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The Place of the Instrument in the Analysis of Learning Interactions

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Abstract This paper presents the results of an experiment, which aimed to assess the impact of a computing environment on the quality and participation of year 10 students within a cooperative learning situation. The participants of the study were 15-year-old Amerindian students who lived in an isolated village in the Amazonian forest in Guiana. Our study emphasized an interactionist approach and used the KITLoK model to examine the content, quality and frequency of exchanges in an interactive learning situation. The results showed an evolution of written output, whereas did not indicate any significant change in oral participation. For this study, we used a software application, which helped stimulating students in their argumentations during their interactions within a multicultural and multilingual context.

Keywords: *instrument, computer, argumentation, Amerindian student, interaction analysis, interactive learning, cooperative learning, KITLoK Model*

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1. Introduction

Our paper presents the results of an experiment conducted in a class of Amerindian students from a secondary school located in an isolated indigenous site within the Guianese forest. Our research is of an exploratory nature.

The originality of the situation presented in this study can be summarized as follows:

-First, the argumentations were co-constructed in pairs orally. Argumentation within a school context is both a tool for disciplinary learning and practice supporting the development of transversal skills. By argumentation, we mean an exchange that aims to persuade the interlocutor by using reasoned arguments.

-Secondly, the written argumentations were used to persuade another pair.

-Finally, the argumentation was not only in oral form but also written (the arguments were expressed via using software application especially designed for this type of activity).

All three areas of skills content knowledge (*savoirs*), know-how (*savoir-faire*), and know-to-be (*savoir-être*) skills were targeted through the implementation of this pedagogical tool in the classroom. Some of the objectives of this argumentation activity were the construction (co-construction) of the disciplinary knowledge (*savoirs*), the language practice and proficiency (oral expression, turn-taking etc.), the development of critical thinking skills (argumentation, precision, explanation etc.), the acquisition of responsible attitude and the development of democratic thinking (knowing to respect different ideas without accepting).

Although all of the aforementioned skills were important, for these Amerindian secondary school students who lived in an isolated area the activity we proposed were especially important.

Firstly, argumentation occupies an important place in Year 10, which is the year when all French students prepare for the DNB national certificate [1]. This exam certifies the general knowledge of a student (generally between 14 and 15 years of age) at the end of the compulsory secondary school education.

Secondly, we intended to focus on the linguistic and collaborative dimension that covers the practice of argumentation. For these students (who would leave their village the following year to attend high school in one of the cities in French Guiana), proficiency in French, the language of schooling, was important because it was instrumental in school success.

Nevertheless, putting in place an argumentation activity with students who spoke an indigenous language and who were not used to straightforward argumentations in their own culture was difficult. The difficulty was partly explained by the differences between the family educational practices of this group of people and those of the school ([2,5,6]). The family educational practices of

1 The national certificate (DNB) is a French diploma certifying the acquisition of general knowledge at the end of secondary school. The students then generally between 14 and 15 years.

this socio-cultural group were characterized by observation and imitation, which contrasted with the practice of argumentation. These indigenous students are described as discreet and reserved in discussions and speaking by sociologists and anthropologists ([2,5,19]). Moreover, these students' mother tongue is Emerillon whereas their schooling is carried out in French. This gap between family and school educational practices (particularly regarding argumentation) inspired our main issue here. We therefore, sought know: *Which mechanisms should be put in place in order to promote the expression and participation of students in argumentation activities?*

2. State of the Art and Research Hypothesis

Various observations on the use of computers in learning situations [22] have shown that the activities based on software applications create a form of dialectic between the knowledge required to complete the tasks and the reflection on how to do the task. This particular use of computers makes it an instrument for cognitive mediation. Moreover, interactions between users do not only concern the task to be completed, but also involve relational and social aspects. In addition to being an instrument of cognitive mediation, the computer seems to promote communication and social relationships. The learning situation then becomes a complex set of relationships, mixing interactions with peers and tutors, as well as interacting with the machine itself.

Our assumption was that 'the use of software in collaborative activities of argumentation is likely to promote linguistic interactions between students who are not culturally used to discussions and the production of argumentation'.

We therefore used specific computer software called *CoFFEE* to implement and facilitate argumentation activities in the classroom (see Section 3.2). Although usually argumentation is carried out without the involvement of any technological instrument, the use of computers can positively contribute to argumentation. The argumentation activity is then carried out according to two-way communication, in writing via networked computers (whereby the same interface is shared between the various participants in the debate), as well as in oral conversation between the members of the group/pair sharing the same computer (see Figure 1).

