HAL
open science

Analyzing Exploratory Talk as a Socio-Cognitive Practice: Identity, Group Argumentation, and Class Debate Quality

Claire Polo, Kristine Lund, Christian Plantin, Gerald Niccolai

To cite this version:

Claire Polo, Kristine Lund, Christian Plantin, Gerald Niccolai. Analyzing Exploratory Talk as a Socio-Cognitive Practice: Identity, Group Argumentation, and Class Debate Quality. 2015. hal-01208319

HAL Id: hal-01208319

https://hal.science/hal-01208319v1

Preprint submitted on 2 Oct 2015

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Analyzing Exploratory Talk as a Socio-Cognitive Practice: Identity, Group Argumentation, and Class Debate Quality.

Claire Polo, Kristine Lund, Christian Plantin, Gerald P. Niccolai

ICAR Laboratory

Abstract: This paper addresses the appraisal of the quality of student debate about a socio-scientific issue, with a focus on the interactional factor. The "scientific café" pedagogical situation offers an opportunity for observing the circulation of arguments from small group to class-level debate, indicating the quality of group reasoning.

We use Mercer and Wegerif's typology of student *talk* (*exploratory*, *cumulative*, *disputational*) and study the attitude toward self-identity needed to engage in *exploratory talk*. Such a positioning is conceptualized as being associated to specific politeness rules and face-preservation system. Three case studies held in an American and a French high schools explore the boundaries between those 3 categories and questions which units of analysis are relevant for assessing students' argumentation.

The paper provides methodological tools to apply this typology to authentic students' interactions, where students' engagement in a specific group talk type is both a matter of cognitive skills and perceived relevancy in a given social context. We propose a refinement of the analytical categories that allows studying students' argumentation at different time scales (interactional phase, sequence, subsequence) and social levels (*group talk*, individual *self-identity footing*, and repercussions on class debate).

Keywords: argumentation, collaborative learning, exploratory talk, face-work, group cognition.

Introduction

Literature in education research raises the role of argumentation among students both for learning new concepts and as a key skill to develop (e.g. Andriessen, Baker, Suthers, 2003; De Vries, Lund, Baker, 2002; Driver, Newton, Osborne, 2000; Erduran & Jiménez-Aleixandre, 2007; Weinberger & Fischer, 2006). Argumentation is considered as a way to learn new knowledge by fostering socio-cognitive conflict based on intersubjective dissonance (Roschelle & Teasley, 1995). Moreover, having the students debate with their peers in the classroom is also promoted as an exercise necessary to their enculturation into the scientific world, perceived as specific community of practice (Lehrer & Schauble, 2006, Lave & Wenger, 1991, Bisault, Rebiffé, Lavarde, & Fontaine, 2000). Such a perspective emphasizes students' understanding of scientific progress as a result of solving scientific controversies and leads to bring frontier science topics and socio-scientific issues to the classroom (e. g. Driver et al., 2000).

The special attention paid in science education to didactical developments on how to address socio-scientific issues meets concerns of citizenship education. They can be defined as social controversies involving techno-scientific knowledge as well as values, emotions and interests (e.g. Aikenhead, 1992; Albe, 2006; Gayford, 2002; Kolsto, 2001; Simonneaux & Simonneaux, 2009; Zeidler, Sadler, Simmons, Howes, 2005). The democratic participation of all the citizens to public debate requires training about how is knowledge produced, communicated and evaluated (Jimenez-Aleixandre, Diaz de Busturia, 2008: 68). These trends result in developing debate activities about socio-scientific issues inside and outside the classroom.

Nevertheless, little is known about how to assess the quality of student debates on socio-scientific issues, and some teachers are still reluctant to engage in such activities that may lead to empty fights of opinions (Albe, 2009). Many studies provide a structural assessment of students' discourse based on Toulmin (1958)'s pattern of an argument. In this perspective, the quality of one argument corresponds to the extent to which it combines more or less complex elements justifying and specifying a given claim (e. g. Clark & Sampson, 2007). But such approaches, focusing on explicit explanation of one's reasoning, take little account of the dialogic nature of oral argumentation. Still, some structural components, called *rebuttals*, which correspond to anticipations of potential counter-arguments, are interesting for their dialogic perspective, and are generally considered as indicators of high quality argumentation. Besides, most studies agree that four factors influence the quality of debates about a socio-scientific issue: the degree of students' knowledge about the topic (e.g. Lewis & Leach, 2006), their understanding of the controversial and interdisciplinary nature of the issue (e.g. Driver, Leach,

Millar, Scott, 1996), students' epistemic values (e.g. Désautels & Larochelle, 1998; Sandoval, 2005), and the quality of students' interactions during group debates (e.g. Mercer, 1996; Albe, 2006).

This paper contributes to a better understanding of this last interactional factor, which is key for studying group cognition during argumentation. It consists of two detailed case studies based on videotaped data of groups of students debating about drinking water management in a semi-formal educational setting, the junior "scientific café", an extra-curricular activity held at school.

In the first section, we first describe our theoretical background, which associates conceptual tools from research on science education, collaborative learning, argumentation studies and interactional linguistics. This interdisciplinary focus allows us specify Mercer's object of analysis, the group talk as a mirror of group reasoning (1996) not only as a cognitive process, but also as a social practice involving specific structuring rules. In the second section, we present the methodology that we have developed to operationalize Mercer's theory into 5 indicators of group talk. The last section, through three empirical case studies held in the USA and France, proposes pedagogical and methodological questions. On the methodological side, this section pinpoints the need to diversify the units of analysis and refine Mercer's categories into different time scales and social levels. On the pedagogical side, these deeper microanalyses question the boundaries between the different types of group talk, and their functions for learning. We also problematize transition processes that specify students' discursive activity when they are on their way to *exploratory talk*, generally considered of higher educational value, and the matter of designing a pedagogical setting helping the students find such a talk relevant to the situation.

Theoretical background

In this section, we first present the general focus on group talk quality as an object of interest for the research on collaborative learning and the implications of such perspective, which tries to address cognition processes at the group level. In a second subsection, we detail the main categories that we use in this paper, Mercer and Wegerif's typology of talk into *cumulative*, *disputational* and *exploratory*. In a last subsection, we introduce linguistics' conceptual tools useful to complete this approach, coming from interactional linguistics and argumentation studies (*face-work*, *politeness system*, *argumentative politeness*).

Collaborative Learning, Group Cognition and Valuable Group Talk

Research on collaborative learning studies group argumentation as a way to deepen understanding of phenomena and learn in a diversity of settings (school, workplace, informal education, etc). Such a focus led to

consider the group as a cognitive unit distinct from the sum of the participating individuals and to question the specific factors determining successful group reasoning (e. g. Stahl, 2002, 2005, 2006). A large part of the studies of group reasoning are based on an analysis of group discussion features. For instance, Simon and her co-workers studied the topical exploration procedures used by a group of students in the science classroom (Simon, Erduran, Osborne, 2002).

Such concern gave rise to the definition of specific types of talk in the classroom considered of high educational value: (a) 'academically productive talk' in interactions involving both the students and the teacher (e. g. Adamson & Rosé, 2013; Dyke, Adamson, Howley, & Penstein Rosé, 2012), (b) 'accountable talk', emphasizing that any assertion must be easily justified, (e. g. Alexander, 2010 ; Michaels, O'Connor, & Resnick, 2008 ; Michaels, O'Connor, Hall, & Resnick, 2002 ; Michaels, O'Connor, Sohmer, & Resnick, 1992), (c) 'collaborative argumentation', focusing on collaboration dynamics (Nussbaum, Sinatra, Poliquin, 2008), (d) 'co-constructive, critical argumentation', insisting on the social attitude in small groups fostering debate advancement, (Asterhan, 2013). One of the first authors to define a specific talk valuable for learning in small groups are Mercer and Wegerif, in the context of the mathematics classroom, referred to as *exploratory talk* (Mercer, 1996; Wegerif and Mercer, 1997). They distinguished it from two other types of talk of less educational value: *cumulative talk* and *disputational talk*. This paper is mainly based on those categories, which have been successfully adapted to other contexts, especially to socio-scientific debates (Albe, 2006, Lewis & Leach, 2006).

