

Rapanta, Chrysi

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# BEWILDERMENT AS A PRAGMATIC INGREDIENT OF TEACHER-STUDENT DIALOGIC INTERACTIONS

CHRYSI RAPANTA

## Abstract

*Several studies on dialogic pedagogies have contributed to shedding light on how the traditional, authoritative Inquiry-Response-Evaluation (IRE) pattern may be transformed into more open, discursive formats through the inclusion of discursive moves, e.g. questions, that are more “authentic” than others. However, the problem of defining genuine teacher-student dialogue at a discourse sequence level remains open. In this essay, I define this type of dialogue from a cognitive perspective, as a dialogue aimed at fulfilling a sensemaking goal framed in at least three ways: as an individual constructionist, a socio-constructivist, and a socio-epistemological process. I then propose bewilderment, based on the philosophical concept of “critical aporia,” as a necessary ingredient of pedagogical teacher-student interactions. These two elements, sensemaking and bewilderment, are then used together as framing indicators of three different profiles of pedagogical dialogues.*

## Keywords

*critical aporia, bewilderment, pedagogical dialogue*

## Introduction

Recent developments on dialogic teaching and how it may be accomplished have contributed to shedding light on how the traditional, authoritative Inquiry-Response-Evaluation (IRE) pattern may be transformed into more open, discursive formats (Vrikki et al., 2019). From the simple move of transforming an evaluation into a continuation (Mehan, 1979), an uptake (Collins, 1982), or a follow-up move (Lyle, 2008; Wells, 1993), to the creation of patterns or sequences of moves that are more productive than others (Engle & Conant, 2002), scholars have offered multiple ideas on what teachers should do or say when trying to be more “dialogical.” However, the main question guiding this essay has not yet been answered: *How can we assess whether a teacher-student dialogic sequence is genuine in the sense of achieving its major goal of contributing to the sensemaking process of participants, especially the learners?*

I investigate the pedagogical function of bewilderment expressed through the philosophical concept of “critical aporia” (Papastephanou & Angeli, 2007) as a “pragmatic ingredient” of genuine teacher-student dialogues. My analysis approach is pragmatic in the sense that it is based on the interdependency between meaning making and interaction, and how one informs and influences the other (Levinson, 1983). Within a pragmatic analysis approach, meaning making is always intentional, given that communication is intentional, and thereof any process within. When applied to learning, for a pragmatic approach to be considered as “ontological” (i.e. valuing learning as an authentic experience in itself) as compared to “instrumental” (i.e. de-valuing learning as a goal per se) (Matusov, Baker, Fan, Choi, & Hampel, 2017), the goals pursued through interaction are learning goals, and the activity types (Levinson, 1992) leading to the fulfilment of such goals are learning activity types, explicitly directed towards learning objectives (Coll & Falsafi, 2010).

Although the goal-orientedness of interaction is a criterion for a pragmatic analysis of dialogue, it is not a pre-condition of how dialogue should be. That said, a pragmatic analyst views dialogue as a set of more or less fulfilled communicative intentions according to assumptions based on the manifestations of such intentions in interaction (both verbal and non-verbal). The dialogue goals thereof refer to the assumed participants’ joint intentions from the analyst’s point of view, and not to dialogue conditions set *a priori* among the participants. This clarification is important especially when it comes to teacher-student dialogue, which is more to be understood as a “slide of an ongoing communicative relation” (Burbules & Bruce, 2001) than as an isolated conversation with a beginning, a middle, and an end.