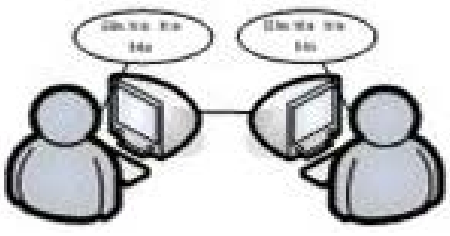

Figure 1. An example for a situation of argumentation assisted by a computer

Peer interactions (student-student), whether they are equal or slightly asymmetrical, appear to have significant influence on the learning process. Such interactions positively influence individual psychological processes, the interpersonal dynamics of educational assistance [20] the co-development of knowledge [18] and the mechanisms of cognitive confrontation [21].

At the cognitive level, in line with research carried out on cooperative learning [17], various studies have revealed the process of opinion change and the joint development of new knowledge both in and through the interactions in argumentation activities ([7,8]).

In these argumentation activities assisted by computer the elements of social interactionism, as developed by Vygotsky, are naturally present. The collaborative learning situation (through peer tutoring), the language production and argument development in French (as a second language) or the use of artifacts in knowledge acquisition (acquisition of technical skills, through the use of software) all constitute the elements of Vygotsky's concept of learning. Vygotsky's theory emphasizes the different processes involved in any social learning situation: the functions of mediation and supervision provided by adults (the concept of "zone of proximal development"), and social transmission and semiotic mediation. For Vygotsky [25], intellectual development of children goes from inter-personal plane (e.g. with more experienced adults and peers) to the intra-personal plane (internalization of the processes implemented during social interactions). Language (especially the written language) plays a psychological role as an instrument here.

3. Carrying out the Experiment

3.1. Population

The experiment was conducted at an isolated site in French Guiana, in Camopi, where the indigenous Wayapi and Emerillon live. In this village in the Amazonian forest at the top of Oyapock river, students are schooled until 15 years of age in an annex of the secondary school of St. George. Education is provided by supply or primary school teachers. French is used at school and the native language is used within the village.

The cultural and linguistic context means that the integration of these students in secondary school is difficult.

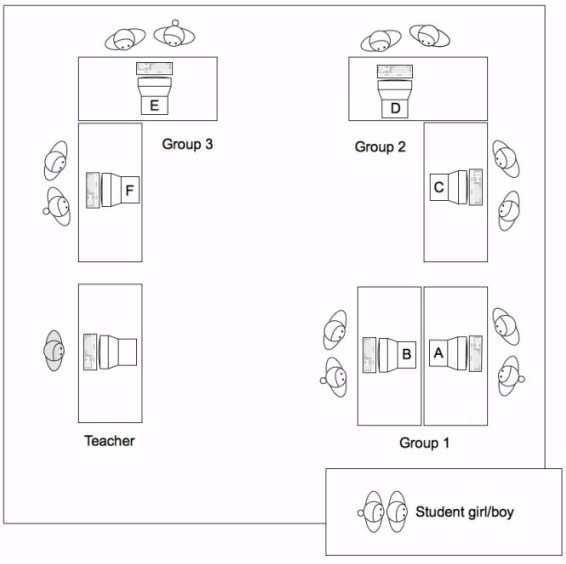

Figure 2. Organization of the class during the discussion session

In this secondary school, there is only one class per year due to the low number of staff. We conducted the experiment with a class from Year 10 - the last year of secondary school before high school – with 12 students aged between 15 and 16 years of age (eight boys and four girls). The class was organized into three groups of four students for each discussion (see Figure 2).

Each focus group was formed of two dyads - each dyad using a computer - who had to exchange with the CoFFEE software which had been specially designed for this type of activity within the framework of a European Research and Development project on instrumented collaborative learning [10]. The output of each group discussion was analyzed individually.

3.2. The *CoFFEE* Computing Environment

The software used in this study was developed in the framework of a European research and development projet[2] related to educational technology, more specifically about computer environments for collaborative learning in the classroom. In this paper we use collaborative learning as an umbrella term to refer to all learning that occurs when students work together in groups.

The CoFFE[3] (Collaborative Face-to-Face Educational Environment) is a set of software applications that enables students to work together on the computer network through activities based on different communication tools. The utilization of this software that we proposed here has already been the subject of several studies ([3,10,11,13,14]). In this specific learning situation, students were divided into small discussion groups and encouraged to discuss a given topic, conversing both in writing via the computer interfaces and orally. The following main tools were made available for the students to use: (1) a structured chat which enabled exchanges in the manner of a remote chat, whilst structuring the discussion in a tree form organized by theme, (2) a shared text editor giving students the opportunity to write a text to several people and (3) an argumentation graph model for developing a shared space which represented the holding of the debate through boxes connected to each other by opposition or support links (see Figure 3 below).