A Typology of Talk to Describe Groups' Activity in the Science Classroom

Mercer assumes that "quality as a social mode of thinking" (Mercer, 1996: 359) is visible through some patterns of students' talk. He defines *exploratory talk*, corresponding to a special group reasoning of high educational value, as follows:

> First it is talk in which partners present ideas as clearly and as explicitly as necessary for them to become shared and jointly evaluated. Second, it is talk in which partners reason together – problems are jointly analyzed, possible explanations are compared, joint decisions are reached. From an observer's point of view, their reasoning is visible in the talk. (Mercer, op. cit.: 363)

When the concept of 'exploratory talk' is used to analyze argumentation about socio-scientific issues, authors do not emphasize consensus building but rather insist upon the quality of students' understanding of alternative viewpoints, building up complex dialogic arguments (Albe, 2006, Lewis and Leach, 2006).

Nevertheless, Mercer observes that in the classroom, the students often fail in engaging in exploratory talk, and rather develop *cumulative* or *disputational talk*. *Disputational talk* is "characterized by disagreement and individualized decision making" and is embodied in "short exchanges consisting of assertions and counter-assertions", with no supporting justification. On the opposite, *cumulative talk* refers to a discussion in which "speakers build positively but uncritically on what the other has said". Typically, it involves many "repetitions, confirmations and elaborations" (Mercer, op. cit.: 369).

An interesting aspect of this typology is that these 3 types of talk are related to 3 types of recognition the students might expect, corresponding to what they base their self-identity on:

> In exploratory talk (…) the 'yes' of cumulative talk and the 'no' of disputational talk move almost instantly, with only the briefest hesitation, to the construction of different kinds of self-identity. The first constructs and maintains self-identity as in solidarity with the physically present group while the second constructs individual self-identity in opposition to others. Exploratory talk, on the other hand, does not appear to imply or require a specific form of identity commitment. By engaging in exploratory talk, participants maintain a psychological detachment both from themselves as individuals and from the group. (...) In exploratory talk, then, one ultimately identifies neither with one's own self nor with a group but rather with the dialogue. (Wegerif & Mercer, 1997: 54-56)

In this paper, we refer to these different attitudes toward self-identity adopted by the students at the individual level as *competitive footing* in the case of *disputational talk*, *consensual footing* in the case of *cumulative talk*, and *constructively-critical footing* in the case of *exploratory talk*. The term "footing" comes from interactional linguistics, more specifically Goffman's analysis of talk (1981), and corresponds to the changing roles an individual displays during a conversation, by more or less insisting in different aspects of his social, institutional or interactional identity.

In order to foster engagement into *exploratory talk*, authors emphasize some 'ground rules' to be established in the classroom:

This is talk in which:

- all relevant information is shared;
- everyone in the group is encouraged to speak by other group members;
- opinions and ideas are respected and considered;
- everyone is asked to make their reasons clear;
- challenges are accepted;
- challenges and alternatives are made explicit and are negotiated;
- alternatives are discussed before a decision is taken;
- the group seeks to reach agreement before taking a decision or acting
- the group takes responsibility for decisions

(Fernández, Wegerif, Mercer, Rojas-Drummond, 2002: 43 ; Wegerif, Littleton, Dawes, Mercer, 2004: 144 ; Mercer & Sams, 2006: 512)

These principles are consistent with the four indicators of productive argumentation mentioned by Asterhan:

> general willingness to listen and critically examine all the different ideas […]
> willingness to make concessions in response to persuasive arguments […]
> an atmosphere that is characterized by collaboration and mutual respect […]
> the activity is perceived as a competition between ideas and not between the individuals
> (Asterhan, 2013: 254)

Such rules show a great concern to ensure social recognition of each member of the group in a way that fosters adoption of 'constructively critical' self-identity footing, necessary to engage in *exploratory talk*.

Disagreeing and The Matter of Face Preservation: Insights from Linguistics

We find helpful to use insights from linguistics to understand students' choice of a given self-identity footing, more or less likely to contribute to the group's engagement into a given type of talk. Two research traditions bring interesting conceptual tools to this question: interactional linguistics and argumentation analysis. One of the key results of interactional linguistics is showing that politeness rules largely structure interactions. Politeness is then defined as anything that someone does to make sure to preserve his own and others' face, or

positive social value, in the interaction (Goffman, 1974: 15). Generally, linguistic politeness implies a preference for agreement over disagreement (Brown & Levinson, 1988). Explicit thematization of disagreement that characterizes argumentative interactions makes them very different from ordinary conversations. While interactions are usually more relation-centered then object-centered, when a topic is very important to the speakers, they might render explicit their disagreement and move to a more object-centered interaction (Traverso, 1999). Keefer and his colleagues refer to these two types of interaction with a similar vocabulary, distinguishing 'issue-driven' and 'position-driven' discussions (Keefer, Zeitz, Resnick, 2000).

In argumentation studies, it has been claimed that argumentative context does not correspond to a breaking of the general politeness rules, but rather to the shift to another politeness system, with adapted rules giving way to the thematization, deepening and justification of disagreement. Then, from an emic perspective focusing on participants' viewpoint, expressing disagreement is not considered as a dispreferred move (Pomerantz, 1984). In this specific context of argumentative interactions, one is expected to criticize others' argument, for instance, and therefore doing so is not displaying impoliteness (Plantin, in press: 369).

When debating in groups, the students must chose the appropriate politeness system, which can be problematic because the situation is similar to ordinary conversation with peers, but is also constrained by the didactical demand to argue. We claim that the way they finally seek face preservation leads them to choose a specific self-identity footing, which is decisive for the type of talk the group gets engaged into (as summarized in table 1). In *cumulative talk*, face-preservation relies on not thematizing disagreement and adoption of a *consensual* footing, as it works in ordinary conversation: no one needs to face individual challenges. On the contrary, in *disputational talk*, each student's face is strongly attached to his own ideas and their victory over others' ideas, corresponding to individual competitive footing. What is very special to exploratory talk is that the matter of face preservation is transferred to the group level, as it is associated with group achievement. Individual challenges are permitted as long as they contribute to the construction of better arguments considered as the group property, a source of pride of each member. When this need for recognition is satisfied, a constructively critical footing can be used, and focus can shift from the relational to the cognitive dimension of the interaction.

Table 1

Correspondence between group talk, self-identity and face-preservation system

	Group talk		
	Cumulative	Exploratory	Disputational
Self-identity footing	consensual	constructively critical	competitive
Face-preservation system	preserving consensus by not thematizing disagreement	focusing on group achievement	searching victory of one's own ideas upon others'

Methodology

In this section, we present the pedagogical situation and the analytical tools we developed to operationalize Mercer and Wegerif' typology of talk.

Pedagogical situation

The pedagogical situation is a scientific café about drinking water management, co-designed by the ICAR research laboratory and a French non-profit specialized in informal science education. It was implemented and videotaped in Mexico, the US and France (Polo, 2014: 83-106). This paper presents 3 case studies based on 2 *cafés* held at the high school level in May 2012, in Wisconsin (USA) and in Lyon (France).

The students are in groups of 3 or 4 around a table. The activity (110 minutes long in France, 90 minutes long in the US) is organized around a multiple-choice questionnaire and oriented towards a main question. The students are first asked to answer the main question individually with anonymous electronic devices. Then, three subtopics are explored, providing students with basic information. Each subtopic ends with a socio-scientific type question, called an "opinion question". When an opinion question is asked, the students must discuss it at their table and chose one answer for the group (3 minutes). This collective vote is made public and then a classroom debate begins (5 to 10 minutes). Finally, each student votes electronically and individually on the opinion question. At the end of the activity, the main question is asked again and the students then follow the four steps used for all the opinion questions (group debate, group vote, class-debate, individual vote).

The data analyzed here correspond to group debate phases on the first opinion question (case 1), the third opinion question (case 2) and the main question (case 3). Even if our analysis is focused on students' argumentation in small groups, we will also use short extracts of the class-level debate that follows a given group talk phasis. Indeed, the contributions made by members of a group to the class debate allow us to assess

the outcomes of the previous group discussion. This is one of the indicators that we developed and used to analyze students' group talk. We detail these indicators in the next section.

Analytical tools

We operationalized Mercer and Wegerif's concepts into 5 indicators of group talk:

1. The fact that each assertion accepting or rejecting an argument or an option is or is not supported by a justification, since *exploratory talk* occurs when "challenges are justified and alternative hypotheses are offered" (Mercer, 1996: 369). We assume that the justification can be produced by the student who makes the assertion or by another group member, spontaneously or after the idea has been challenged.