This essay suggests “sensemaking” as a pragmatic goal (van Dijk, 1977) of the learning activity type (Levinson, 1992) manifested in teacher-student

dialogue sequences. A sequence of dialogue, i.e. a combination of various exchange pairs, is the minimum unit of analysis for a dialogue macro-structure or activity type to emerge (Macagno & Bigi, 2017). I address two main research questions: *Which pedagogical dialogue sequences promote sensemaking as a learning goal?* and *How do they do it in terms of promoting student bewilderment?*

The essay is structured as follows. First, sensemaking is defined as a learning goal. The identification of bewilderment or critical aporia as an indicator of pedagogical dialogue, defined as dialogue framed as sensemaking, is then proposed. Finally, examples of real classroom interactions are provided to showcase the importance of bewilderment as a “pragmatic ingredient” of sensemaking-oriented dialogue sequences, in the sense that its greater or lesser presence may mark which goal of sensemaking is pursued at each time of interaction.

### **Sensemaking as a framing goal**

Sensemaking and meaning making are two inter-related concepts often found in educational research literature. Although they share the same basis, they are not the same. The term “sensemaking” was born within the context of organizational studies and is used to refer to the process of “making sense” of things, in particular of “reality as an ongoing accomplishment,” and “it takes form when people make retrospective sense of the situations in which they find themselves” (Weick, 1995; p. 15). Sensemaking, as described by Weick, is: “grounded in identity construction,” “social,” “ongoing,” and “driven by plausibility rather than accuracy” (Craig-Lees, 2001). From a psychological perspective, sensemaking relates to phenomena such as creativity, curiosity, comprehension, mental modelling, and situation awareness (Klein, Moon, & Hoffman, 2006). Those phenomena and the interaction processes involved in sensemaking, such as seeking information, evaluating content, and using representations (Butcher & Sumner, 2011), are usually interpreted from a structural-functional and not from a cultural-individual perspective (for the distinction between the two, see Slegers, Geijssels, & Van den Berg, 2002).

The related concept of “meaning making” refers to the construction of knowledge through and because of our interaction with others and/or with semiotic tools, such as films and books (Vygotsky, 1986). In this sense, it forms part of sensemaking as it helps individuals understand the world and construct their experience within it. However, although meaning making is always dialogic, as it implies the dialogic relationship of addressivity and responsivity (Matusov, Marjanovic-Shane, & Grabovski, 2019; p. 273), sensemaking is not, as it is based on interaction, which is not always dialogic,

at least not in its genuine sense. To better understand this distinction from an educational point of view, I use the account given by Scott, Mortimer and Aguiar (2006). According to these authors, a teacher-student interaction is dialogic when it is open to different points of view; however, it can be “played out with different levels of *interanimation* of ideas” (Scott et al., 2006; p. 610, emphasis in the original). A low-level interanimation of ideas implies that different ideas are made available on the social plane, but without being explored, contrasted, compared, or further developed, as would be the case of a high-level interanimation (Scott et al., 2006).

In this perspective, the teacher’s role in framing dialogic interactions with students, especially in whole-class discussions, is of high importance. Elaborating on Goffman (1974), Ford and Wargo (2012) define framing as an “essentially an explicit or implicit reference for conceiving of one activity as part of another activity – represented by some as an answer to the question, ‘what is it that is going on here?’” (p. 375). There are different types of framing, such as instructional/dialogic (Engle, 2006; Ford & Wargo, 2012), social, affective, and epistemological (Hammer, Elby, Scherr, & Redish, 2005). The approach followed here is instructional/dialogic, similarly to Engle (2006) and Ford and Wargo (2012), but with the difference that although those authors’ approach to framing focuses on disciplinary content learning, my approach focuses on learning in its broader sense, applicable to different disciplinary contexts. Moreover, I propose sensemaking and not meaning making as a general learning goal, because it is more adapted for a pragmatic analysis, for which participants’ ideas and processes are only perceived *a posteriori*, looking back to their communicative acts.