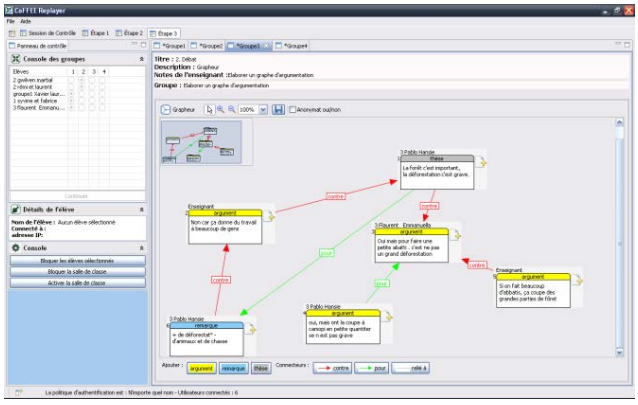

Figure 3. The CoFFEE teaching interface which oversees the work in progress of each group of students (the graph model is shown here)

2 LEAD Project financed by the European Union between 2005 and 2008, see http://www.lead2learning.org/.

3 *CoFFEE* is afree and open source software which works with the main operating systems today. It can be downloaded at http://www.coffee-soft.org/

To accompany these aforementioned communication tools, CoFFEE offers some applications for the individual and collective management of the activity, such as: a notebook for taking notes, a voting system and a module for sharing files (text, audio, video).

Each CoFFEE session is defined by a succession of steps. Each step is based on one or more tools mentioned above and is configurable with a specific design module. Depending on the specific educational scenario chosen, students may use these tools either individually or altogether and apply different settings to them (to show the tools available on the screen, the minimum/maximum number of contributions, anonymous contributions, etc.).

Through the interface intended for the teacher use (see Figure 3), the teacher can coordinate and regulate the activity of different group discussions.

For instance, the following can be given as examples for the activities that the teacher can coordinate or regulate: the distribution of students according to groups, conduct of the session (moving from one step to another), intervention within a group (via the interface), ending of the activity, etc.

At the start of the session, the teacher interface reminds the students of the stages that will be linked together and the tools that will be used, together with a description of the work to be carried out in each of them. The stages progress step by step at the pace set by the teacher who guides the session from his/her workstation. The interface also provides a listboard of students attending the session and their group membership.

3.3. Activity Description

The instructional sequence took place over two days (see Figure 4). On the first day, an hour-long discovery session introduced the argumentation and ownership of the software. On the second day, a two-hour discussion session took place on the theme of “deforestation”.

In this paper we will present the second session concerning the central activity in detail (coded as “A2” in Figure 4).

Activity	Object of the activity	Objective
A0: Pre-activity	Training	Training in argumentation and ownership of the IT environment
A1: Introductory activity ⇩	Preparing the debate: watching a video	Acquisition of argumentative knowledge for the specific debating space
A2: Central activity ⇩	Debate via structured chat followed by construction of an argumentation graph	Interactive argumentation
A3: Summarising activity	Writing a summary which may be marked by the teacher	Representation and inclusion of everything learned throughout the debate

Figure 4. Collaborative Argumentation-Based Learning (Inspired by Baker et al., [9])

The argumentation activity in this session was introduced by a video projection to stimulate the students’ contributions and provide them with useful information for the construction of new knowledge through the debate. Several documents were also made available for the use of students (e.g. textbooks, newspapers, scientific reviews, etc.).

We present in Figure 5 the communication situation implemented in this study (see the framed item in Figure

5). This multichannel situation is the most complex because it involves two dyads of students discussing the proposed theme: (1) in writing, through two networked computers or (2) orally, in their pairs or with their peers from the other dyad or (3) with the teacher, both orally and in writing, all computers were connected to the computer.

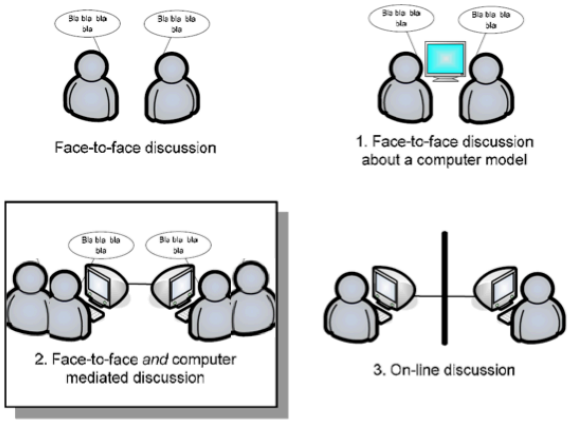

Figure 5. Situation studied in Camopi: face-to-face and computer-mediated discussion

The following Figure 6 and Figure 7 show the complex communication situation of face-to-face and computer mediated discussion in the second discussion group.