2. Whether or not conversational turns follow one another with students engaging "with each other's ideas" (op. cit.: 369) and elaborating on the basis of the argumentative content of prior turns.

3. If options and arguments are truly explored, "analyzed", and "compared" (Mercer, 1996: 363), and "critically but constructively" appraised (op. cit.: 369) before being abandoned.

4. The nature of the decision-making process. With or without consensus, do the students attempt to have every member of the group agree on the collective vote, trying to reach a "joint decision" (Mercer, 1996: 363)?

5. The extent to which the whole group feels "responsible" for the decision made (op. cit.: 371). In the context of our study, this means that any of the group members can report any argument developed during the group discussion to the class-debate, and not only his own contributions. This 5th indicator provides essential insight on how the three levels of learning relate. On one hand, exploratory talk is then defined by subsequent individual high quality contributions corresponding to complex dialogic arguments taking into account counter-discourses and supporting discourses previously held during the group debate. On the other hand, the transfer of group ideas to the class level debate works as a motivation for the group debate and an institutionalization scene for resulting arguments.

Exploratory talk is considered achieved when the five indicators are positive. But what happens when some but not all the indicators are positive? Can we then specify features of *disputational* or *cumulative talk*? How do they relate to exploratory talk and inform the self-identity footings that foster high-quality debates?

What happens when a discussion phase is not typical of any single type of talk? How do those atypical cases inform us about the relations between the 3 types of talk and the way analyses can be refined?

Such issues are addressed throughout the following two case studies.

Analyses and Interpretation

These analytical tools helped identify *exploratory talk* sequences among Mexican, American and French students (Polo, 2014: 123-155). Nevertheless, we also observed students engaging in *cumulative talk*, especially in the US corpus (6 cases out of 18). The first case presented here is emblematic of this type of talk. In the second subsection, we show another case corresponding to the same group of students engaging in *exploratory talk*. We then discuss the conceptual implications of confronting these two first case studies. For the third case, the whole discussion cannot be categorized into a type of group talk at a first sight, as it shows both features of *exploratory* and *disputational talk*. We detail how the empirical study led us to refine the analyses at different time scales, in order to better understand the students' activity. Both cases are interesting for questioning the boundaries between the three types of group talk and specifying their functions, not only as cognitive activities but also as social practices.

Large transcripts are provided for each case study, which serves as a basis for analysis. The proposed interpretation, based on the 5 indicators of group talk, is systematically grounded in precise references to students' discourse. This methodology is typical of qualitative discourse analysis, and relies on a great transparency that allows the reader to directly assess the analysis process as it is presented (Freshwater, Cahill, Walsh and Muncey, 2010).

Case 1: *cumulative talk* and reluctance to challenge others' ideas limiting exploration

In this first case study, we present an emblematic example of *cumulative talk* from an American high school, and discuss the nature of such talk regarding how self-identity is related to the group dynamics and how it differs from *exploratory talk*.

A clear case of *cumulative talk*

Louise, Pamela, Kelly and Sabrina are discussing the first opinion question, about the promising potential sources of drinking water for the future (cf. figure 1). Their dialogue is transcribed below[1].

1. LOU i think it's B\
2. SAB cause I feel like people waste a lot of water
3. KEL yeah [xxx
4. SAB [like washing their dishes like before they put them in the dishwasher like brushing your teeth, [showering
5. KEL [or showers

6. PAM showers [yes

7. KEL [they take long (.) showers

8. SAB <((nodding head in the affirmative)) uhuh>

9. LOU or just like other stuff

10. PAM people like when they brush their teeth (.) they leave the water running or like when you wash your face or whatever

11. SAB <((nodding head in the affirmative)) uhuh>

12. KEL ((nods head in the affirmative))

13. LOU or people that like throw away bottled water [or half the time it's like it's not even finished and they'll just throw it away&

14. KEL [<((nodding head in the affirmative)) yeah>

15. LOU &so I think it's B

16. SAB or they dump it out on the sidewalks

17. KEL or like washing your car

18. PAM yea[h:

19. LOU [oh yeah

20. KEL and then all the chemicals in it go in the grass (.) which is not good

21. LOU ((laughs))

22. LOU so do we agree on B/

23. KEL B\

24. PAM put B on the thing

25. SAB ((puts letter B on the stand))

Only option B is considered, proposed by Louise at turn 1. There is neither opposition nor verbal appraisal, but the other girls ratify the proposition by nodding their heads and by giving subsequent examples and elaborating on them. Even if they all agree, the decision process is made explicit and the students show great concern in making sure that everybody is consulted before voting (from turn 22). Indicators 1, 2 and 4 are therefore positive.

What is obviously missing is indicator 3: the students are not being critical about what each other says, even though some assertions are less relevant to the question being debated, such as turn 19 (switching to a general

discussion on non-environmental friendly practices). This is typical of *cumulative talk*: Lewis and Leach (2006: 1283) already noticed that it differs from *exploratory talk* on students not being "constructively critical", not "challeng[ing] ideas" or "consider[ing] alternative viewpoints".

Let's have a look at indicator 5. During the following class-debate, only one contribution is made from this small group:

SAB because we waste a lot of water like in the shower and like washing your face

Here Sabrina only repeats her own example. She does not enrich her discourse from ideas shared by other members of the group during the previous debate, indicator 5 is therefore negative.

Consensual footing and *exploration* limited to the non-controversial side of the issue

Even though the students are not engaged in *exploratory talk* here, they are doing argumentation. They are involved in a classical rhetorical process based on induction, building up arguments from examples (e.g. Amossy, 2000: 133-139). Therefore, what we understand here as a rich argumentative activity only differs from *exploratory talk* due to a limitation to one dimension of the space of debate, corresponding to its uncontroversial side. *Cumulative talk* can be defined as a consensual *exploration* limited to one alternative of the answer to the general argumentative question. In this case, students focus on common examples of environmental education that confine the discussion to a *doxa* they are all familiar with and they therefore easily agree on (Amossy, 2006: 36-37).

Group harmony seems more important to them then creating strong arguments to support their view during the following class-debate: each student displays a *consensual footing*. The interaction is more relation-centered than object-centered, or issue-driven, which is typical of daily ordinary conversation (Traverso, 1999). The politeness system the students are using ensure each other's recognition through the usual preference for agreement over disagreement (Brown & Levinson, 1988).

Later during the café, the same group of students successfully engages in exploratory talk, when discussing another opinion question. This case of emblematic exploratory talk is presented in the next sub-section.

Case 2: emblematic case of *exploratory talk* and group talk as a social practice

An emblematic case of *exploratory talk*

The same four girls are now debating about the third opinion question, about how the price of drinking water should be determined. They mainly focus on two rival options: drinking water should be priced depending on its quality (item C) and drinking water should be sold at a price depending on family income (item D) (cf. figure 2). The dialogue at their table is transcribed below, including the discourse of the first moderator (MO1) occurring, at the class level, when the group takes it into account:

1. LOU er: i think it should be priced by its quality because if [you'd have better quality it's just more work to like x it\
2. KEL [((nodding head in the affirmative, looking at Louise))
3. KEL em: there's more [production <((turning hands)) for it to>
4. LOU [((turning hands))
5. LOU yeah\
6. KEL yeah\
7. KEL [em:
8. SAB [and what about (.) family income/ [you need water\
9. PAM [yeah i also think D too 'cause like i don't think like less fortunate people should be (.) punished like you know what i mean like because they don't have money they pay for water they shouldn't (.) [not get water
10. LOU [yeah:
11. SAB [xx time it's not their (fault)=
12. LOU =they could like they could overu:se like they could (.) not pay as much and [<((turning hands)) get more water>&
13. PAM [and take advantage of that yeah: it's true
14. LOU &take advantage of it\ (.) when like it should be [<((swinging hands)) equal for all people>&
15. KEL [((nodding head in the affirmative))
16. LOU &you know what i mean/ 'cause like in like it's their fault that they are (.) poor\ in a way because they could go find a job but they didn’t like you know what i mean/

17. PAM yeah

18. LOU like i think it should be equal among everyone\

(3.8)

