

How Innovation Emerges in Collectivities in Online Collaborative Learning

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Abstract. The purpose of this paper is to identify how participants are sharing innovation and creativity processes in online collaborative learning. We analyze the participation framework in a corpus composed of 30 hours of online meetings between undergraduate students, their professors, and international experts. We present a multimodal interaction of verbal and body language in collaborative activity for the analysis of moment-by-moment events in social interaction. Also using conversation analysis, we focus on how participants interact with both verbal and nonverbal expression. The analysis offered has drawn on a methodology to study and identify innovation promoted in online collaborative learning. The interaction between participants is easily observable with multimodal interaction analysis focusing on social interaction processes. We have tried to draw a map of the links between participants in a group interactional process that follows similar patterns and structures. However, in many cases, this order is purposely interrupted by chaos and emergencies to stimulate creativity. We can observe how this disorder is intentionally a part of the structure of this kind of meeting.

Keywords: Innovation · online collaborative learning · conversation analysis · multimodal interaction.

1 Introduction

In this paper, we analyze the participation framework in a corpus composed of 30 hours of online meetings between 32 undergraduate students of an Andean university, their professors from the host university and two international experts in innovation based in a UK university. In these online collaborative learning meetings [1–3], students present their projects focused on Innovation and Entrepreneurship. The internet-based IT platform used was ZOOM. The meetings were recorded on the same IT platform, which allows for the inclusion of the participants' comments during the session.

We are able to recognize the occurrence of innovative processes in online collaborative learning through the positive emotions and attitudes expressed by the participants and find that positive reinforcement, cooperation, and empowerment, promote innovation and creativity. Martins and Terblanche [4] note that

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creativity is the activity of generating ideas and that innovation implements creative ideas [5,6]. Many authors have worked in this direction [7,8], arguing that innovation is the implementation of creativity. It can, therefore, be said that creativity is part of the innovation process.

To identify creativity and innovation in online collaborative learning, we adopt a multidisciplinary, multisectoral, cooperative perspective in the implementation of students' ideas. In their projects, they attempted to apply their creative ideas in a specific context (the Andean region) to create better conditions of well-being in society.

We present a multimodal interaction “ [9–12] of verbal and non-verbal communication in online collaborative activities for the analysis of moment-by-moment social interaction. Also using conversation analysis [13–15], we focus on the ways in which participants interact with their words and their non-lexical expression (gaze, gestures, prosody). Thanks to this methodology, we describe the moment-by-moment interactional work performed in collaborative activity [16,17]. In its most straightforward prospect, the sequence of steps that interests us is: (a) that ideas and projects are shared among participants, (b) that participants try to improve the ideas and the projects, and finally (c) that they find an innovative solution to manage the project. This is our “step-by-step movement into advice-giving” follows a similar course of action described by Heritage and Sefi [18].

The students use English, their second language, to communicate with the professors and experts in the meeting, but when they experiment with problems, they switch to their first language, Spanish, to manage the project between themselves. Data were transcribed according to a system for capturing the auditory details of conversation designed by Gail Jefferson [19] and a system for recording gestures devised by Goodwin [17], wherein not everything visible in the video must be transcribed, only what is analytically relevant.

2 Distributed Innovation

We start our multimodal interaction analysis by presenting an extract where improvised narratives (or bits, [20]) of collaborative interactions emerge from the efforts of the group to work together. Sawyer calls it the emergence in conversation to refer to groups that are relatively unrestricted and, therefore, unexpected ideas could arise. In contrast, are groups engaged in creative activities that are relatively constrained, such as symphony orchestras, where predictable results of their collaboration are expected [20].