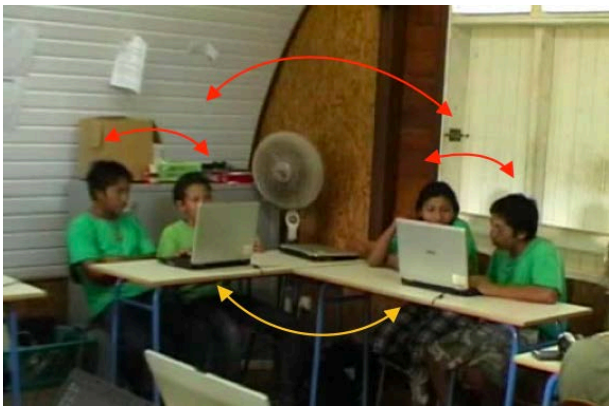

Figure 6. Discussion between students, between groups and with the computer

Figure 7. Discussion with the tutor, between students, between groups and with the computer

The red arrows in Figure 6 and Figure 7 show the oral exchanges within the same dyad - sharing a computer – as well as the verbal exchanges between the two dyads in a discussion group. The yellow arrow indicates communication through the interface of two networked computers.

Figure 7 shows the presence of the tutor in the exchanges who can intervene either remotely via computer or orally.

4. The *KITLoK* Model (Knowledge, Instrument, Tutor, Learner, other Knowledge)

The presence of computers in learning situations has led to the development of analysis models, from ternary (teacher, student, knowledge), to quaternary (teacher, student, knowledge, instrument) ([1,12,23]). We therefore opted to use the KITLoK (Knowledge, Instrument, Tutor, Learner, other Knowledge) model which was put forward by Ailincai in 2010 ([1,4]).

Inspired by Bernard's Media Square, the KITLoK model analyzes interactive change in a polyadic context, in complex educational situations, whilst integrating various teaching devices. Whilst retaining the basic building blocks of the model mentioned (Tutor/Learner/ Instrument/Knowledge), the KITLoK model (see Figure 8) goes further in the analysis of interactional dynamics.

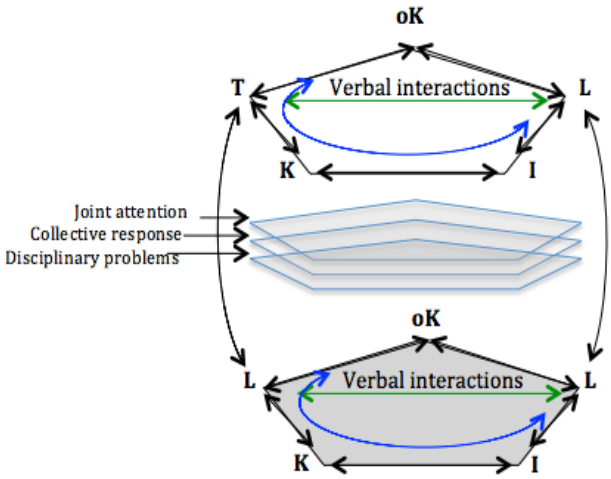

Figure 8. The *KITLoK* Model

This model proposes the identification of the initiator of the exchange (tutor or learner), as well as the noteworthy behaviour of the students (joint attention, collective response, lack of attention, disciplinary problems), which may impact the interactional structure according to the elements present in the interaction:the purpose of the exchange (knowledge at stake, other knowledge, various exchanges); the instrument (and the use made of it) ; the learning situation (collaborative or not) ; the number of interactants (learning or polyadic situation, notably in the classroom) ; the initiator of the exchange (tutor, learner); the space opened by multiple simultaneous interactions (learner-computer /computer-tutor / tutor-learner), which give the child new learning opportunities.

The coding of interactive situations (see Table 1) as inspired by Bernard [12], monitors the progress of the exchanges and the analysis of interactive variation, with many revisions being possible due to the introduction of the stated elements.