19. KEL er:

20. LOU er: i would say C but what are you guys [saying/

21. SAB [what did you x the quality that was

22. LOU like [in a xxx water

23. KEL [that's bad water or [the water

24. LOU [xxx water is like more expensive than our like (gross) water which is more expensive than like

25. LOU [((shrugs))

26. KEL [it's because like it's like [processed more and like

27. LOU [xxx water\

28. SAB [((nodding head in the affirmative))

29. LOU it's processed more [and

30. SAB [yeah\ i think it's either C or D\

31. LOU it actually takes work to go like get it and find out xx

32. MO1 okay so: [if you guys actually wanna pull up your letter now/ let's get started

33. SAB [maybe C AND D\ 'cause like

34. PAM just pu- just put C:\

35. SAB ((taking card C))

36. KEL put D\ no put C

37. MO1 you guys put your letters [up xx\

38. SAB [what/

39. KEL i don't know:\ (0.8)

40. SAB [we should put

41. PAM [just put C and i'll explain like why we think D too\

42. KEL yeah:\

43. SAB <((putting card C)) well i'm putting C\>

44. LOU C\

The two options, when suggested, are immediately justified. At turn 3, Louise gives a reason for choosing C (quality-dependent pricing): '*if you'd have better quality it's just more work'*. Similarly, at turn 8, Sabrina justifies option D (family income-dependent pricing): *'you need water'*. When approving the proposition of voting D, Pamela does not only express agreement but she also elaborates a justification for supporting it: *'i don't think like less fortunate people should be (.) punished like you know what i mean like because they don't have money they pay for water they shouldn't (.) not get water'*. Such justifications are based on fundamental norms or values: on the one hand the merit ideal and a fair retribution of work (option C); on another hand the right to satisfaction of fundamental needs and the social justice ideal (option D). In this last perspective, the concept of merit is reversed in a contradictory argumentative direction, implying that poor people must not be "punished" for their socio-economical status. At refuting, the students also show a great use of justifications. When Louise counter-argues option D, she gives 3 reasons for it: 1) arguing in reference to potential consequences of this proposition, about the risk of abusing one's privilege of having access to cheap water ('*they could overu:se'*, turn 12) ; 2) reversing Pamela's argument, by asserting that poor people are actually responsible for their economical status: '*it's their fault that they are (.) poor\ in a way'* (turn 16) ; 3) substituting absolute equity to social equity as an ideal of justice, using and repeating as a motto (turns 14 to 18) : '*it should be equal among everyone'*. At the end of the day, indicator 1 is highly positive: all propositions and refutations are justified.

This discussion also presents features of *exploratory talk* according to criteria 2 (reasoning together) and 3 (critical examination). When she counter-argues, Louise takes time to truly consider and evaluate the rival proposition before going back to her own (indicator 3). Kelly co-constructs with Louise a justification to her proposition made at turn 2 (turns 3-6), and reformulates it at turn 26 ('*it's like processed more'*), before Louise reuses it in a new dual move (turns 27 to 32). Such collaboration not only shows common reasoning (indicator 2) but also a circulation of ideas among the students, even before the class debate starts (indicator 5). Pamela also behaves in conformity with indicators 2 and 3: she tries to understand others' arguments and takes part in their elaboration, even if she does not agree with the corresponding proposition. For instance, at turn 13, she completes Louise's sentence despite the fact that Louise is counter-arguing her own proposition. Here, her evaluation '*it's true'* is ambiguous: it is difficult to know whether it corresponds to a concession or to an expression of an opinion change about the proposition under discussion. Sabrina also engages in exploring option C, even if she does not want to choose it, from turn 21 and onwards, by prompting Louise and Kelly to

specify their reasons to select it. She positively evaluates their justification at turns 28-30, but, when the moderator announces that it is the time to vote, Sabrina shows that, even if she is ready to accept option C, she is still convinced about her initial choice: « *maybe C AND D* » (turn 33).

Then, despite time pressure, the four girls make a lot of effort to get everybody's consent in the voting decision process (indicator 4). At turn 20, Louise explicitly asks others to express their opinion. Sabrina tries to reconcile the diverging views by suggesting voting for two options, going against the rules of the game. Then Pamela acts as what is called in argumentation studies a *third party* (i.e. Plantin, 2005: 78), temporarily stepping away from her own opinion and working as a facilitator of the group collaboration. She does so when she proposes an alternative to both follow the rule of the *café* and ensure that all the opinions are considered: choosing C, the option they all agree on, and taking the personal responsibility for also defending option D during the class debate (turn 41). The other students ratify this decision at turns 42-44, Sabrina even voicing the action that she is doing when she puts letter C on the stand.

What about the last indicator? Below is the transcript of the group contribution to the class debate, initiated by the first moderator:

1. MO1 and why did you guys chose C instead of B/
2. PAM we thought like C and B because: what we
3. SAB °D\°
4. KEL °D\°
5. PAM oh yeah C and D because em: like we chose C because em:
6. LOU ((laughs))
7. PAM like (0.9) <((opening hands, turned to the sky)) oh i can't really explain> <((hands back to the table)) but like (0.5) however like like however like much time it's putting like (0.3) prod- like producing the water/ should be like (1.0) sold at a higher price like if it's like more better quality it should be sold at a higher price but if it's just (0.5) <((skeptical face)) regular water [i guess>&
8. LOU [((laughs))
9. PAM &like it should just be (0.7) like affordable\ and then we (0.2) thought D too because em: we thought that like less fortunate families shouldn't be like (0.5) punished not really punished but shouldn't like (.) have like a: <((moving hands)) lack of water> because (.) of

like their jobs or whatever [their income

10. SAB [because it's not always&

11. MO1 [their income/

12. PAM [yeah\

13. SAB &their fault that they're poor and then some people like inherit money/

14. MO1 hum hum\

15. SAB so like (.) why should they get (0.4) the: like (2.1)

16. MO1 yeah\ [that's a good x\ and you guys had a different view/

17. SAB [yeah\

18. T2 ((laugh))

Here, indicator 5 is highly positive. All the girls seem to feel responsible for the different ideas expressed at their table. The ideas actually 'traveled' from individual contributions to group reasoning and finally complex dialogic were arguments expressed at the class level.

Pamela starts by mistaking, saying B instead of D. The other members of the group then help her at turn 3-4, showing great concern about what is going to be said in their common name. Nevertheless, they also display confidence in Pamela's ability to develop the group ideas. Even if she is hesitating, pausing for long periods, nobody interrupts her, neither do they try to answer in her place. Pamela proves capable of explaining her own arguments, about how unfair would be to punish poor people for being poor (« *shouldn't be like (0.5) punished* »), as well as others' arguments, like the fact that producing water of better quality requires more work (« *however like much time it's putting like (0.3) prod- like producing the water* »). In terms of learning outcomes, she gained both a new idea and the whole reasoning supporting it.

It is only once Pamela has finished that Sabrina takes the floor, to complete Pamela's discourse with another element. The sentence « *it is not their fault* » (turns 10 to 13), and the example of inheritance are counter-arguments to the refutation of option D previously justified by Louise (« *it's their fault that they are (.) poor\ in a way* », turn 16). In the vocabulary of Toulmin's Pattern of an Argument (Toulmin, 1958, Clark & Sampson, 2007), Pamela and Sabrina here co-construct a *rebuttal*, an element emblematic of the most complex level of arguments. This contribution to the class debate shows that the girls enriched their reasoning by taking into account potential refutations.

Finally, collective laughing at their table at turn 18 seems to be a group reaction to Sabrina's long pause and subsequent shared tension, indicating that the four students experience relief when the moderator finally turns to another group.

Contextual relevancy and engaging in group talk as a social practice

Confronting case 1 and case 2, we can see that engaging in a specific type of group talk is not only a matter of cognitive skills. In case 2, the four students show that they are able to engage in exploratory talk. But they did not in the first opinion question, which they treated by *cumulative talk*. As a result, we claim that engaging in an educationally valuable talk should not only be considered as a cognitive process but also as a social practice in itself, more or less contextually relevant to the participants.

In case 1, the students have an understanding of the activity as a consensual display of their knowledge of usual environmental friendly discourse. They adopt the corresponding self-identity footing at the individual level, seeking face-preservation through group consensus and disagreement avoidance.

In case 2, they are still aligned as a group, but on a different self-identity footing, constructively critical, which attaches face-preservation to group achievement. Then, criticism of one's ideas is not considered as a face-threatening act, as long as it permits building stronger arguments to valuably contribute to the class debate.

The next case addresses group talk relevancy as a social practice at a different time scale, in sub-sequences playing specific roles in broader, topical sequences of argumentation. It is based on data from a school in Lyon, France, displaying different uses of *disputational* and *exploratory talk*.