Extract 11:1

1. Jair (Student): ((J. moves his hands during his intervention, while
2. the other two students observe their hands. Fig. 1-2)) We want to
3. break the barriers that we have (0.4) because the economical
4. situation, you know that people are not (0.2) here (0.2) like in
5. previous situations of, of ↑economical resources
6. Expert: Ya

7. J: tend not to trust in the future. We want to give them an
8. opportunity (0.2) to trust. How can we give them this problem that we
9. have created to succeed in the future. Basically we have given the
10. main idea of the project, to give education to sectors mh
11. neighbors to important university in Ecuador, but is...
12. E: Mmh It is almost, as you say, not so much but is education.
13. But how you describe mmhh tools for learning, tools or
14. techniques that allow: children to have better learning
15. skills to take better advantages in education
16. J: Yes
17. E: The... in elementary level, ((students observed fixed the
18. screen. Fig.3)) so for me I understand, how... what age ((J.
19. touches his face. Fig.4)) kids have for?
20. J: From six to twelve years old
21. E: It's twelve old, ya, ya. Ok, excellent.

The first thing to do is identify patterns of the collaborative emerges of improvised narratives [20] of our multimodal interaction analysis. We need to observe the conversation constructed turn-by-turn. We have 8 turns in 21 Lines between two participants. From Line 1 to Line 11, the student explains the educational aspect in an economic context, presenting the importance of the first one in the current context of a crisis. The expert interrupts the student (Line 12) for asking in which ways the project will improve education in the country because everybody knows that education is important for the future. He tries to redirect the meeting towards the project and not towards the economic context, asking for tools and techniques (Line 13 and 14) for promoting better learning skills. It is a state of emergency, where the conversation is abruptly interrupted and freezes the students.. In Figures 1 and 2 we observe how students are relaxed in front of the screen, but in Fig. 3 they have changed their body positions,



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

and the three students observe the screen intensely while the expert irrupts in the conversation. In Fig.2. the two female students look at Jair's the hand movement and then look to the expert, identifying what he was saying during his intervention. At Line 20, they quickly answer the question with relevant information, collaborating with the expert. The expert in Line 21 assumes that his interruption was disruptive and assures them that everything is fine after the emergence of the collaboration saying, "Ok, excellent".

One of the characteristics of the emerging collaboration is the moment-to-moment contingency in which the action of each person depends on the previous one, as in Lines 19, 20, and 21. The interactional effect of these actions alter the subsequent actions of other participants, and each participant contributes equally to have a collaborative process. A wide range of actions is possible at each moment of the conversation; the emergence of the narrative cannot be reduced to the speakers' intentions in individual turns because a speaker cannot know the meaning of his turn until the other actor has responded [20]. Speakers tend to show increased formality and explicitness in managing turn switching [21]. In Lines 11 and 12, when the student presents the economic context of his country, the expert interrupts to introduce another aspect of the project to arrive at the end of the extract with useful information. The collaboratively emergent nature of the group enables something novel and creative to occur [20]. This aspect is the basis for the study of distributed innovation in groups because groups that diverge from routine engage in something new. As in the classic example of Hutchin [22], wherein emergencies occur with navigation teams, the team is capable of collaboratively creating an innovative response. We can observe this only with multimodal interaction analysis because it becomes manifest through multiple interactions among participants.

But why is it important to observe innovation in social interaction processes? In the next extract, we observe how innovation emerges in collectivities and is constructed more on a social scale than individually (2:19, 2:24).

Extract 2:19

1. E: It has many problems, the amount of money for customers have to
2. spend in medical treatments is enough mmhh to spending, spending
3. enough the average to spend on medical, medical treatments:
4. Ana: ((Students maintain the silence for 18 seconds)) Profe nos ayuda
5. Teacher helps us
6. ((referring to professor 1))
7. E: Los clientes para las medicinas y tal, eh (0.2) tiene la plata, el
8. Customers for medicines and such, eh (0.2) have the money,
9. dinero bastante para comprar los productos que:: ustedes están
10. enough money to buy the products that:: you are
11. pensando de vender a ellos, hay un mercado de valor para
12. thinking of selling to them, there is a market of value to
13. comprar los, los productos.
14. buy the, the products.
15. Richard: Of course, because we will arrive to far places and