Within a broader view of learning as sensemaking, at least three more concrete instructional framing goals are encountered in the literature. The first is the constructionist framing (Burningham & Cooper, 1999), according to which instruction consists of supporting learners in making sense of information, with the goal of becoming independent in their own searches and research in regard to what they need to learn and why. In this type of framing, learning is an individual enterprise mainly achieved through the use of “stored conscious and unconscious knowledge and emotions to interpret and respond to internal and external stimuli” (Craig-Lees, 2001; p. 520). The second is socio-constructive framing, according to which instruction aims at supporting learners in making sense of phenomena through articulating meanings and ideas with others. Collaborative problem solving is an example of this (Pirolli & Russell, 2011). Finally, socio-epistemological framing aims at supporting learners making sense of themselves through their authentic participation in social discourse and the constant negotiation of their learning goals, ideas, and identities. An example is learning within a community of practice (Ng & Tan, 2009).

A common aspect among these types of framing of learning as a sensemaking activity is that a degree of puzzlement or bewilderment is necessary for learning to take place under each of the three approaches.

Under a constructionist learning perspective, learners are expected to make meaning of available knowledge on their own through connecting to previous experiences. Although they can be stimulated by social interaction, it is they, often guided by a coach, who decide how to make their understanding explicit through language (Craig-Lees, 2001). In that sensemaking context, “the function of the educator is to support what the learner decides to do and accept that there will be diversity of understandings within each learner” (Anderson & Kanuka, 1999; p. 9). The (degree of) experienced puzzlement lies on the learners themselves, depending on which frames or experiences they draw on to make sense of the discussed concepts. For example, Hammer et al. (2005) describe a class in which students were asked “How big a mirror do you need to see your whole body?” During that class, on that day, a student named Sherry replied that “You need a mirror the same size as your body,” although several other students in her class gave different replies, such as that the mirror needs to be half the size of your body. The next week, Sherry told her group that she owns a mirror at home that is half her size, which in fact reflects her whole body. A discovery took place within Sherry after the class interaction about the concept; she then communicated the discovery to the others. Probably, what was shared on that day in class was students’ information about the mirror-body relationship, without any further request to reflect on that information and use it appropriately to explain the phenomenon of reflection. Probably, the teacher’s goal was just to open the space of “dialogue,” with students contributing different ideas, but not the space of negotiation or of debate of those ideas.

Under a socio-constructivist perspective, learners are expected to make sense of a concept or a phenomenon by negotiating their attributed meanings about it. Puzzlement is created because of the comparison of one’s ideas to another’s. The instructor’s role is to facilitate such puzzlement through inducing learners to zetetic aporia, focusing on the resolution of a problem.

Finally, under a socio-epistemological perspective, learners are expected to create and negotiate their constructed understandings about a concept or a phenomenon. Again, puzzlement is created because of the comparison of one’s arguments to another’s. It is not only about knowing a concept or thinking about a phenomenon, but also and mainly it is about defending one’s own account of such. The instructor’s role is threefold: to coach individually, if necessary, one’s understanding of knowledge necessary for the phenomenon at hand; to facilitate the peer-to-peer confrontation of ideas or interpretations about the phenomenon; and to promote critical thinking and reflection about those ideas and interpretations through their constructive, dialogic confrontation (Ford, 2012).

Although puzzlement has been approached from a cognitive learning perspective, as described above, its function and manifestation within teacher-student dialogic interactions has not been sufficiently investigated. In the next section, I discuss the concept of puzzlement or bewilderment in its original term of *aporia*, and its relation to pedagogical dialogue.

### **Aporia as the basis of pedagogical dialogue**

Aporia literally means “lacking a *poros*: a path, a passage, a *way*” (Burbules, 1997; p. 34). In Plato’s dialogues, *aporia* was used to describe the state of puzzlement experienced by Socrates’ students as result of his questioning method, also known as *elenchus*. However, Socrates’ dialogic technique was not always pedagogically constructive, as in many cases Socrates himself revealed the answers to his students rather than allowing them to arrive at the answers by themselves. At other moments, his intellectual “trapping” was so irritating for his interlocutors that learning did not actually take place.