Case 3: *Arguing* and Arguing: Topical and Sequential Nature of Group Talk

In this third case, we present an interaction between Jérémie, Julie and Laurent, who are discussing the main question, about what would access to drinking water in the future depend on (cf. figure 3).

At first sight, they seem to be alternating between *disputational* and *exploratory talk*, *arguing* in having an *argument*, and *arguing* in collectively engaging in *argumentation*. We describe these features in the first sub-section. A deeper analysis, based on the 5th indicator, the circulation of arguments, give light to another interpretation, and reveals the topical and sequential nature of group talk. In the second sub-section these results are detailed, and put into perspective with the general need for multiplying units of analysis to study group talk (phase, sequence and sub-sequence). Taking into account this key indicator also helps distinguish between style effects and core argumentative mechanisms. Last but not least, a third sub-section emphasizes the matter of individual self-identity footings' alignment toward group engagement in a specific type of talk, with a deeper

look at transition sub-sequences.

Arguing and Arguing: Apparently Alternating Between *Disputational* and *Exploratory talk*

The dialogue of Jérémie, Julie and Laurent is partly transcribed and translated below, but its analysis is carried out all along the 3 sub-sections.

1. JUL euh: moi j'ai trouvé F xxx mais j'sais plus c'est quoi (euh: i found F xxx but i don't remember what it is)
2. JER moi j'suis désolé mais ça va être A\ (I am sorry but it's going to be A\)
3. JUL nan c'est [C\ (no it's [C\)
4. JER [parce que: à l'heure qu'il est c'est pas rapport à A (because: nowadays it's based on A)
5. LAU ouais parce que l'eau elle va dev'nir d'plus en plus chère\ (yeah because water is gonna become more and more expensive)
6. JER et p- elle va dev'nir d'plus en plus chère et: les gens c'est des capitalistes et ça changera pas ça a toujours été comme ça et ça restera toujours comme ça\= (it's gonna become more and more expensive and the people are capitalist and it won't change it has always been like that and it will always be like that=)
7. LAU =l'eau ça a rien à voir avec le capitas-lisme\= (=water has nothing to do with capitalism\=)
8. JER =si\ parce que [c'est: les gens quand (=yeah because [it's: the people when)
9. LAU [parce que l'eau c'est vital alors forcément ce c'est ça va dev'nir plus cher [même ([because water is vital so it's gonna automatically become more expensive [even)
10. JER [c'est vit- c'est vital ([it's vit- it's vital)
11. LAU [si c'était des communistes ou quoi ça s'rait pareil\ ([if they were communist or whatever it'd be the same)
12. JER nan\ (itwouldn't\)
13. LAU si\ (it would\)
14. JER nan\ (no\)
15. LAU l'eau elle deviendrait quand même chère\ (water would become expensive anyway)
16. JER nan\ (no\)
17. LAU bah si tu veux faire comment/ (sure it would how would it work otherwise/)
18. JER parce que (because)
19. LAU moins y'en a plus plus ça d'vient rare plus ça d'vient cher c'est logique\ (the less there is the the scarcer it becomes and the more expensive it becomes that's logical\)
20. JER bah moins y'en a plus ça d'vient plus ça d'vient cher (of course the less there is the more expensive it it

becomes)

21. LAU hein\ (what\)

22. JER ouais mais y'en aura toujours autant de: (yeah but there'll always be the same amount of:)

23. JUL de l'eau (of water)

24. JER de l'eau\= (of water\=)

25. JUL =[mais après ouais mais ça= (=[but after yeah but it=)

26. LAU =[ouais mais après faut trouver des moyens justement pour euh: pour euh (=[yeah but after ya gotta find ways exactly for uh: for uh:)

27. JUL qu'elle soit [propre/= (to make it [clean/=)

28. LAU =récupérer d'l'eau d'la mer et tout ça (=get the water the water from the sea and all that)

29. JER bah ouais et les moyens c'est quoi c'est la tunne (sure yeah and the ways what are they it's cash)

30. JUL nan\ c'est les avancées [scientifiques (no\ it's scientific [progress)

31. LAU [ouais c'est la tunne\ ([yeah it's cash\)

32. JER et pour avoir des avancées scientifiques on fait [comment/ (and how do you make scientific progress [how/)

33. LAU [mais nan y'a pas b'soin\= ([no but there's no need\=)

34. JUL =nan mais [vous voulez pas de mettre des billets sur l'bord d'l'eau et ça marche il faut des instr- avancées scientifiques (no but [it's not gonna work if you put bills on the waterfront scientific progress is needed)

35. JER [il faut d'la tunne\ il faut d'la tunne donc [c'est la A: ([cash is needed\ cash is needed so [it's A:)

36. LAU [nan mais on ils savent déjà faire hein euh désaler l'eau désaliniser [l'eau\ ([no but we they already know how to do you know uuhh unsalt the water desalinate [the water\)

37. JER [mais ça coûte cher\ ([but it's expensive\)

38. LAU oui mais après c'est vital alors tu t'en bats les couilles de [l'argent\ (yes but it's also vital so you don't give a shit about [money\)

39. JER [((pretending to count bills))

40. JUL [les inventions scientifiques si tu les fais dans quelques années tu trouves un moyen pas cher euh de: ([if you do scientific inventions in a few years you find a cheap way to euh to:)

41. JER tu trouves un moyen/ vas-y trouves-le\ (you find a way/ go ahead find one\)

42. JUL nan mais j'suis pas scientifique merci\ (no but i'm not a [scientist thanks anyway\)

(...)

98. JUL il faut d'la tunne ET des scientifiques mais faut avoir des scientifiques aussi (cash AND scientists are needed but scientists are also needed)

99. JER mais faut avoir d'la tunne (but cash is needed)

100. JUL [oui mais si t'as des scientifiques c'est euh logique qu'il faut les payer ([yes but if you have scientists it's euh logical they must be paid)

101. LAU [oui mais les scientifiques t'inquiètes pas ils sont tranquilles ([yes but the scientists don't worry they're relaxed)

102. JUL ouais mais ils vont pas donner [d'leur poche euh pour euh: (yeah but they won't pay out of their own pockets euh to euh:)

103. LAU [et euh ça va ouais\ nan mais les scientifiques j'pense ils gagnent assez pour pas casser les couilles ([and euh it's okay yeah\ no but the scientists i think they earn enough not to break our butts)

104. JER [c'est sû:r ([for su:re)

105. LAU [ils vont pas s'arrêter d'travailler oh bah merde tant pis j'suis pas payé bah tant pis tout l'monde meurt\ ([they're not gonna stop working oh shit it's a shame i'm not paid bad luck everybody dies\)

106. JER ((puts letter A on the stand))

107. MO1 à trois vous affichez un deux trois allez-y (on three you put it up one two three go ahead)

108. LAU ((takes letter A off))

109. JER ((takes it from him and puts it on the stand again))

110. LAU °ouais il faut mettre ça\° (°yeah we have to put this\°)

111. JER °mais:° (°but:°)

112. LAU °fallait l'mettre maint'nant là° (°we have to put it right now°)

113. JER °tu veux mettre quoi toi/° (°what do YOU wanna put/°)

114. LAU °A\° (°A\°)

115. JUL °nan mais c'est pas 'rav\° (°no but it doesn't matter\°)

116. JER °les scientifiques° (°the scientists°)

117. LAU NAN faut mettre A pelo: on était deux à l'dire\ (NO we have to put A dude two of us said so\)

118. JER on met les deux <((posant F à côté de A)) on met les deux:> ([we put both <((putting F next to A)) we put both:>) (...)

124. JUL °j'te jure ça va j'ai pas envie d'parler en plus\° (°i promise it's okay and i don't wanna talk anyway\°)

Analysis using indicators 1-4 leads us to qualify their discussion as alternating between *disputational* and *exploratory talk*, through 6 distinct episodes.

The students are engaged in *disputational* talk at turns 1-4: they oppose each other with non-supported assertions that they repeat without adapting to what the others say. The negative appraisal of the alternative option is not based on explicit refutation. At turn 2, Jérémie shows no concern for what the others think of option A (*access to water will depend on economic income*), which he raises as a definitive choice. Indicators 1 to 4 are negative.

Jérémie and Laurent are also experiencing *disputational talk* at turns 11-16, even if they seem to agree on option A: the disagreement is about the reasons supporting their choice.

