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Do teachers make all their students play the same learning games? A comparative study of learning games in Biology and English in primary and lower secondary education

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Abstract:	This article, based upon the field of comparative didactics, seeks to contribute to the identification of generic and specific features in the teaching and learning process. More particularly, its aim is to examine, through the study of two different school subjects: biology and English as a second language, how passive didactic differentiation (Sensevy et al. 2008) can develop and account for the gap in progress growing between more able and less-able students. For our analysis, we adopt a didactic viewpoint basing our study on what is going on in the class when the teacher and her students interact and use notions borrowed from the Joint Action Theory in Didactics (Sensevy and Mercier 2007; Sensevy 2011). At the end of the article, we mainly argue that more teacher training focused on 'objects of learning' and 'knowledge-in-use' is necessary if we want teachers to be able to produce didactic milieus adapted to students with mixed abilities and, more generally, if we want to increase epistemic access (Morrow 2007).

Do teachers make all their students play the same learning games? A comparative study of learning games in Biology and English in primary and lower secondary education

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1. Introduction

This article is based upon the field of comparative didactics. As such, it seeks to study whether similar phenomena can be observed in teaching and learning two different school subjects: biology and English as a second language. The study of the epistemic content of the didactic transactions (Vernant, 1997) involved is based here on the analysis of two teachers' usual practices - in two different subjects and at two different levels: at grade 2 for biology and grade 6 for English. At first sight, it may appear surprising to compare these two seemingly very different subjects as one of them is scientific whereas the other is literary. However, we believe that learning a subject consists in some way of learning how to speak the language of that subject[1]. Therefore, in both situations, students have to deal with the use of an unfamiliar language: the language of biology and the English language. Thus, this article seeks to contribute to the identification of generic and specific features in the teaching and learning process.

It is now well known that learning differences and students' relationship to the culture of learning can be accounted for by a variety of phenomena among which their social and family background plays an important role. Students' relationship to the culture of learning has an important impact on their opportunities to succeed (Guild and Garger 1998; Rochex 2001)

It is also well known that far from reducing the gap between students from upper and lower social class, schooling tends to widen it. Indeed, PISA 2009 results (OECD 2011) show that, in an equitable education system, students' academic success is largely independent of their family and socioeconomic environment. By contrast, in an inequitable education system, the impact of these variables is important. In that case, education systems are far from offering equal opportunities for all. In Austria, Belgium, France, Germany, Luxembourg and Hungary the impact of socio-economic status is greater than in the average of OECD countries, although income inequalities are below average.

A great deal of research has been conducted to try and understand the mechanisms responsible for this state of affairs. Our research forms part of this. Nevertheless, we adopt a specific viewpoint: a didactic[2] one and as such we base our study on what is going on in the class when the teacher and her students interact. Therefore, our study follows work conducted recently in primary education (Piquée and Sensevy 2007) showing that teachers are subject to constraints that affect their actions. One major constraint lies in the fact that teachers have both to take into account the progress of the didactic time and students' heterogeneous abilities.

The notion of passive didactic differentiation (Sensevy et al. 2008) provides a means of accounting for the gap in progress growing between students during the year. “The notion of *passive didactic differentiation* allows us to understand and categorise the development of heterogeneity, which we consider is part and parcel of the teaching process." (*Ibid.*). These results lead us to believe that the

1 “The language uses, closely related to the epistemology of the subjects cannot, in our opinion, be taught / learned outside the context of the activity itself” (Jaubert & Rebière 2001).

2 In our work, the word “didactic/s” is used in its French meaning. This signifies that, following Chevallard’s work (2007), we focus on the anthropological and action-based dimension of the teaching and learning process and insist on the necessity to associate the analysis of knowledge in use with the study of institutional practices, in which the pieces of knowledge are created, developed, used, spread, taught and learned.

didactic joint action (Sensevy and Mercier 2007; Sensevy 2011) could be elective since some students seem to be excluded from it.
In our opinion, the phenomenon of passive didactic differentiation could present both generic features, which could outweigh subjects and levels of education (at least in regard to the two case studies presented here), and also more specific features related to the learning environments characteristic of each subject.
The purpose of this article is to study how the phenomenon of passive didactic differentiation can be described in its generic and specific dimensions and, in doing so, to investigate the following question: to what extent does the teachers' and students' joint action tend to reduce or widen the gap between less-able and more able students?
In order to try and answer this question, we will examine how the situations set up by teachers contribute to the development of learning inequalities and how the way teachers regulate didactic transactions causes passive didactic differentiation that contributes to widen this gap between students. However, before presenting our analyses, which are conducted at a micro level, and our main results, we will first outline the main theoretical tools we use to conduct our analyses and describe our methodology.