For a dialogue to be pedagogical in a genuine dialogic sense, and not in its monologic sense as described by Bakhtin (1999), in which “someone who knows and possesses the truth instructs someone who is ignorant of it and in error” (p. 81), the dialogue needs to be open to meaning making (Nystrand, Gamoran, Kachur, & Prendergast, 1997). According to Matusov (2009), “meaning making is always creative; it is a surprise. It is a possibility among many other possibilities, and therefore never pre-determined” (p. 2). Given this surprise element, when seen from the teachers’ perspective, meaning making can be neither “framed” nor assessed. However, from a cognitive, sensemaking point of view, it is possible to assess when teachers and students are discursively inclined to experience a pedagogical communicative relation (Burbules & Bruce, 2001). In this section, I describe puzzlement or *aporia* as an indicator of genuine teacher-student dialogue.

Going back to Matusov (2009), “when something cannot (or is made difficult to) be challenged or tested by the participants (e.g., the students or even the teacher), the genuine dialogue ceases to exist” (p. 87). In other words, for dialogic teaching and learning to take place, both teachers and learners must experience a degree of openness to epistemological uncertainty or “indeterminacy” (Murray, 2006) in order for genuine sensemaking to take place. From a socio-cultural perspective, meaning making is genuine when both teachers and students engage in the learning experience. This implies that teachers challenge their own knowing and understanding before inviting students to do the same, as they are the ones who usually present the object of learning and dialogue to students. Presenting the object or issue as something more or less open to meaning negotiation and sensemaking has an effect on

the quality of dialogue. The challenge for teachers is neither to forget what they know nor to pretend that they do not know, but to genuinely problematize the issue under discussion and subsequently students' contributions to it. This problematization, when done genuinely, can provoke an "epistemological shudder" in teachers themselves and subsequently in their students, as it allows teachers to decontextualize and decompose what is taken for granted (by themselves, in the textbook, by a broader scientific community, etc.) in order to promote and illuminate (new) understandings (Charteris, 2014).

From the teachers' perspective, a first step towards an aporetic dialogue is the introduction of questions that can have an aporetic function. According to Politis (2006), there are two kinds of aporetic functions: the cathartic or purgatory one, in which the interlocutor realizes their ignorance, therefore freeing themselves from the pretense of knowledge; and the zetetic or inquiry-related one, which is part of the search for answers to a particular problem. For either of the two types of aporia to take place, a question-issue that may be used as an aporia-producing puzzle is necessary. However, there is a difference in the question-issues that promote more of a cathartic or a zetetic aporetic function. For issues that call for multiple answers of equal epistemic weight, the zetetic function of aporia is encouraged, as learners are engaged in the genuine sharing of their experiences, searching for answers to a problem within themselves, i.e. related to their personal sensemaking. Two-sided questions, such as dichotomic dilemmas, with good reasons for each side, are more appropriate for a cathartic aporetic function as they are considered genuine aporia-producing puzzles (Politis, 2006), in the sense that learners experience a sense of "loss" or "perplexity" when they find themselves fighting to increase the plausibility of their arguments within a community of learners trying to do the same. In this type of dialogic aporia framing, the socio-epistemic aspect of sensemaking is encouraged. Finally, a third type of framing may be found between the two types, one in which learners are gradually guided to experience a change in their own learning experience through constructing new knowledge due to their engagement in dialogue. As this new knowledge is usually the one marked or expected by the teacher, the type of aporetic function activated resembles the zetetic one. However, it is also partially cathartic, as, on one hand, the learners are invited to revise their prior knowledge/experience in light of the new knowledge and understandings emerging in dialogue; on the other hand, the new knowledge and understanding is the one expected by the teacher.

