas, deepening and elaborating knowledge.

Student 13: "Student 11, your interface could represent equations like $2 + 7 = 5 + 2 + 2$ and perform operations like remove one object from each side $7 = 5 + 2$? Your interface could represent other operation besides sums?"

Student 11: "I didn't think about that. But it is a good idea, because the aim is to show children the equilibrium between equations that contains basic operations (sum, subtraction, multiplication and division). Do you have any other suggestions?"

This communicative event reflects is an example of the communicative event



integration. This communicative event also intertwines convergent and divergent thinking implying a more complex idea. Student 13 integrated a new functionality to Student 11's.

Student 14. "I think that the use of a balance is not attractive for children. I wandered I a 3D world, in which the numbers are personages and the operations are a kind of portal that transforms the numbers in equivalent numbers".

In this communicative event the knowledge has been rebutted to a deeper knowledge. Student 11's idea has been rebutted after critic. This communicative event depicts a transaction where a student elaborates other student's idea. From a critical posture student 14 realized a criteria and a new idea, so student 14 converged to diverge. Student 14 performed the communicative acts elaboration and consideration of different points of view. Student 14 elaborated and applied criterion to criticize Student 11's interface and following considered a new perspective.

Student 11. "There could be a color representation to each number and a combination of two numbers could result in a specific color".

Student 14. " This is impossible because there are more numbers than basic colors ".

Student 11. "But we could associate the colors to different grades of a specific color".

Student 14. " How the personages would be represented?".

Student 13. "I like the personages represented by numbers that possess human features".

In this passage, communicative events attack, defense and advancement emerged. There were the communicative acts consistency evaluation and fluent production.

Example 4

Student 13: "I was thinking about to explore a human cell three-dimensionally. We could visualize each component functioning".

Student 12: "I would like to know how the cell 3D navigation will be? The user



will be able to enter in the cell?”.

Student 11: “The interface will allow the user to choose a specific cell component to be analyzed separately?”.

Student 13: “The user would go inside the cell and choose the component where he is located to be analyzed?”.

Student 14: “This interface is not appealing to students. Who proposes something more interesting?”.

Student 11: “I suggest a virus attack”.

Student 14: “I liked this idea. This will call much more attention”.

Student 13: “I don’t think that my proposal should be disregarded. It addresses important information that the students must know. ”

Student 14: “I don’t see why we can’t combine Student 13’s idea and Student 11’s idea”.

Student 12: “We could think in real situations to explain the cell functioning”.

In this communicative event, student 14 and 12 achieved a dialectical synthesis. A new knowledge has been constructed in this communicative event. In a dialectical synthesis the knowledge obtained is an extrapolation of the current ideas, being a kind of divergence, but it is also a convergence to a new idea. In this communicative act the students had to pursue other alternative to resolve a conflict. The conflict followed by a dialectical synthesis describes a transactional knowledge building and reflects a successful collaborative learning process, where the knowledge is advanced. The students engaged themselves in a transaction that depicts a joint synthesis that transcends and includes concepts, and agglutinates ideas in a better idea. Concepts have been integrated, pointing a new and important relationship between different perspectives. This communicative event makes explicit a change from divergence to convergence. Students 14 and 12 treated the other students’ ideas as something that could be improved, considering that to develop other’s ideas is an aspect essential and basic for the knowledge advancement.

Example 5

Student 12: “We need to choose an interface to be developed”.



Student 14: "I prefer student 13's idea, because it is intuitive and possesses a noble application".

Student 12: "If we choose interface 13, we need to provide realism to the cell visualization. This is very difficult".

Student 14: "Do you remember the opening of the House television serial? The interface could be the same level of realism".

Student 13: "Could you post the video?".

Student 12: "Student 11's interface is better than Student 13's interface. It is better defined and simple".

This communicative event is an example of the communicative event joint comparison. The students discussed the interfaces features before taking some action in the direction of a consensus. Criteria have been applied to evoke important functionalities of the interface in order to obtain a consensus. Students diverged and surpassed initial positions in the group. Different alternatives have been contemplated from the visualizations of different criteria and consensus has been reached. The consideration of different criteria is a type of divergent thinking while the consensus is a type of convergent thinking. So, the group diverged in order to not preternaturally converge.

The qualitative analysis unveiled 25 communicative acts and 10 communicative events related to creative collaborations. Following, categories of communicative acts unveiled are described:

- 1. Validity checking. Certificating the validity of an argument.*
- 2. Decision. Decision about X or Y is valid. Choosing good criteria or choosing according to criteria.*
- 3. Concept formation. Abstractions made from features and states. Entities correlations.*
- 4. Feature specification. Establishing the properties of an entity.*
- 5. Quantification. Estimative of frequency, percentage or any other measure of quantity.*
- 6. Definition. Meaning generation.*
- 7. Comparison. Metaphors, analogies and other comparisons according to*

criteria.