Table 1. *KITLoK* coding grid of Interactions, Ailincai (2010, 2015)

Exchanges initiated by the Tutor		
KITLoK	**K**nowledge in action-**I**nstrument-**T**utor-**L**earner-**o**ther **K**nowledge	The model is only complete in activities targeting two "knowledges" (e.g. the CLIL approach: students discuss amongst themselves the knowledge at stake ("K"), in a foreign language ("oK")
KITL	Knowledge in action-**I**nstrument-**T**utor-**L**earner	The exchange (and/or manipulation) concerns the *Knowledge in action* and either refers to or uses the instrument
ITLoK	**I**nstrument-**T**utor-**L**earner-**o**ther **K**nowledge	The exchange (and/or manipulation) concerns *other Knowledge* and either refers to or uses the instrument
KTL	**T**utor-**L**earner-**K**nowledge in action	The exchange (or gesture) concerns the *Knowledge in action* without using or referring to the instrument
ITL	**I**nstrument-**T**utor-**L**earner-	The exchange and/or manipulation of the instrument without reference to any kind of *Knowledge*, or the misappropriation of the instrument
TLoK	**T**utor-**L**earner-**o**ther **K**nowledge	The exchange (and/or manipulation) between the Tutor and the Learner concerns *other Knowledge*
KIT	**K**nowledge in action-**I**nstrument-**T**utor	The Learner is absent; the Tutor acts alone on the instrument in relation to the Knowledge in action
IToK	**I**nstrument-**T**utor-**o**ther **K**nowledge	The Learner is absent; the Tutor acts alone on the instrument in relation to another knowledge
KT	**K**nowledge in action-**T**utor	The Learner is absent; the Tutor is preoccupied by the Knowledge in action
ToK	**T**utor-**o**ther **K**nowledge	The Learner is absent; the Tutor is preoccupied by other Knowledge
IT	**I**nstrument-**T**utor	The Learner is absent; the tutor uses the instrument without a specific purpose in mind or without aiming for any kind of knowledge
Behavior of the interactants which either characterizes some interaction time or is liable to change the interaction		
JA	Joint Attention	Learners observe a phenomenon in order to have a response.
CR	Collective Response	Several learners respond to the tutor's requests.
AA	Absence of attention or Disciplinary Problems	Learners respond noisily, disturbing the activity and/or interrupting the interaction linked to knowledge.
Interactions amongst learners		
IL	**I**nstrument-**L**earner	*Learners* use the instrument individually without collaborating or targeting any particular knowledge
LoK	**L**earner-**o**ther **K**nowledge	*Learners* act individually (without collaborating), concerning other knowledge or other activity
KL	**K**nowledge in action-**L**earner	*Learners* act individually (without collaborating) but remain preoccupied by the knowledge in action
ILoK	**I**nstrument-**L**earner-**o**ther **K**nowledge	*Learners* use the instrument individually (without communicating between themselves) concerning other Knowledge or another activity
KIL	**K**nowledge in action-**I**nstrument-**L**earner	*Learners* work individually without communicating between themselves but remain preoccupied by the knowledge in action and use the instrument
LLoK	**L**earner-**L**earner-**o**ther **K**nowledge	*Learners* exchange between themselves on *other Knowledge*.
ILL	**I**nstrument-**L**earner-**L**earner	*Learners* discuss the instrument (or handle it) with little concern for the *Knowledge in action*
KLL	**K**nowledge in action-**L**earner-**L**earner	*Learners* discuss amongst themselves the *Knowledge in action;* the *Instrument* is absent.
ILLoK	Instrument-**L**earner-**L**earner-**o**ther **K**nowledge	*Learners* use the instrument regarding *other Knowledge*.
KILL	**K**nowledge in action-**I**nstrument-**L**earner-**L**earner	*Learners* exchange on the knowledge in action by using the instrument.
KILLoK	**K**nowledge in action-**I**nstrument-**L**earner-**L**earner-**o**ther **K**nowledge	The model is only complete in activities targeting two types of "knowledge", e.g. the CLIL approach

Note that in this model the author has also identified an area entitled "other Knowledge" (coded as "oK"), which is not a misuse of the instrument in respect of Rabardel's meaning. It refers to the spontaneous knowledge which can be caused by the evolution of the interaction which is unrelated to the Knowledge in question within the activity, affected by the learning situation (e.g. questions asked by learners, cultural and linguistic factors, etc.).

This analysis model is anchored in Vygotsky's theory [25], which places the instrument and language (as fundamental aspects of cultural behavior) in the center of higher mental processes of the individual. This instrumental perspective has a major influence in the analysis of relationships between learners and artifacts and techniques.

This model also builds on the work of Bruner, notably regarding the approach, which is in the intersection of cognitive psychology and cultural psychology. This approach states that culture will provide the child with all the basics of cognitive development. According to Bruner, the development of intelligence is closely related to the construction of intentional behavior since intentions are related to culture ([15,16]).

Interaction plays a central role in this model, which was tested in the analysis of complex learning interactions in the school or home environments, with primary or secondary students. Activities were organized in small groups, in multicultural and multilingual contexts, with learning through mentoring or coaching situations mediated by computer.