To conclude, for aporia to serve a genuine pedagogical dialogue, framed in such a way as to promote students' sensemaking experience, it must not be considered as a unidirectional transmission from the more knowledgeable teacher to the less knowledgeable student (as was often done in the Socratic dialogues). Although the teachers will always be the ones who will know



more, they must “regain personal epistemological uncertainty about the taught curriculum” (Matusov, 2009; p. 90), through engaging in the learning process as learners themselves. Within a community-of-practice approach, both teachers and students are learners and active constructors of knowledge, specifically of the commonly acquired knowledge that is the result of their productive dialogues. Teachers do not construct knowledge for the students; they construct the space and opportunities for knowledge to be constructed together with the students. For this genuine co-construction to take place, it is important that teachers become orchestrators of genuine dialogic interactions, the active drivers of a sensemaking process. Still, it is not clear how such pedagogical dialogues should look, especially when they take place in a teacher-centric mode, i.e. teachers guiding a dialogue with the students, rather than facilitating students’ groupwork. In the next section, I describe my account of how aporia may be manifested in pedagogical dialogues, and what sensemaking goals it may serve.

### **Profiles of pedagogical dialogues based on the aporetic function they promote**

The aporetic element is present in every discussion focusing on a particular issue or problem. It may take several forms, such as: exploring the issue itself, exploring interpretations of the issue, exploring problems emerging from the issue, and exploring solutions that address those problems (Rapanta, 2018). In this last section, I argue that the different types of aporetic functions discussed above may serve as pragmatic indicators for deciding, from an analyst’s point of view, what type of sensemaking activity is framed each time. To do so, I present three pedagogical dialogue profiles based on the three types of sensemaking goals discussed at the beginning. I argue that different functions or degrees of aporia are appropriate for each type.

#### *Sensemaking Type 1 Pedagogical Dialogue: Producing aporia*

This first type of pedagogical dialogue focuses on individuals learning how to construct knowledge by themselves. The teacher’s role regarding aporia is to present students with an issue that somehow is problematic and to induce them to be motivated to solve it. This creation of doubt or uncertainty and the urge to solve it is the basis for a “thinking culture” in a classroom (Tishman, Jay, & Perkins, 1993). The goal of such types of dialogue is divergent, as they potentially lead participants to an introspective attitude, to a “search within,” so that their own understanding of the issue at hand may subsequently take place. These types of sensemaking dialogues may resemble “opinion-storming” interactions, in which each participant states

what they think about the topic, without searching to convince others about that opinion. Each point of view is valuable and accepted as it is, as long as it is relevant to the topic, as decided by the teacher. Table 1 shows an example of a Type 1 sensemaking dialogue, in which the teacher leads 7<sup>th</sup>-graders into an “opinion-storming” interaction about what some house rules may be.

Table 1  
*Sensemaking Type 1 Pedagogical Dialogue*

Speaker	Speech
Maria	Respect the space where we live.
Teacher	Respect the space where we live. Who agrees with this rule by Maria, does everyone agree? Or no one?
Paul	Yes.
Teacher	This “yes” is nice! Why do you agree?
Paul	(◊)
Peter	Because it is a nice rule.
Teacher	Because it is a nice rule... Say, Luke. What would you like to say in regard to this rule by Maria, what do you think?
Luke	I think it is correct. Because I hate it when my brothers come into my room and start to mess it up.
Teacher	What do your brothers start to do?
Luke	To disorganize it.
Teacher	To disorganize your space. So, respect the space of everyone. What do you all think? Respect the space of everyone. Ok... Do you all agree? Respect the space of everyone...
George	I don't know. I just have a room all by myself.
John	I don't.
Michael	Oh, I do.
Teacher	So, when you don't have a room just for yourself...
Michael	We should respect the space of others... Respect the other inhabitants (students laugh).
Luke	Respect the other <i>residents</i> .
Teacher	The other residents. But tell me something about this rule, respect everyone's space, does the space refer to a room?
Luke	Yes.
Peter	It could be.
Teacher	Let Luke say.
Luke	It could be the space that someone needs in order to reflect.
Teacher	Exactly, the space that everyone needs in order to reflect.
Luke	I share my room and I do have to do this; I live in...
Teacher	You share your room and you have to do this. And you, Michael, would you like to say anything?
Michael	No.
Teacher	No?
Choir	[inaudible] (Students speak at the same time).