2. Theoretical framework

2.1. Joint Action Theory in Didactics (JATD)

JATD stems from French Didactics (in particular, Brousseau 1998; Chevallard 2007) whose core principle states that in order to understand a didactic activity (i.e. an activity where someone teaches and someone learns) one needs to understand a *system*, the *didactic system*, which is a system composed of three subsystems, the subsystem of Knowledge (the piece of knowledge in question), the subsystem of the Teacher, and the subsystem of the Student. By arguing that the didactic system is an *indivisible* system, we emphasize the fact that if one wants to understand a *didactic transaction*, where person B does something so that person A learns something, one needs to study the relationship between the three subsystems.
In this theory, teaching and learning situations are described as games, which are not defined in terms of *game theory* but with reference to Bourdieu's work (1987) in which human interactions can be seen as games. From the games defined within this theory[3], we will focus in this article on what we call 'learning games', which can be briefly defined by two major characteristics: the first one is that these games can only be observed *in situ*, that is while the teacher and the students are playing them; the second is that they are by nature collaborative games − joint games that rely on a joint action (Clark, Herbert H., 1996).
In our theoretical framework, these games are described in relation to two core notions, the *didactic contract* and the *milieu*, that allow us to evaluate the way the situation evolves over time and thus to better understand the conditions in which knowledge is built up via the on-going transactions. Indeed, using the notion of learning games helps us surface the way in which the didactic contract expresses itself through a system of objects that constitutes the didactic milieu (Brousseau 1998; Sensevy 2007, 2011).

2.2. The didactic contract and the milieu

The notion of *didactic contract* (Brousseau 1998) is used to describe the system of habits, which is largely implicit, between the teacher and the students in relation to the knowledge in question. On the basis of those habits established in the didactic institution, each participant (the teacher or the students) attributes some expectations to the other(s). This means that these habits are collective habits or joint habits that represent a permanent feature of the didactic relationship even though the nature of the didactic contract may evolve according to the game that is currently being played. Thus the didactic contract provides shared understanding between the teacher and the students, against which the didactic transactions occur.

3 For more information about the way the notion of games is used to describe teaching and learning situations, see Gruson, Forest and Loquet, 2012.

But this shared understanding has to be renewed. Thus, in order to learn, students have to deal with a situation involving a problem that previous knowledge does not allow them to solve. In JATD we term this situation a *milieu* (Brousseau 1998). This concept describes the system of material and symbolic objects corresponding to the new knowledge the students are to acquire. In this account, the older pieces of knowledge enable the teacher and the students to play the appropriate learning games whereas the new knowledge provokes a kind of resistance to the student's action. The fundamental idea here is that by experiencing the resistance of the milieu, students identify an area of ignorance and the need for a specific piece of knowledge that will bridge this "ignorance gap".

2.3. The notion of capital of adequacy

The next notion we refer to is the notion of capital of adequacy (Sensevy 1998; Tambonne and Mercier 2000 and Marlot 2008, 2012). It allows us to characterize students' relationship to the culture of learning and the effect of that relation on the way students develop learning abilities. Indeed, some students develop an "almost natural" ability to focus their attention on 'adequate objects', that is to say, objects in which knowledge is most densely embedded. These students have, according to Sensevy (1998), a significant 'capital of adequacy'. In contrast, other students are unable to recognize adequate objects. In that case, they are considered to be students having a low capital of adequacy.

The ability to identify adequate objects is strongly related to the capacity to interpret the institution's and teachers' expectations. Thus, as we can see, the notion of 'capital of adequacy' is fundamentally linked to that of institution: some objects are adequate for a given institution (and not for another). The teacher expects the students who have a significant capital of adequacy to produce the expected behaviour, and then he relies on them to move his teaching project forward. Consequently, these students generally benefit from a high "capital of trust" among their peers.