16. final customers. But all customers, owners of the stores,
 17. owners of big system of stores. For this reason, I think there
 18. is. It is not expensive for them because benefits are so big
 19. for example, expand the market. For this reason, ((Students
 20. speak between them, Professor 1 smiles)) Ok, for the reason
 21. they pay for the service.
 22. E: I saw the video, and I am very interested in speaking to
 23. you, ((Students and professors lend high attention to the
 24. Expert's words sharing a quick look between them, Fig.5.))
 25. this is a very exciting opportunity, mmhh:: you know, my
 26. organization, SETsquared , we work with a lot
 27. of start-up technology companies, and the help-care area is,
 28. particularly, in an exciting moment, is attracting a lot of
 29. opportunities. There are, there are a little development, looks
 30. at taking the expertise mmhh:: taking the expertise which is in
 31. the centre and in final ways, distributes to the periphery,
 32. maybe to core consumers or maybe to location far away, and the
 33. the development for digital technology and Internet is making
 34. this, mmhh: very very ((inaudible)) right now. Mmh: I think
 35. there is something you need consider it in your plan, we see a
 36. large number of innovations are really involved taking central
 37. expertise, mmh: so traditions, doctors, centre providing advise
 38. across to Internet, distributing mmhh: medical treatments
 39. providing via Internet create a more efficient delivery of
 40. health-care to people and consumers are, are:: excited or
 41. eclectic by the current system. So I think you have got, a very
 42. strong, a very strong market opportunity with your idea to
 43. distributing the expertise from the pharmacy into the outside
 44. areas. What I worry about it is considering building your
 45. infrastructure with the ATM, the machines, the computers. Mmh:
 46. one of the reasons is so the Internet infrastructure and the,
 47. the, the ownership of computer is becoming increase everywhere.

In this long extract, we observe how students, professors, and expert interact, firstly explained the problem in two different languages (English and Spanish) to



Fig. 5. High attention to the Expert

understand the point better (Lines 1-3, 7-14). At this moment, participants understand the interactional mechanism that occurs when innovation is distributed throughout a group. The student in Line 15 tries to give an explanation offering an innovative solution to the problem presented (15-21), looking the others to find the best way to present it. Defining the interaction rules, the expert gives his innovative view for the project, using technical terms (Line 27), specific strategies (Line 31, 37-41, 43-45), and presenting previous experiences (26-28). Innovation is not centered in an individual (the expert) but in the entire interaction dynamic with all of the participants: online collaborative learning is a form of distributed innovation between the actors.

Also in this interaction it is possible to demonstrate the potential power of interaction analysis as a tool to understand innovative groups. We identify gazes between participants (23-24), long silences during reflection (Line 4), and code-switching between the second language (English, L2) and mother tongue (Spanish, L1). Of course, every group has a different interactional mechanism and the expert knows this. For this reason, when starting a new meeting, students are allowed to present a summary of the project and to get to know each other.

How creativity and innovation are distributed across people, tools, and environments has been called distributed cognition [22, 23]. When cognition processes are distributed, they become visible analyzing verbal and gestural interaction [20]. Multimodal interaction analysis can help to describe these processes. We observe whether the process is collaborative or not between participants through social interaction processes. It is social because we identify a non-individualistic dynamic, where each actor listens and participates in the meeting. Also, this social interaction among participants is an open system because it allows changing the dynamic of the process without having rules defined a priori. Every participant can interrupt or enter the conversation when s/he prefers without difficulty.

Another characteristic is that a social interaction community is the locus of innovation, it is the context where innovation emerges, and we called this as the community of innovation. This then is a collaborative network constructed from collaborative emergencies, as we observed in Extract 11:1. In Extract 2:19, we have a further diversity of actors and authorities, but the open-system community is the same, and there is an interchange of ideas without following a common pattern. The expert reformulates the students' ideas, explaining the problems and strategies for succeeding steps in their projects, they interrupted him, and the professors observe the dynamic. We observe the same dynamic as the professors and use it in teaching our classes of Innovation and Entrepreneurship in the common core of Science, Technology, Engineering, and Math (STEM) careers. From these classes, the students work on the projects presented to the experts in these online collaborative learning meetings. An author that helps us in these classes is Charles Hampden-Turner [24], who presents 'cubes' models to help understand why it is important to teach innovation to STEM students. One of these cubes is based on emotional intelligence.