The teacher asks questions, inducing students to aporia, but does not problematize their answers. A zetetic aporia aiming at revealing different perspectives linked to students' personal experiences without questioning them is encouraged.

*Sensemaking Type 2 Pedagogical Dialogue: Opening up to complexity*

A second type of aporia-based pedagogical dialogue is one where students, guided by the teacher, engage in a zetetic aporia by focusing on aspects that need to be solved and by producing temporary solutions to them. An example of such a type of dialogue focusing on the constructive aspects of aporia is shown in Table 2.

Table 2

*Sensemaking Type 2 Pedagogical Dialogue*

	Speaker	Speech
1	Joy	Sir, how do you know how much mass you are?
2	Teacher	OK, good question. You know when you step on a scale and it says 75 kilos,
3	Joy	But isn't that the weight?
4	Teacher	It's actually your mass.
5	Richard	But why do we say that's how much we weigh?
6	Teacher	Kilos, mass is measured in kilos. Because everybody uses the language incorrectly.
7		Weight is a force. What do you measure forces in?
8	Joy	Newtons.
9	Teacher	Right. So if you talk about weight you should really be talking about so many newtons. One kilo of mass on Earth produces a weight of 10 newtons.
10	Joy	10 newtons.
11	Teacher	Right. Now what do you weigh? It's your mass in kilos times 10.
12	Yusuf	But how do you know your mass?
13	Teacher	You can measure it using,
14	Michael	450 newtons.
15	Teacher	Your weight is how many newtons you weigh. The force pushing down,
16	Joy	Oh, so wait. Say I,
17	Yusuf	I'm 50 kilos, what I'm []
18	Teacher	OK, 50 kilos. 10 newtons a kilo.
19	Ahmad	So 500 newtons.
20	Teacher	500 newtons is your weight. Cause it's a force.
21	Yusuf	But our mass is,
22	Teacher	50 kilos. His weight is 500 newtons. If you go to space your mass is still 50 kilos but your weight, zero.
23		If you go to the moon, your mass is still 50 kilos but your weight is a sixth of what it was here. So what's that? What's 500 divided by 6?

24	Dina	So, is this right sir? [shows him her paper] This is when it's on Earth and this is when it goes onto the moon.
25	Teacher	That's right. That's right.
26	Joy	Sir, how can your weight still be the same? If your weight,
27	Teacher	No. Your mass is the same, your weight is different.
28	Dina	But how is your mass the same if you (...) times it,
29	Teacher	Because mass is the number of atoms contained in your body. It's atoms that are mass, ok? Particles. That doesn't change when you go up in space. What changes is gravity.
30	Joy	So mass is your weight, and if I weigh 90 kilos, and that's 900 newtons. That means I weigh 900 newtons.
31	Teacher	Yes. That's right. Cause weight is a force.
32	Joy	So isn't that just all the same things?
33	Teacher	Kind of but they are different. Mass and weight are different.
34		I understand why you've got a problem because in our everyday language we use the word weight and really what we're talking about is mass.

In the example above, the teacher and the students construct aporias and temporary solutions related to the problem of distinguishing between mass and weight. During this excerpt of a pedagogical dialogue, three main interrelated aporias are expressed by two different students: (a) Joy's aporia in Line 1 ("How do you know how much mass you are?"; (b) Yusuf's re-formulation of Joy's aporia in Line 12 ("But how do you know your mass?"; and (c) Joy's second aporia in Line 26, which serves more as a follow-up of her initial aporia construction ("How can your weight still be the same?"). The teacher's role is to welcome students' questions as genuine scientific aporias, even when they seem to repeat each other. His acknowledgement of the scientific value of the aporias put forward by the students themselves occurs both at the beginning and at the end of the episode (Line 2: "Good question"; Line 34: "I understand why you've got problem because...").