8. *Interpretation. Concept or assertive inferred from a static or dynamic data pattern.*
9. *Deduction. Logical antecedent and consequent. Rules instantiation.*
10. *Instrumental Action. Production of an action plan or procedure.*
11. *Information checking. Evaluation of quality and sources of information.*
12. *Consistency evaluation. Search for contradictions.*
13. *Redirecting. Reorientation, transformation and conceptual redefinition.*
14. *Speculation. Search for plausible ideas. Abduction.*
15. *Relevance analysis. Identification of relevant elements, properties and relationships according to criteria of relevance.*
16. *Consideration of different points of view. Visualize ideas and objects from different perspectives. Consideration of different contexts.*
17. *Fluent production. Production of multiple ideas, alternatives and solutions.*
18. *Original production. Extrapolation.*
19. *Elaboration. Going deeper into knowledge. Filling with details. Giving more complexity to inter-relationships. Analysis. Synthesis. Criteria establishment.*
20. *Integrating. Ideas combination and integrating. Synthesis.*
21. *Convergent organization. Associations. Class membership. To delineate a single path.*
22. *Divergent organization. Class exclusion. To delineate many paths.*
23. *Induction. Search for patterns and regularities.*
24. *Application. Confronting ideas obtained with collected data or personal experiences.*
25. *Meta-cognition. Reflection concerning the knowledge building process.*

Following, categories of communicative events unveiled are described:

1. *Joint Exploration. Joint formulation of new ideas, involving mainly the creative cognitive abilities.*



2. *Defense. Grounding an opinion. Clearing a misunderstanding or diffuse concept. Sharing information. Defending a previous affirmation based on evidence or posterior interpretation.*
3. *Attack. Evaluating other's hypothesis or opinion.*
4. *Advancement. Change of participants' positions and arguments advancement. Evidence of evolution and knowledge re-design.*
5. *Joint comparison. Metaphors and analogies accommodation. Joint analysis of inferred alternatives.*
6. *Inter-subjectivity. Ideas inter-subjectivity. Indications that participants share the solution.*
7. *Integration. Integration of important aspects, creating new concepts and pointing out to important or unacknowledged relationships and connections between different perspectives.*
8. *Rebuttal. Rebuttal is a refutation that results a reinterpretation when confronting a condition capable of defeat or rebut the warrant conclusion.*
9. *Dialectical Synthesis. Synthesis of the opposing assertions.*
10. *Systematization. Systematization involves relationships and creation like the integration, but the related action is not only to integrate but also differentiate. The underneath key process is to distinguish or refine relevant concepts.*

Concerning the communicative acts and events, it was detected an interplay between divergent and convergent thinking. Communicative acts are composed by communicative acts intertwining communicative acts concerning the divergent thinking and that ones concerning the convergent thinking. Empirical data evidenced that despite creative thinking process is the generation of new ideas or the recombination of known elements into something new that relies on imagination, the divergent, the random and to consider multiple solutions and alternatives, it also involves the convergent thinking that depends on a systematic search for solution and multiple evaluative actions. These two mental activities are integrated. Students intertwined these ways of thinking by means of a transactional dialog in productive episodes, advancing and deepening the knowledge.



Conclusion

The framework elaborated here indicates that creative collaboration is productive when grounded in transactional exploration, comparison, and synthesis of ideas. Both divergent and convergent thinking arises in reflective and transactional processes that lead to a joint creative synthesis.

The framework developed for argumentative discourse understanding considers collaborative creativity and provides a systematic way to understand knowledge building processes in function of innovation. The students' collaborations, meta-cognitive, and cognitive processes are embedded in Dewey's concepts of transactions and inquiry, and refine the knowledge building approach. The discussed framework presents an original point of view that unveils collaborative processes whereby innovations emerge from groups. It shows how knowledge can be progressively transformed and developed, providing a theoretical perspective to analyze students collaborative creativity in small groups.

In the framework, productive online discourse dialog incorporates and makes explicit verbal creativity combined with rationality, apart from traditional approaches of creativity that suppress critics during exploratory processes. Dialog is seen as a transactional process that possesses exploratory features, besides critical ones. An interplay between convergent and divergent thinking in a transactional way offers a new perspective of how creativity is embedded in social groups.

A productive online discourse triggers the knowledge cycle presented here, addressing reflective process as a range of convergent and divergent mental abilities, advancing and deepening the knowledge. This work evinces that reason and intuition, order and chaos are complementary in mental activities. It is necessary creative thinking to provide the new, but critical thinking to evaluate it.

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