In the cube called “Dilemma 1”, Hampden-Turner observes that the helix represented from point 0 to the reconciliation zone is counter-clockwise. Students follow this process when they elaborate a similar project to present to the expert. Firstly, they need to invest themselves emotionally in a new venture that represents their aspirations and passions so that they are emotionally embodied with the project and can then represent an integrated idea to the expert at the beginning of the online meeting. Of course it is not only the emotions and passions that insure a project will have success, and it is important to be able to put the idea in an intellectual and logical order from this first emotional investment. The students must organize the results of their experience to present the project to the professors and experts intelligently so that the spiral moves back towards the vertical axis as they make sense of their investment. Only then can they reflect upon and reorganize their ideas: “Note that this happens over time and that the arrow of time moves from the near bottom-left-hand corner of our cube to the far top-right-hand corner, as the helix spirals around it.” [[24], p.114].

The expert represents the intellectual ordering and the students the emotional investment. The social interaction between these parts has the purpose of promoting emotional intelligence when the hand, the heart, and the brain work together. In the previous extract we observed how in Line 22 to 47 the expert starts a long monologue. He makes an effort to redirect the students’ project to the actual context of the market to be applied in society with successful results. This is a primary aspect of this type of online collaborative learning. Students have great and brilliant ideas, but they need experience and knowledge to be able to apply them. For this reason, professors of the undergraduate course collaborate with experts to receive suggestions and feedback as to how to redirect the student’s emotional investment to work towards intellectual organization. This integration is the basis for successful projects in innovation and entrepreneurship.

Extract 2:24

1. Richard (student): We will help people, because
2. E: Yeah
3. R: ehm: because It
4. E: For me, I think you are innovating, ((High level of attention from
5. students and professors, both of them are touching their chins with
6. hands, Fig. 6.)) you should see this, as a particular service, in



Fig. 6. High level of attention

7. the first instance, because you will provide values for users very
8. very quickly, and a big interest for the government...

In Extract 2:24 the expert introduces the value of the proposal and the project. Later, the expert helps to focus the project on the society and on finding strategic partners. Students were attentive, as were the professors, fixing their gazes on the screen, touching their chins, listening to the experts' suggestions. Head turning and eye gaze play an important role in speaker switching [25] and that both these behaviors are reliant on directionality [21]. We can thus identify this online collaborative learning group as a collaborating group, where individuals collectively generated a shared innovative project.

3 Distributing knowledge in group

In this section, we introduce how distributed knowledge is collectively shared in these learning contexts. In the next two Extracts (7:14, 7:16), an expert explains the results of similar projects presented in the past, with both their successful and unsuccessful consequences. In one case a successful project caused problems of too much success in society. After this explanation, students begin to comment on the projects in their L1, but the professor interrupts them, explaining what the expert said and not what the students think she said:

Extract 7:14

1. Professor: What I understand Expert 1 and 2 from your comments it is
2. that in both cases are cases of successes of entrepreneurship, that
3. from your point of view, entrepreneurship, they have ((inaudible))
4. that they have in their plan, they have created in the business
5. model, right?
6. E1: ((he touches his chin with his hand, Fig. 7.)) Exactly
7. P: So I would like to see more, what do you make these
8. examples, these business models that they are proposing as a
9. success? And, and: then we can take account of this side effect,
10. but first we need to have success.

In Extract 7:14, expert is explaining how students need to think about the consequences of their actions, thinking about whether their project will produce benefits or not for society, and in which ways it might affect it. Students take notes of the suggestions to reconsider their project. In Lines 4-8, the professor



Fig. 7. Expert 1 touches his chin

identifies the main problem with the students' project, the business model. It represents a positive spin for their projects.