Moreover, for the coding of interactions located in the various linguistic and cultural contexts (school and family), Ailincai cites the influence of Valsiner's developmental model [24]. In this model, the environment in which the child develops, the organization of physical and spatial resources, as well as the rules of life and prohibitions, depends on the culture to which the child belongs to. For Valsiner, the environment becomes a bearer of meaning that can guide the child's development. In this regard, adults play a fundamental role since the setting up of situations that allow interaction between the child and its environment is marked by the cultural background of these adults. Valsiner argues that the constraints under which the child develops are divided into environmental constraints (external to the child) and personal stress (physiological and psychological) that are unique to each.

Ailincai's *KITLoK* model focuses on this approach as environmental constraints and includes a physical dimension (e.g. educational materials) and a psychological dimension (e.g. educational styles of adults, instructions, regulations, prohibitions, uses).

4.1. Collected Data

The type of data collected throughout the experiment varied and partly comprised video recordings made during the two sessions. Three cameras were placed in the computer room to closely capture student activity, whether verbal or non-verbal. In order to be able to use such data for research purposes, it should be noted that a parental consent form was given to students before the start of the experiment.

The data also consisted of the computer traces generated by the *CoFFEE* software, which recorded the traces of interactions made during the sessions (via a sort of black box), apart from the functions available to users. Once analyzed, these traces show how the activities performed by the students (Figure 9).

Figure 9. Structured Chat, Environment Heading, Group 2

Translation of Figure 9: Structured Chat

1- Teacher: Deforestation isn't serious because there are many forests throughout the world
2–2 GM: yes but we continue to take away the forest which will be serious because the Amazonian is the lungs of the Earth
2.1 –Teacher: yes but we can then plant trees
2.1.1 – 2 GM: what with? If there aren't any more trees, there aren't any more seeds
2.1.2 – 2 because I can't eat game
2.2 – 2 GM: the forest it's important for Earth because the forest filters the air
2.3 – 2 GM: no it's not good because if we take all the good wood, these woods will become disappearing woods
3-2 GM: yes I am against because I don't like to see the dirty river; I would really like to see clear water
4-2 R and L: Because afterwards there might no longer be any food in the forest and animals are going to disappear and plants which heal us will disappear too.
4.1 – 2 GM: I don't want the baboons to die
5 – Teacher: We make beautiful furniture with exotic wood!

The students were made aware of the fact that their work was saved before using the software.

In addition, it is possible at any time to save (as an image file) the students' work from the teacher interface, in particular the argumentation graphs (Figure 10).

The video recordings were transcribed and coupled with the written work produced by the students (the arguments that appeared in the graphs). The transcripts were sorted as separate exchanges and coded according to the *KITLoK* grid previously presented in Table 1.

We considered that the exchange was about the Knowledge ("K") in action if the written or oral interventions from group members focused on the theme of "deforestation". If the exchange only focused on the handling of the instrument - including the software - or on other topics however, we considered this to be "other Knowledge" ("oK").

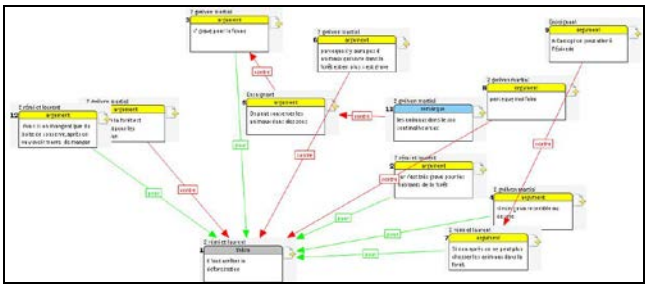

Figure 10. Argumentation graph, Group 2

Translation of Figure 10: Argumentation graph

1. thesis: we must stop deforestation
2. argument: because it's very serious for the inhabitants of the forest
3. argument: it's serious for the fauna
4. argument: If not it will look like a desert
5. argument: we can keep animals in zoos
6. argument: Because there won't be animals living in the forest and also it's serious
7. argument: if not afterwards we won't be able to hunt animals in the forest any more
8. argument: because I'm hungry
9. argument: In Camopi we can go to the grocer's shop
10. argument: impossible to read
11. remark: animals in zoos are sad
12. argument: If we only eat food in tins, we will be fed up with eating afterwards

5. Results and Discussions

By coding the data in accordance with the KITLoK model, we were able to produce a timeline of the activity.

In Figure 11 we show how the interactions unfolded for the three groups during the second session.

To facilitate the presentation of the data, from a vertical reading of the codes on the ordinate axis, we can distinguish the following:

- firstly, three large spaces: (1) the central part of the timeline, corresponding to space "n" for situations, which lack interaction or are difficult to code (joint attention, collective response, disciplinary problems); (2) the part above space "n" for interactions initiated by the tutor; and (3) the portion below the "n" space for interactive situations between students without the presence of the tutor.