Turns 29-31 show similar patterns, but on the opposition of A (*access to water will depend on economic income*) to F (*access to water will depend on scientific advances*).

Nevertheless, there are also moments of *exploratory talk* in this interaction. In turns 4-10, Jérémie and Laurent are deeply collaborating. Laurent formulates two arguments supporting Jérémie's assertion, which he immediately repeats: water is going to become more expensive and it is "vital". Indicators 1 and 2 are positive. But the reason added by Jérémie at turn 6 is rejected by Laurent, and then another episode of *disputational talk* starts. Indicator 3 is partly positive: there is a critical look at the other's argument but no justification of the counter-assertion.

The exploration of Jérémie's reason only starts at turn 17 when Laurent asks him for more explanation, beginning another episode of *exploratory talk*. Laurent also develops one of the reasons he gave before: "the scarcer the water is, the more expensive it becomes" (turn 19). This idea is constructively co- criticized by Julie and Jérémie, who reject the premise with the argument that there will always be the same amount of water on Earth (turns 22-24). Julie then reintroduces option F (*access to water will depend on scientific advances*) in the discussion, assuming the procedural norm that a proposition cannot be abandoned without being explored. Laurent's behavior shows a concern for this rule since he did not forget the proposition and contributes to its reintroduction. Indicators 1, 2 and 3 are positive. Jérémie's reaction at repeating the opposing option starts another *disputational* phase.

But, from turn 32 onwards, the students turn back to *exploratory talk*. Interesting supporting elements respond to each other: Jérémie uses a causal argument to justify that money precedes scientific progress; to which Julie opposes first a refutation by absurdity (turn 34) and then a refutation of the direction of causality (she frames

scientific progress as a step towards affordable technology at turn 40). Finally, Laurent goes beyond this materialistic opposition by referring to the fundamental norm that "you can't put a price on life" and by insisting how vital drinking water is (turns 38, 105). Indicators 1, 2 and 3 are positive. The 4th indicator is also completed: Jérémie shows great concern for taking everybody's vote into account (turns 110, 113, 115). It is Julie's choice not to make her opinion visible, after accepting option A (*access to water will depend on economic income*) even though she did not abandon option F (*access to water will depend on scientific advances*) (turn 98); she wants to avoid talking during the class-debate (turn 124).

Nevertheless, considering the 5th indicator of group talk (the circulation of arguments) helps clarify sequences and embedded subsequences, their roles for collective reasoning, and making sense of this alternation.

The Circulation of Arguments as a Key Indicator of Group Talk

The 5th indicator addresses how arguments are reused during the class debate, revealing which content from the table debate was actually shared by all the group members. This content-orientated criterion prevents from quick judgment based on style effects, for instance considering that a confrontational rhetorical necessarily indicates *disputational talk*. As shown in case 1 and 2, this indicator also allows the analyst to assess outcomes of previous group discussion on students' arguments and reasoning. The circulation of arguments is therefore decisive for isolating relevant units of talk in terms of debate quality. In case 3, two contributions to the class-debate are made by students of the group, revealing a strong difference in group talk among the two corresponding topics.

The first one is initiated by one of the moderators (MO1) with an intervention of the other moderator (MO2). It is transcribed and translated below:

1. MO1 et là-bas vous aviez une réponse différente des deux autres c'était laquelle/ (and there you had a different answer from the two others which one was it/)
2. JUL euh c'était la D\ (euh it was D\)
3. JER °la D/ ° (°D/°)
4. JUL °ouais j'crois° (°yeah i think so°)
5. JER °nan c'était la F j'crois\° (°no i think it was F\°)
6. SYL t'avais la réponse D et euh donc euh pourquoi tu penses/ (you had answer D and euh so euh why do you think/)

7. JUL °ah attends\° (°ah wait\°)

8. JUL ((reads the question again))

9. MO2 pourquoi la D [alors/ (why D [then/)

10. LAU °c'tait la F [t'avais dit° (°it was F [you've said°)

11. JER [°des avancées scientifiques\° ([scientific progress\°)

12. JUL °ouais c'était la F\° ouais c'était la F\ (°yeah it was F\° yeah it was F\)

13. MO1 comment/ (what/)

14. JUL la F\ (F\)

15. MO1 t'avais choisi la F/ (you chose F/)

16. JUL ouais\ (yeah\)

17. MO1 d'accord bah tu peux nous expliquer pourquoi la F/ parce que justement elles étaient plutôt contre la F elles pensaient que ça dépen- la F euh rev'nait aux rich[esses euh (okay so can you explain why (you chose) F/ because they were specifically against F they thought it would depen- F equals wealth euh)

18. JUL [ben la F euh c'est sûr qu'il faut d'l'argent mais euh on peut pas 'fin c'est pas en ayant juste de l'argent que on: qu'on va avoir d'l'eau: potable quoi 'fin pour avoir assez d'l'eau faut aussi euh ([well F euh for sure money is needed but euh we cannot i mean it is not just having money that we: we're gonna have water: drinking water you know i mean to have water we also need euh)

19. JER des scientifiques pour euh la faire (scientists to euh make it)

20. JUL ouais (yeah)

21. JER 'fin pour trouver des avancées: des trucs comme ça (i mean to make progress: such things)

Julie is asked to justify her view (turn 1), and she seems pretty confused at speaking in front of everybody; she does not even remember the letter of the option that she wanted to vote for. Jérémie and Laurent help her and show that they know which answer she was defending (turns 5, 10 and 11). Jérémie even completes Julie's sentence at turn 19 by rephrasing the specific counter argument she used against his own argument. Moreover, Julie's main contribution is based on their previous collaboration: she concedes that money is necessary to do science, but not sufficient — this is a complex dialogic argument that she built during the group discussion (turn 18). This concession constitutes a *rebuttal* in the terms of Toulmin's Pattern of an Argument (Toulmin, 1958, Clark & Sampson, 2007). As in case 2, an argument previously shared in the group debate was strengthened by the inclusion of the anticipation of a potential counter-discourse.

Finally, the 5th indicator shows that the students were actually debating efficiently when discussion centered on the debate A vs F. Therefore, all the turns concerning this debate can be interpreted as a global *topical* sequence of *exploratory* talk. The two phases of *disputational talk* opposing options A and F, occurring at the very beginning of the discussion, and when the topic is re-introduced (respectively at turns 1-2 and 30-32) can be understood as opening sub-sequences, serving a function of exhibiting the different viewpoints before *exploration*.

Let's have a look at Laurent's contribution to the large group debate, a few minutes later:

LAU moi j'pense que l'accès à l'eau elle va dépendre de la richesse des gens parce que plus elle va dev'nir chère 'fin plus elle va dev'nir rare plus elle va dev'nir chère et donc euh: ça s'ra les riches qui: auront (i think that access to water will depend on people's wealth because the more expensive it's gonna become well the scarcer it's gonna become the more expensive it's gonna become and so euh: the rich people will be the ones who: will have)

Here, Laurent only reports on his own idea, without taking into account any counter argumentation, even if the two other students did build a clear justified refutation that he did not question (turns 20-25). Indicator 5 here shows that in the end, when discussing the reasons for supporting option A, the students were not effectively cooperating. As a result, our interpretation is that the group was not really totally engaged in *exploratory talk* at turns 18-29, even if they were not in *disputational talk* any more.

We consider that at turns 3-29, the students were actually engaged in a global topical sequence of *disputational talk*, which includes two more collaborative sub-sequences. The first one (turns 4-10) is an opening sub-sequence that allows Laurent and Jérémie to understand what they agree and disagree on before *disputing*. The second one (turns 18-29) can be qualified as a transition subsequence during which each participant goes back to a behavior that makes possible the following *exploratory* sequence. The next subsection provides a deeper analysis of this kind of hybrid units of talk.

Figures 4A and 4B summarize the topical and sequential relevant units we consider after this deeper analysis of Jérémie, Julie and Laurent's dialogue. Methodologically, it is essential to distinguish three time scales to understand what is happening in such a debate: the phase level, corresponding to the whole group discussion about a given question; the sequence level, corresponding to a topical unit developed during all or part of a given phase; and the sub-sequence level, corresponding to parts of a given sequence playing specific interactional functions, that may require a local change of type of talk.