There are some patterns that experts introduce in every meeting. For example, here we observe how experts present a few similar examples of the student's project, and students take notes about these previous experiences. This is the way the experts share their knowledge with the students in these online collaborative learning meetings, and the same pattern and similar Lines of dialogue are repeated with the same order in other meetings.

We have observed a similar structure in Sawyer and DeZutter's work [20], where 'bits' about the project being 'interactive' occurred at all meetings. The 'bit' is an interactional routine in online collaborative learning that contains three basic elements: The students show their project; The experts present previous similar projects with successful and unsuccessful consequences; The students try to put a positive spin on this by calling the project "Interactive".

Extract 7:16

1. E2: Maybe you will have a very successful company, that you will be
2. involved, using the waste water, maybe a clean water product, is it
3. right?
4. Angel (student): Clean water? ((while Jordy is taking notes after
5. that A. gave him a notebook, Fig. 8.))
6. E2: Yeah, clean WATER, agua ((everybody smiles)) It is one Spanish
7. word that I know
8. E1: Two words, Agua and Cerveza ((everybody laughs, Fig. 9.))

Smiles and laughs (Line 6-8) stimulate a cooperative environment for innovation among participants. Using two words in the student's first language related to the project, water (agua), and another referring to the same liquid state, beer (cerveza), using humor to bring emotions into play. Alves et al. [26] identify three dimensions of cooperation environments for distributed innovation: diversity of actors and competencies (experts, professors, and students), coherence respecting the integration of complementary activities (problem-solving, previous projects, successful examples, etc.), and interactivity with strong cooperation relationship. A cooperative environment stimulates positive emotions and interactivity between participants as in Fig. 8. (students passing the notebook), and Fig. 9. (when everybody laughs). It is a funny and informal moment, but students continue to take notes while are laughing. Every actor is involved in improving the project with the distributing innovation process.



Fig. 8. Passing the notebook



Fig. 9. Everybody laughs



Fig. 10. Students discuss together in Spanish

Like using an informal dynamic in a formal setting, such as encouraging laughter in the meeting in Extract 7:16, bringing together people from different entrepreneurial sectors (experts 1 and 2) and people from science and technology institutions (professors and students) to work towards common goals (innovation and entrepreneurship projects) stimulates a cooperation environment [26]. Multidisciplinary and multisectoral cooperative environments link diverse knowledge sets and skills needed to create and bring to the market complex projects and facilitate the exchange of knowledge rooted in individuals [27, 28]. An online meeting served multiple but distinct functions in supporting complex teamwork.

In Extract 9:5, students are discussing ideas in their L1, (Fig. 10.), while the professor underlined the importance of asking questions:

Extract 9:5

1. P: To understand at this point questions are most important that
2. answers
3. E1: mmhh, mmhh
4. E2: Yeah, yeah ((inaudible)) we try to identify competitors, right?
5. Competitors or similar products like to be able to take information
6. from, or learn from, mmhh one thing looking at this model,
7. understanding how you are going to, generate resources for the, to
8. learn from, and how do you want funding to build that platform and
9. then, eh: what do you happen when employed, how are you going to make
10. that.

We have observed how in online collaborative learning one of the patterns that the experts follow is to formulate new questions that students have not yet answered. In this case, the focus is in recognizing who are the competitors for their project. It is another important point to identify how students construct innovation socially. In half an hour students need to try to answer these questions or take notes for improving the project. Distributed innovation is composed of several activities that come before structures development processes. One of these activities is to build questions.

Questioning stimulates idea generation, the creative part of the innovation process [4]. Questions encourage creative processes and generate valuable ideas for products, services, processes, and procedures [4]. The implementation of these new ideas is innovation, which again, is the application of the results of creativity [29–31]. Koen [31] defines this process as ‘fuzzy front end’, where participants

expose new ideas that are often chaotic, unpredictable, and unstructured and come before a structured development process. Questions from the experts have the function of prompting this creativity, and the greater the number of ideas at the start of the new project development process, the greater is the probability of successful products [32].