- secondly, still on the ordinate axis, the codes unfold from space "n" towards the top and bottom of the chart, from the simplest interactive binary structure (speaker/knowledge or speaker/instrument), passing by the ternary structures to arrive at both ends of the chart and the most comprehensive interactive quaternary situations (at the top are the TLKI, TLoKI, situations initiated by the tutor; at the bottom are the LLKI / LLoKI interactive situations initiated by the learners).

A horizontal reading of the chart enables us to analyze, for each of the three groups identified by a different color (see the Key of Figure 11), the duration and type of interactive structure between minutes 30 and 90 on the abscissa axis.

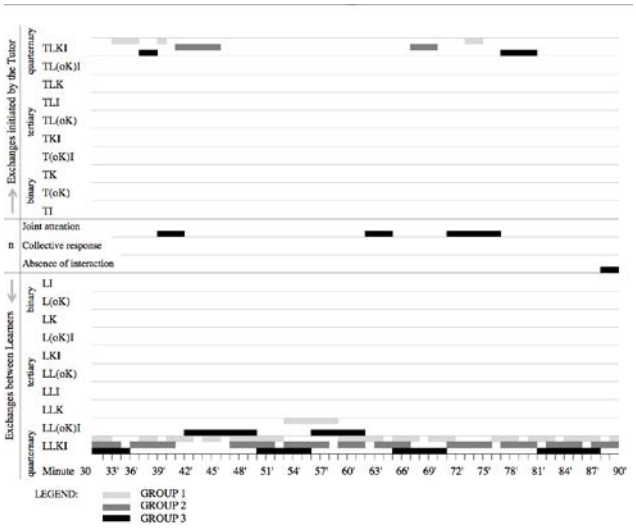

Figure 11. Timeline Graph showing the unfolding of interactions within the three groups between minutes 30 and 90 (in accordance with the KITLoK codes outlined in Table 1)

A first reading of the chart reveals that the three groups rapidly accepted the activity since exchanges within each group started at minute 30. This corresponds to the start of work within the sub-group, since the first 30 minutes had been dedicated to watching the film, reminding participants of how the software operates and launching the debate.

From examining the chart in its entirety, we can assume a comfortable use of the IT environment since the exchanges are mainly quaternary in structure – with four actants interacting - and initiated by learners, with the activity mainly taking place at the lower end of the chart, in the "learners" space.

The presence of the Knowledge at stake (in particular with regard to the arguments on the theme of deforestation) and the Instrument in almost all of the three groups' interactive structures, as well as joint attention, show that the students were working well autonomously.

A closer reading of the chart reveals disparities between the three groups in terms of the number and duration of the exchanges.

As such, Group 1, identified by the lightest color in the chart, appears to be the most productive in terms of "for and against" arguments within the debate: thirteen interactive structures initiated by students who put forward the same number of arguments, as well as two interactive structures initiated by the teacher. Moreover, the duration of the exchanges was relatively short which may indicate an element of responsiveness and/or quick acceptance by the group members to the arguments presented. In addition, this could be an indicator of the degree of control that the students had over the (computer and software) instrument.

The interactive structure of Group 2's activity was similar to that of the first group, being predominantly quaternary, initiated by students and thus situated at the bottom of the chart. The discussion was also interesting, although slightly less productive in terms of "for and against" arguments, with only twelve interactive structures compared to the sixteen produced by the first group. The interactions within this group lasted up to 6-7 minutes, longer than those of the first group, which can be explained by a longer time for reflection for stating the argument, for example, by disagreements within the group, or even by non-mastery of the instrument (the software in particular) which would necessitate a longer time for data entry.

The third group differed from the first two in terms of both the number and the type of the interactive situations used: only six exchanges were produced at the initiative of students. In addition, the transcripts revealed several "moments of reflection" within the group, without any output, which we coded as "joint attention" and a time of waiting, coded as "no interaction".

In terms of knowledge development, the KITLoK chart briefed us on both the themes of contributions, including the presence of the knowledge involved (which in this activity was deforestation), as well as the number of them. Reviewing the graphs (ex. Figure 10), which shows the argumentations as a whole, provides us with information whether an argumentation is simple or complex (the maximum number of interconnected boxes signify complexity and richness of an argument) [9]. The complexity of the argumentation here signifies that the boxes are connected not only to the initial thesis box but also other argument boxes. When the boxes are connected directly to the initial box, this signifies that the arguments put forward about the 'thesis' have not led to new arguments linked to one another.

In this sense, the students' outputs seem comparable to those obtained in a previous study in Paris ([10,11]).

The video recordings, however, show less activity with regard to the oral exchanges within the dyads.