Alignment *on Constructively Critical Footing* and Transition to and from *Exploratory Talk*

When transiting from *disputational* to *exploratory talk*, the students gradually adapt their attitude toward self-identity. They accept to consider each other's proposition (turns 18 and 23), but are not ready to submit their own assertion to the collective *exploration* process yet. Jérémie does not explain why he disapproves of capitalism and how it is related to option A (turn 19). Laurent does not listen to the refutation of his idea that water resources are diminishing, as his latter contribution to the class debate shows. Julie is just entering the discussion and does not give her own viewpoint. The students are still in a *competitive footing*: they focus on personal success and proving that their own ideas are right. Even if they are not immediately ready to see their ideas challenged, they show that they are open to consider other ideas, an important start to gradually align their self-identity footing and face preservation system to a *constructively critical* attitude.

In the next *exploratory* sequence running from turn 30 onwards, they accept to make explicit their reasoning, submit it to others' criticism, and collectively build more complex arguments, which they later defend all together. Even if they keep on using a confrontational style of dialogue, their self-identity is then attached to collective improvement through deepening of the space of debate even if that means abandoning or modifying individual ideas (ex: turns 32, 36, 98, 100).

At the end of the phase of debate about this question, from turn 106 and onwards, the students are stepping away from exploratory talk. Jérémie seems to remains on a constructively critical footing, trying to obtain everybody's consent to make a decision, even suggesting to vote twice in order to make all the discussed opinions visible. He explicitly asks Julie what she wants to vote (turn 113).

On the contrary, Laurent thinks that the majority should choose (turn 117), and he is not searching for Julie's consent at all. Finally, Julie overtly decides not to make her opinion public and agrees to vote in favour of the others' preferred option. She bases her decision on the exercise format, explaining that she does not want to talk in front of the whole class (turns 115, 124). Laurent and Julie act as if they had already finished debating in small-group, they're not in exploratory talk any more, but rather focusing on the next phase of the activity: the class debate during which they will have to defend the group's answer.

During this closure subsequence, group talk is hybrid, due to the fact that the three students are not aligned in their understanding of the interactional aims: Jérémie is still trying to *explore* the question in the group, while Julie and Laurent are strategically anticipating the next phase of the activity, the class debate.

Conclusions

The analytical categories of *exploratory*, *cumulative* and *disputational talk* proved useful in assessing the quality of small group debates on socio-scientific issues related to drinking water among Mexican, American and French students. The scientific café as a pedagogical situation led us to define such categories more precisely thanks to a set of 5 indicators of the quality of students' joint activity: (1) whether assertions and refutations are justified, (2) whether the students elaborate on the argumentative content of previous turns, (3) whether they critically evaluate each others' arguments, (4) whether they take everybody into account when making the decision for the collective vote, (5) whether a particular students' talk during the following large group debate integrated the rest of the group's supporting or opposing argumentation or only voice his own initial ideas.

The 5th indicator, with a focus on the circulation of ideas, is particularly interesting for 3 reasons. First, it prevents the analyst from judging a whole interaction too rapidly on the basis of a stylistic effect — here the fact that the students in case 3 tend to have a confrontational rhetorical style. Instead, it offers a content-based criterion related to the objects being discussed. Second, such a focus on the circulation of contents enables the identification of complex sequences as global units of talk when they are consistent with the actual quality of students' collaboration. Last but not least, this indicator allows us to relate the three levels of learning, specifying the links between the quality of group talk, individual outcomes revealed by the construction of more complex dialogic arguments including *rebuttals*, and contributions to the class debate.

Through three case studies, we illustrate how students' individual attitude toward self-identity fosters engagement in a certain type of talk, and affects the quality of the debate at the group level. Engaging in *exploratory talk* requires students to adopt a *constructively critical footing*, valuing their self-identity through the group's achievement based on a critical assessment of individual ideas. In other words, a balance must be kept between two radical ways of ensuring social recognition: engaging in ordinary non controversial interaction without truly considering the objects being debated (*consensual footing* typical of *cumulative talk*) and sticking to a first individual claim, struggling to win over others' ideas (*competitive footing* typical to *disputational talk*). Students' footing is not necessarily the same during a whole interaction and such a balance can be modified according to local interactional aims. For instance, subsequences of *disputational talk* expressing the different competing views seem sometimes (as in case 2) to be normal openings for *exploratory* sequences, and must not be given derogatory status. The comparison of the same group of students engaging in *cumulative talk* (case 1) and *exploratory talk* (case 2) shows that engaging in a given type of talk is not only a matter of cognitive ability. Students' perceived contextual relevancy of a specific self-identity footing and the

associated face-preservation system is also very influential in determining a group's engagement in a specific talk.

Such results must be taken into account for the design of argumentation-based pedagogical activities. It is essential that the students, individually and as a group, understand the activity as a relevant social context for engaging in *exploratory talk*, a place where any idea can be voiced, rival options examined and challenged, without threatening people's face, in the pursuit of learning achievement. The students studied in cases 1 and 2 did not seem to have perceived the group debate this way until long after the *café* started. Two changes in the pedagogical script could help students align their perception of the context as relevant for engaging in *exploratory talk*.

First, what Mercer and his colleagues call the 'ground rules' of *exploratory talk* can be rendered explicit by the moderators before the *café* starts, and students can be reminded of them before each phase of group debate. A moderator's introductory speech about these rules would emphasize the need for sharing information, encourage each student's participation, call for a respectful atmosphere while allowing one's own ideas to be challenged, and finally maintain interest in others' ideas, while criticizing ideas and not individuals (Asterhan, 2013, Fernández et al., 2002, Wegerif et al., 2004, Mercer and Sams, 2006).

Another way to foster students' engagement in *exploratory talk* could be to constrain their group debate by scripting it with specific tools aiming at having those rules apply. For instance, providing the students with a procedure for debating, which implies discussing all the options, A to F, one by one, each student telling his opinion about each option before stepping to the next one (Weinberger, Ertl, Fischer, & Mandl, 2005). Such scripting is not necessarily chronological. It could also give each student a maximum number of turns materialized by a discussion ticket. Another option is to only script the decision-making process, preventing them from the easy majority vote procedure, by giving each student a right of veto, for instance. Of course, over-scripting must be avoided, to allow the students to feel at ease to voice their ideas and gradually build more complex arguments (Dillenbourg, 2002). The class and the group habits and history, as larger contexts, must also be taken into account at defining appropriate tools for scripting group debates.

Still, it seems important that these tools, together with the elicitation of the ground rules, do not systematically ban *cumulative* and *disputational talk* from group discussions, in the cases where they serve specific functions of wider, globally *exploratory* sequences. In addition the time that the students might need to transit to *exploratory talk*, and align their self-identity on a constructively critical footing should not be neglected. Regarding this last point, if a feedback device was too quickly reactive in blaming students for not engaging in

exploratory talk at the very beginning of the group debate, this could block normal *exploration* opening processes and destabilize the students.

Figures

Figure 1. Opinion question 1, which serves as a basis for Pamela, Sabrina, Kelly and Louise's discussion analyzed in case 1.

Figure 2. Opinion question 2, which serves as a basis for Pamela, Sabrina, Kelly and Louise's discussion analyzed in case 2.

Figure 3. Main question, which serves as a basis for Laurent, Jérémie and Julie's discussion analyzed in case 3.

Figure 4. Case 3 interactional phase analysis into sequences and subsequences.

Figure 4A. *Exploratory* sequence about A/F debate.

Figure 4B. *Disputational* sequence about reasons for A.

References

Adamson, D., & Rosé, C. P. (2013). Academically Productive Talk: One Size Does Not Fit All. In *Proceedings of the 2nd Workshop on Intelligent Support for Learning in Groups*.

Aikenhead, G. (1992). The integration of STS into science education. *Theory Into Practice*, 31(1), 27–35.

Albe, V. (2006). Procédés discursifs et rôles sociaux d'élèves en groupes de discussion sur une controverse socio-scientifique. *Revue Française de Pédagogie* (157), 103-118.

Albe, V. (2009). L'enseignement de controverses socioscientifiques. *Education & Didactique*, 3(1), 45–76.

Alexander, R. (2010). Speaking but not listening? Accountable talk in an unaccountable context. *Literacy*, *44*(3), 103–111.

Amossy, R. (2006). L'argumentation dans le discours. Nathan.

Andriessen, J., M. Baker, et D. Suthers. (2003). Arguing to learn: Confronting cognitions in computer-supported collaborative learning environments. Springer Netherlands.