The constructive element of openness to complexity is evident throughout the dialogue at several points. For example, the teacher gradually increases the complexity of examples, starting off with a scientific observation (Lines 2 & 4: "You know when you step on a scale and it says 75 kilos, (...) it's actually your mass"), passing on to a scientific law (Line 9: "One kilo of mass on Earth produces a weight of 10 newtons"), continuing with a more complex scientific observation (Line 23: "If you go to space your mass is still 50 kilos but your weight, zero"), to finish with a more complex scientific law (Line 29: "That [mass] doesn't change when you go up in space. What changes is gravity"). When it comes to students, the same openness to complexity is present. From a simple application of a scientific law, i.e. transformation of one's own mass into weight (Lines 14 & 19), to a more complex calculation

including comparison between one context and another, i.e. weight on Earth compared to weight on the moon (Line 24), to a self-generated example of a problem and its resolution (Line 30).

The teacher leads the students toward a predefined endpoint every time – by slightly increasing the complexity of the undisputed examples. Students' questions emerge in the dialogue, and counter the teacher's, leading to predictable endpoints. The atmosphere in the class seems to allow students to really explore the issues relevant to weight and mass, but the teacher is actually closing their puzzlements, rather than opening them even more. They could be opened by reformulating the aporias through challenging the temporary solutions proposed; for instance, even on Earth gravity is not the same, and one can be different weights, etc. This opening up to critical aporia is more evident in the next example.

*Sensemaking Type 3 Pedagogical Dialogue: Opening up to critical aporia*

Another type of sensemaking pedagogical dialogue does not focus on the construction of knowledge itself, but on the use of knowledge in ways by which different accounts of the same phenomenon and even different aporias may emerge. What matters is not so much that students make sense of a particular phenomenon, as in Example 2; this learning will also emerge as a by-product. The principle focus is on students constructing their own accounts about what they think a more valid (scientific) explanation may be. In the example presented in Table 3, students argue about whether it is better to play sports indoors or outdoors.

Table 3

*Sensemaking Type 3 Pedagogical Dialogue*

	<b>Speaker</b>	<b>Speech</b>
1	Andrew	Ok, the point is about the spaces ... in the closed spaces there is more transmission of bacteria and viruses between people ... so, everyone gets sick if someone gets sick. Outside, there are also bacteria and viruses, and so we can also get sick. But... there is more oxygen than in an interior space, because the air... is always the same, and when we inhale and exhale, it is ... there is more carbon dioxide getting out ... and therefore the concentration of carbon dioxide in the space starts to increase and that of oxygen to decrease...
2	Laura	One of the problems of sports in the open air is the solar exposition ... we have to carry ... if we are not protected, it can affect our skin, even when the sun is not ... even when it is cloudy ... [inaudible] (she continues her reasoning mentioning also vitamin D)
3	Teacher	<u>And how is it that vitamin D relates to that? Explain!</u>
4	Laura	When ... if we are doing sports in the open air ... but being protected ... we can receive the sun's energy but not the vitamin D...

5	Teacher	When we are wearing sun protection, can we absorb vitamin D?
6	choir	Yes!
7	Teacher	Do you agree with her?
8	choir	Noooo!
9	Teacher	<u>So, how is it?</u>
10	Laura	...I may be mistaken, but when the vitamin D, it only gets absorbed, if we have...if we don't wear sun protection ... [ ]
11	Teacher	It is not about being protected or not protected. It is ... when... when the sun... it projects on our skin, isn't it? There is a substance, let's say, in our skin, called pro-vitamin D and the sun helps this substance to be transformed into vitamin D ... and so, go on ... <u>how is it now?</u>
12	James	Miss, but how is it that ... if we put on sun protection, we don't receive any vitamin D? If not, then it is bad to wear any protection ... shall I put the protection or take in vitamin D? It doesn't sound right, we must have our sun protection on ... (students laugh)
13	Teacher	<u>So? How can we solve this?</u>
14	choir	[inaudible] (students talk simultaneously)
15	Andrew	We can be outdoors during the hours that it is not as hot ... that is ... we cannot be in the sun between 10 in the morning and 4 in the afternoon.