The small number of oral interventions seems to confirm our previous assumptions:

-firstly, one might wonder about the influence that the parenting style of this sociocultural group might have on the interactive style of the students in class ([2,5,6]). Indeed, the indigenous students from the Oyapock River were described in our previous work as having a high degree of autonomy with their learning based on observation, imitation and manipulation ([5,19]).

- secondly, one possible explanation for this could be linguistic in nature. The fact that these Amerindian students possess only an average grasp of French (the language of their schooling) does not facilitate oral exchanges.

However, the large number of interactive structures within the chart may suggest the "compensatory" and challenging role of the instrument in relation to both the language of schooling and the interactive style of this

sociocultural group. In this sense, our starting point seems to be confirmed.

More specifically, students did not experience any particular difficulties regarding the functionality of the CoFFEE software. Conceptually, the development work relating to it, including graphs, was more difficult (labelling the argumentation boxes, connectors between boxes and orientation of the connectors), hence indicating a need for a training phase to gain ownership of the software.

In terms of the specific debate mediated by computer, this experience seems to have had a positive impact on the students who committed themselves with great enthusiasm to this activity. There is of course the "novelty effect" of the situation at play here too: new faces in the classroom (namely the two researchers), new ways of working, a new support activity and so forth, but this only tells part of the story.

Concerning the language used throughout the activity, conversations within pairs were made in the mother tongue, which is not surprising given the fact that the students were Amerindian. Exchanges between pairs (that could be overheard by stakeholders) were made mainly in French, the language shared by all of the students.

6. Conclusion

The experiment presented in this paper focuses more specifically on the impact of the use of software on the written work produced by students during an argumentation. Being an Amerindian audience with particular linguistic and cultural characteristics (including an interactive style based on autonomy, observation and imitation), it seemed difficult to set up a "classic" face-to-face argumentation. We assumed that the use of a computer interface (the CoFFEE software) could facilitate exchanges within an argumentation. Firstly, using a computer would lessen the effect of confrontation of arguments, which seems to be the opposite of the students' educational practices. Secondly, this method would allow for the building up of knowledge (argumentation graphs) in a way that would better reflect their interactive style (autonomy, discretion, time for reflection).

The different analysis criteria enabled us to account for, both qualitatively and quantitatively, the richness, depth and scope of the debate expressed by the students during the activity.

At the end of the original activity, even though we cannot say what the effects on students in terms of ownership of knowledge were, we are however able to put forward several hypotheses based on the unprecedented nature of the activity.

This specific working environment (that we described here) encourages students to reflect and discuss together the shared task they have to carry out. The teacher here no longer dispenses knowledge but instead organizes, implements and regulates what is happening. It is therefore not a question of learning from what already exists (for example, from textbooks, with which students are most familiar). Instead, students create and develop, individually and with others, "an object of knowledge", the construction of which will gradually feed the production process. This object, the discussion graph, will in fact represent progress on their thoughts whilst playing the role of the instrument, which they will rely upon to produce new knowledge.

Students will therefore learn from each other via a process of co-construction of knowledge through discussion activities. In addition, they will also simply learn to discuss which, as we have seen, contributes to fulfilment.

From this point of view, the operating method of small discussion groups seems conducive to encouraging all students to speak.

Finally, in terms of language, the multiplicity of different communicative methods (speaking, listening, reading and writing) and their necessary linkage are likely to contribute to the development and proficiency of the French language among students.

Given the results, our initial hypothesis seems to be supported: even if the oral contributions made by this class were modest (something that could be explained by the socio-linguistic characteristics of this group), the written work was however satisfactory. Indeed, the results obtained are as rich as those produced by a different socio-cultural group, who participated in a similar experiment and whose mother tongue was French ([10,11]).

We end this paper by stating some key points on how the teacher should implement this type of teaching/learning situation in the classroom. Admittedly, any educational activity that makes use of IT environments is more difficult to put in place because of technological requirements, moreover argumentation activities are more natural when they are done face-to-face. Furthermore, both the handling of the CoFFEE software and the design of the activity sessions require personal investment at the start from any teacher who wishes to use it in his/her class. There is also the question of the role of the teacher during the activity, since the teaching situation put in place requires teacher intervention on two fronts: (1) from behind the screen in order to coordinate the work session via the software control interface and (2) with the students themselves in order to regulate the argumentation activity or to resolve any technical issues ([13,14]).

Finally, we would like to underline the importance of the instrument (in this case, the CoFFEE software via a computer) in learning situations. The instrument seems to be an effective way to trigger learner output and helps to reduce certain distances between the learners and knowledge. This tool also facilitates communication and learning, especially in a multilingual and multicultural context.

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