From the aspect of this dynamic, selected ideas flow through the ‘funnel’ of innovation, and students need to choose the more pertinent ideas to improve their project. The questions that expert 2 formulates (Lines 9-10) are to open doors for the project, to give space to the creativity between participants. The fuzzy front end is important in these meetings to generate creative ideas. Many students, after this session, changed the project radically, for the creative exercise reformulated new ideas.

Extract 4:6

1. P: In Innovation Day you will surprise the audience giving a prototype
2. E1: Yeah, that’s good ((inaudible)) yeah it is very good Jorge if you
3. concern to the judges. If you give a surprise, with the build of a
4. prototype. You make me feel guilty because I can not help you
5. ((everybody smiles, Fig.11.)).

One of the most interesting points in these online collaborative learning environments is hands-on work with the cognitive process in an innovative project. Many student groups try to build a prototype, a physical tool to present their ideas, and at the end of the semester professors of Innovation and Entrepreneurship courses organize an event called ‘Innovation Day’. This event is to show the student’s projects in front of a scientific and entrepreneurial court, where the winner will travel to the United Kingdom to participate in an intensive workshop organized by experts at their Institution. In the first two of these events (2015 and 2016), the winners from 76 projects had elaborated prototypes of their project. In the 2016 event, the second position was also for a team that has developed a prototype.

Expert 1 (Line 2-4) agrees that presenting a prototype for the event would be a grand strategy. In innovation processes, teams can work together to materialize their ideas in a scientific laboratory or the Fab Lab (fabrication laboratory), infrastructures that open to the students of Innovation and Entrepreneurship.



Fig. 11. Everybody smiles



Fig. 12.



Fig. 13.



Fig. 14.

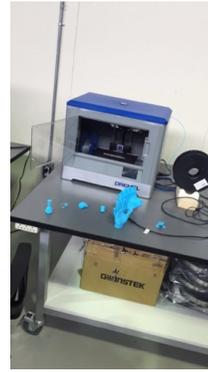


Fig. 15.

The Fab Lab is a space equipped with digital tools that offer various materials to make “almost anything”.

Innovation is practiced in a space like Fab Lab, where students manipulate objects, tools, and digital technology. Students that use these spaces are more likely to be innovative and creative in their projects compared to those without the resources and opportunities for this kind of collaboration. These are spaces to share ideas in, to try out technologies and to put ideas into the real world. Creativity and innovation are hard to measure, but thanks to these prototypes and the success that prototypes have in events like Innovation Day, we can see in ‘real-time’ whether an innovative project can be applied or not in society.

Multimodal interaction analysis helps us to understand why social interaction with people and tools can identify how innovation is shared and developed among participants (Fig. 13.) The prototype is the last step of these innovative projects, the evolution of a creative idea into a physical entity, and the final products of cognition are produced by the participants using digital (3-D model) and non-digital (3-D printed) tools.

Another tool to actualize the new ideas and their implementation is the business plan that we mentioned earlier (Extract 7:14, Line 4-8). This tool evolves the ideas produced in the fuzzy front end to demonstrate product specification, financial analysis, and project management, and is a stricter development



Fig. 16. Business plan



Fig. 17. Stand up

methodology [32, 33] for applying innovation in society. In Fig. 16 and 17 we observe how students present their business plan in the meeting, this is another physical tool that allows attention to be focused in one direction. The generation of ideas many times is a chaotic and unstructured process that is necessary when the meeting starts, but at the end of the meeting it is important to recollect ideas and concretize some aspects of the project, and the meeting concludes with the business plan or the prototype presentation. Multimodal interaction analysis is applied here to help to understand how collaboration between participants generates business innovation also.

We will conclude with the same meeting that we started our analysis to observe how social interaction is often an open system where creativity emerges abruptly in an emergency.

Extract 11:14

1. E1: You are a very very very smart team ((while Jair moves his head
2. forward and back, Fig.18.)), you know, I want a fight with you in
3. this ((E1 simulates punching the webcam, while everybody smiles,
4. Fig.19.)).