Asterhan, C. S. C. (2013), Epistemic and Interpersonal Dimensions of Peer Argumentation: conceptualization and quantitative assessment. In Baker, M., Andriessen, J., Järvelä, S., *Affective learning together. Social and emotional dimensions of collaborative learning* (pp. 251-271). Routledge.

Baker, M., & Andriessen, J. (2009). Socio-relational, affective and cognitive dimensions of CSCL interactions: integrating theoretical-methodological perspectives. In *Proceedings of the 9th International Conference on Computer Supported Collaborative Learning, 2* (pp. 31–33).

Bisault, J., Rebiffé, C., Lavarde, A., & Fontaine, V. (2000). Communiquer en sciences à l'école: des élèves cyber-chercheurs. *Aster, 2000, 31« Les sciences de 2 à 10 ans »*, 122-148.

Brown, P., & Levinson, S. C. (1988). *Politeness*. Cambridge University Press.

Clark, D. B., & Sampson, V. D. (2007). Personally-seeded discussions to scaffold online argumentation. *International Journal of Science Education*, *29*(3), 253–277.

Désautels, J., & Larochelle, M. (1998). The epistemology of students: The « thingified » nature of scientific knowledge. *International Handbook of Science Education*, 1998, 115–126.

De Vries, E., Lund, K., & Baker, M. (2002). Computer-mediated epistemic dialogue: Explanation and argumentation as vehicles for understanding scientific notions. *Journal of the Learning Sciences*, 11(1), 63–103.

Dillenbourg, P. (2002). Over-Scripting CSCL: The Risks of Blending Collaborative Learning with Instructional Design. In P. A. Kirschner (Ed.), *Three Worlds of CSCL. Can we Support CSCL?* (pp. 61-91). Heerlen: Open Universiteit Nederland.

Dyke, G., Adamson, D., Howley, I., & Rosé, P. C. (2012). Towards Academically Productive Talk Supported by Conversational Agents. In S. Cerri, W. Clancey, G. Papadourakis, & K. Panourgia (Éd.), *Intelligent tutoring systems, 7315* (pp. 531-540). Springer.

Driver, R., Leach, J., Millar, R., & Scott, P. (1996). *Young peoples's images of science*. Philadelphia: Open University Press.

Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, 84(3), 287–312.

Erduran, S., & Jiménez-Aleixandre, M. P. (2007). Argumentation in science education: Recent developments and future directions. Dordrecht: Springer.

Fernández, M., Wegerif, R., Mercer, N., & Rojas-Drummond, S. (2002). Re-conceptualizing« scaffolding » and the zone of proximal development in the context of symmetrical collaborative learning. *Journal of Classroom Interaction*, *36*(2/1), 40–54.

Freshwater, D., J. Cahill, E. Walsh, and T. Muncey. (2010). Qualitative Research as Evidence: Criteria for Rigour and Relevance . *Journal of Research in Nursing* 15 (6), 497-508.

Gayford, C. (2002). Controversial environmental issues: a case study for the professional development of science teachers. *International Journal of Science Education*, 24 (11), 1191–1200.

Goffman, E. (1974). *Les rites d'interaction*. Paris: Editions de Minuit.

Goffman, E. (1981). *Forms of talk*. University of Pennsylvania Press.

Keefer, M. W., Zeitz, C., M., Resnick, L., B. (2000). Judging the quality of peer-led student dialogues. *Cognition and Instruction* 18, n° 1: 53-81.

Kolsto, S. D. (2001). Scientific literacy for citizenship: Tools for dealing with the science dimension of controversial socioscientific issues. *Science Education*, 85(3), 291–310.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge university press.

Lehrer, R., & Schauble, L. (2006). *Scientific thinking and science literacy*. Handbook of Child Psychology.

Lewis, J., & Leach, J. (2006). Discussion of socio-scientific issues: The role of science knowledge. *International Journal of Science Education*, 28(11), 1267–1287.

Mercer, N. (1996). The quality of talk in children's collaborative activity in the classroom. *Learning and instruction*, 6(4), 359–377.

Mercer, N., & Sams, C. (2006). Teaching Children How to Use Language to Solve Maths Problems. *Language and Education*, *20*(6), 507‑528.

Michaels, S., O'Connor, M. C., Hall, M. W., & Resnick, L. (2002). *Accountable talk: classroom conversation that works.* University of Pittsburgh.

Michaels, S., O'Connor, C., & Resnick, L. B. (2008). Deliberative Discourse Idealized and Realized: Accountable Talk in the Classroom and in Civic Life. *Studies in Philosophy and Education*, *27*(4), 283‑297.

Michaels, S., O'Connor, M. C., Sohmer, R., & Resnick, L. (1992). Guided construction of knowledge in the classroom: Teacher, talk, task, and tools. *The Reading Teacher*, *46*, 316–326.

Nussbaum, E. M., Sinatra, M. G., Poliquin, A. Role of epistemic beliefs and scientific argumentation in science learning. *International Journal of Science Education* 30, n° 15 (2008): 1977-99.

Plantin, C. (2005). *L'argumentation : histoire, théories et perspectives*. Paris: Presses universitaires de France.

Plantin, C. (2011). *Les bonnes raisons des émotions*. Peter Lang.

Plantin, C. (in press). Politesse argumentative, Dictionnaire de l'argumentation - Une introduction notionnelle aux études d'argumentation, ENS Editions, Lyon.

Polo, C. (2014). L'eau à la bouche : Ressources et travail argumentatifs des élèves lors de débats socio-scientifiques sur l'eau potable. Doctoral thesis, University Lyon 2, France.

Pomerantz, A., & Heritage, J. (2012 [1984]). Preference. In J. Sidnell & T. Stivers (Eds.), The Handbook of Conversation Analysis (pp. 210-228). Hoboken, NJ: Wiley-Blackwell Publishing.

Roschelle, J., & Teasley, S. D. (1995). The construction of shared knowledge in collaborative problem solving. In *Proceedings of the Conference on Computer supported collaborative learning* (pp. 69–97).

Sandoval, W. A. (2005). Understanding students' practical epistemologies and their influence on learning through inquiry. *Science Education*, 89(4), 634–656.

Simonneaux, L., & Simonneaux, J. (2009). Students' socio-scientific reasoning on controversies from the viewpoint of education for sustainable development. *Cultural Studies of Science Education*, 4(3), 657-687.

Simon, S., Erduran, S., & Osborne, J. (2002). Enhancing the quality of argumentation in school science. In *Proceedings of the Annual Meeting of the National Association for Research in Science Teaching* (pp. 7-10). New Orleans, USA.

Stahl, G. (2002). Can community knowledge exceed its members'? *SIGGROUP Bull.*, *23*(3), 3–7.

Stahl, G. (2005). Group cognition in computer-assisted collaborative learning. *Journal of Computer Assisted Learning*, *21*(2), 79–90.

Stahl, G. (2006). Analyzing and Designing the Group Cognition Experience. *International Journal of Cooperative Information Systems*, *15*(02), 157 - 178.

Stahl, G. (2006). *Group cognition*. MIT Press Cambridge.

Toulmin, S. E. (2003 [1958]). *The uses of argument*. Cambridge University Press.

Traverso, V. (1999). Négociation et argumentation dans la conversation familière. *Pragma conference,* Tel Aviv University.

Wegerif, R., Littleton, K., Dawes, L., Mercer, N., & Rowe, D. (2004). Widening access to educational opportunities through teaching children how to reason together. *Westminster Studies in Education*, *27*(2), 143 - 156.

Wegerif, R., & Mercer, N. (1997). A dialogical framework for researching peer talk. *Language and Education Library*, *12*, 49–64.

Weinberger, A., Ertl, B., Fischer, F., & Mandl, H. (2005). Epistemic and Social Scripts in Computer-Supported Collaborative Learning. *Instructional Science*, 33(1). 1-30.

Weinberger, A., & Fischer, F. (2006). A framework to analyze argumentative knowledge construction in computer-supported collaborative learning. *Computers & Education*, 46(1), 71–95.

Zeidler, D. L., Sadler, T. D., Simmons, M. L., & Howes, E. V. (2005). Beyond STS: A research-based framework for socioscientific issues education. *Science Education*, 89(3), 357–377.

Notes

1. As for all the transcripts, the conventions are those of the ICOR group (internet link), with 2 exceptions: capital letter for the answer letters and "(.)" for not-measured pauses. 'Tn', n being a number, is used at the place of the speaker when it is a collective action attributed to the whole group situated at the table being recorder (T1 for table 1, etc).