It is interesting to note that the teacher's role is limited to prompts that encourage students' further thinking (e.g. lines 3, 9, 13). At one point, she intervenes by providing a scientific knowledge hint (line 11), which is necessary for re-directing the students to a scientifically valid inquiry path. After providing this short scientific clarification, she goes on to prompt students towards their own search for a scientific explanation. The fact that the solutions provided are temporary, as they depend on the students' access to scientific knowledge and its interpretation, is evident at the end of the same line (11) where she asks: "So how is it *now*?" The use of the adverb "now" represents this temporality and progress of scientific discourse.

When it comes to students, the two critical aspects of aporia, perplexity and two-sidedness, are both evident in their contributions. For example, in Line 1, Andrew provides a balanced argument integrating the pros and cons of playing sports outdoors, as a result of the previous discussions. Then in Line 10, Laura doubts her belief that vitamin D only gets absorbed when not using sun protection, which was an implicit warrant of her argument against playing sports outdoors, which only became explicit due to the teacher's persistence in asking for further explanation (Line 3). A critical aporia moment is present later (Line 7) when the teacher asks for the whole class to express their agreement or disagreement with Laura's assumption, which leads Laura to reflect on her foundations (Line 10). The teacher asking everyone for their agreement/disagreement with Laura makes it possible for

everyone and Laura to open up towards testing their views. Also, this means that the teacher signals that their own views and reasoning are at stake here. That moment of Laura making explicit her assumption (prior knowledge which in this case is incomplete) leads another student, James, to construct his own aporia (Line 12) focusing on the relationship between absorbing vitamin D and wearing sun protection. This new aporia is temporarily solved with a proposal made by another student, Andrew, in Line 15. It is interesting to note that it is not the teacher's authority that resolves the aporia, but another student's contribution, which may be an object of further negotiations until the community (i.e. the classroom) is satisfied with the result of the dialogue (or until the bell rings, which is usually the case...).

### Conclusion

The relation of bewilderment, conceptualized as uncertainty or doubt, with learning is not new (see Cunningham et al., 2005). The new aspect proposed in this essay is the use of bewilderment or aporia as an indicator of different types of pedagogical framing. Considering sensemaking as a general goal for pedagogical dialogue, three types of framing based on differences in how teachers deal with their own and their students' aporia emerged: producing aporia, opening up to complexity, and opening up to critical aporia.

Although this essay opens the way to more philosophical and empirical work regarding the pedagogical functions of bewilderment, as for example its use for framing pedagogical discussions, it also presents some limitations. For instance, I opted to focus only on the cognitive aspects of sensemaking, manifested in discourse, leaving out another important dimension that accompanies, influences, and nurtures learning: the emotive aspects of sensemaking. Another limitation concerns the view of genuineness within a sensemaking dialogic sequence, taking intentionality (as marked by the teacher) of the learning activity for granted, when other research exists that focuses on the "off the mark" sensemaking processes and outcomes that learners often experience independently of the teachers' expectations and framing attempts (see, for example, Aukerman, 2013). More applied research in pedagogical dialogue and its definition as "genuine" is necessary, to inform practitioners as well as researchers especially in the fields of dialogic and argument-based teaching.

In conclusion, teachers must allow aporia to take place in the classroom, and they should take advantage of it as a springboard for productive dialogue. As Burbules (1997) stated, "the goal is not to eliminate aporia (...) but to see within doubt the questions that make a new understanding possible" (p. 40).

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### **Corresponding author**

Chrysi Rapanta

ArgLab – Reasoning and Argumentation Lab, Faculty of Social Sciences and Humanities, Universidade Nova de Lisboa, Lisbon, Portugal

E-mail: [crapanta@fcsh.unl.pt](mailto:crapanta@fcsh.unl.pt)