Expert 1 provokes students by simulating a fight (Line 2, Fig. 19.) after motivating them (Line 1, Fig. 18.). It is an excellent example of how social interaction stimulates learning and a positive dynamic where creativity emerges. Conflict resolution, planning, or negotiation, where the ambiguity of the information and the requirement for rapid clarification and feedback are critical for the success of the interaction [34, 35]. Student 1 is excited by the idea, moving his head forward and backward towards the webcam (Fig.19.), simulating this fight, a fight of ideas to generate new ideas, to encourage creativity by creating an emergency situation. As we have observed in the first Extract in this paper (Extract 11:1), where it appears as an emerging narrative, now we have an emergency situation.



Fig. 18. Jair moves his head forward and back



Fig. 19. E1 simulates to punch the camera



Fig. 20. Everybody is happy

This is an unstructured and disordered situation, whereas in the previous discussion of the Extract we observed a structured and ordered situation. Now we see chaos in an open system where creativity emerges. When the expert starts the ‘fight’ with the students, he tries to put the social activity ‘in the wild’ [22], using an emergency situation to stimulate the creative activity.

Extract 11:18

1. Emilia (Student): Yes, this is exactly that we want to do!(everybody
2. is happy, Fig. 20.)

In Extract 11:18, participants show positive emotion, finding an accord between them, in other words, after a chaotic and disordered narrative they agree. In Extract 11:19 participants show even more positive emotions. Everybody looks at the camera with happy faces and with a high level of attention.

Extract 11:19

1. E1: I will push things much harder because I think, it is really, a
2. very very exciting idea. Mmhh think stronger that charity and
3. ((inaudible)) I could be, you know, corporate and put under Yachay
4. Tech umbrella ((High attention from students. Fig. 21)).

The expert tries to stimulate this online collaborative learning by pushing things higher, and students approve this strategy. As we saw in the Extract 11:1, the emerging collaboration helped us understand how these narratives emerged over time from the collective activities of the entire group [20]. From an emerging situation, the participants have reached a consensus, an agreement, and this generates a better project. This new project and the positive emotions expressed by participants are the results of group collaboration.



Fig. 21. High attention from students

4 Conclusion

Working together in an online meeting requires a substantial investment of time, emotions, and intellect [36], our analysis has drawn on a methodology to identify the best strategies to have success in these types of collaborative contexts. When effective teamwork is a stake, it is unsurprising that much work is concerned with how to enhance the success of online collaborations [37]. Advice for members to create a sense of connectedness and equality [38], focusing more on social interactions [39] or maintaining a close working relationship [40]. We have tried to draw a map of the links between participants in a group interactional process. However, in many cases, this order is purposely interrupted by chaos and emergency situations to stimulate creativity. We can observe how this disorder is intentionally a part of the structure of this kind of meeting.

We have identified how the collaboratively emergent nature of the group enables something novel and creative to occur, where groups that diverge from routine are enabled to engage in something new. We also observed the students' code-switching between English and Spanish and their different interactional mechanisms (gaze, long silences, hand/arm movement, etc.). While we also had a diversity of actors and authorities, none of this affected the collaborative network they constructed.

An informal dynamic brought into a formal setting, like laughs in the meeting, stimulates a cooperative environment that brought together knowledge and experience from different entrepreneurial sectors and from science and technology institutions to work towards common goals. A multidisciplinary and multisectoral cooperative environment linked diverse knowledge sets and skills needed to create and bring to the market complex projects and facilitate the exchange of knowledge between individuals.

Distributed innovation is shown in collaborative emergencies of structured groups in online collaborative learning. We have observed how the innovation of a group's performance resides in the generation of new ideas from experts, students, and professors. Recognizing positive reinforcement, cooperation and empowerment, actions that promote innovation and creativity [4–6]. The analysis of these online collaboration teams provides a methodology that can be used to analyze the innovation distributed in other contexts in future research.

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