In a complementary way, we consider that the notion of 'capital of adequacy' cannot be understood without being related to that of 'capital of knowledge', i.e. knowledge students have to draw upon to produce adequate behaviours.

Finally, we argue that the originality of this proposal lies in the fact that it represents an attempt to capture the phenomenon of passive didactic differentiation by bringing together the notions of learning game and capital of adequacy (Sensevy 1998; Tambonne and Mercier 2000 et Marlot 2008).

3. Elements of methodology

The data composing the corpus of this research can be categorised as follows: audio and video recordings of two lessons, documents or devices designed or used by the teachers and audio recordings of *ante* and *post* interviews. To make the study possible the lessons have been completely transcribed and these transcriptions used to make synopses[4]. These, in turn, have enabled us to select significant episodes.

The approach used to analyse these data is mainly characterized by a constant interplay between our theoretical tools and empirical data. It is also a clinical approach (Foucault 1963; Leutenegger 2000) that enables the researcher to build a network of meanings relying on different levels of analysis, the micro and meso levels. Indeed, in order to avoid over-interpreting the data, the microanalyses of the interactions are systematically relocated in wider contexts corresponding either to the whole lesson or the whole teaching unit. This movement between different levels is an important feature of our methodology. It includes two main stages: the first one corresponds to the presentation of the context of the episode analysed; the second provides an *a priori* didactic analysis (Mercier and Salin 1988) of the knowledge involved in the situations set up by the teachers. The aim of this *a priori* analysis is to identify the potential learning opportunities but also the possible

4 The synopsis provides a synoptic view of the lesson and makes visible relationships one could not perceive if one looked at the lesson only in a chronological order.

obstacles the situation offers. Finally, the analysis of actual practice is based on a dynamic analysis of the learning game using the language of JATD. It focuses on the way the teacher makes the students play the game and examines the evolution of the different learning games thus allowing us to better understand why some students acquire new knowledge whereas others do not.

4. Presentation of the situations

4.1. An Overview of Teaching and Learning English and Biology in France

In France, following the Common European Framework of Reference for languages (CEFR), the current methodology promoted in the official curriculum is an action-oriented approach "in so far as it views users and learners of a language primarily as 'social agents', i.e. members of society who have tasks (not exclusively language-related) to accomplish in a given set of circumstances, in a specific environment and within a particular field of action" (Council of Europe, 2001). The CEFR provides guidelines for the development of teaching units and tools to measure students' levels of proficiency at different learning stages. At the end of primary school, French students are supposed to have acquired the basic user level (A1). The CEFR assumes that interculturality is developed through language learning, implying that work on language and culture is closely interlinked. Thus, the main objectives of teaching and learning second languages are to develop both students' ability to communicate and intercultural skills.

In biology, the main objective is to encourage the development of a scientific and technical culture among citizens. From a methodological viewpoint, teaching biology in France aims to develop abilities related to the inquiry-based learning. This approach places an emphasis upon students' initiative and questioning as opposed to "direct instruction." However, this scientific investigation is not quite similar to the Inquiry Based Science Education (ISBE), promoted in the USA (Lederman and Stefanich 2004). In classes in France, the questions investigated are (most of the time) proposed by the teacher and acquisition of knowledge is seldom based on experimentation. Knowledge acquisition, throughout the inquiry process, assumes that empirical facts will be cross-checked with items of knowledge. But, this process is often strongly influenced by the teacher. However, as in the ISBE, this approach focuses on understanding the nature of science and the goal remains the production of appropriate scientific evidence to validate or invalidate initial hypotheses. This process of inquiry can be divided into five distinct levels that can be briefly described thus: bringing to light students' mental representations / making students create questions of their own / producing hypotheses / obtaining supporting evidence to answer the question(s) / debating about the results and identifying the item of knowledge in question.

4.2. Context of the study

The two teachers who were observed had quite contrasting backgrounds. The English teacher was a very experienced teacher whereas the biology teacher was a beginner. As for the students, we can consider that they were quite similar even if their ages differed a lot. The students studying English were in year six and those studying biology in year four. Otherwise, the number of students in both classes was about the same: 24 for the English class and 21 for the biology class and both of them were of very mixed ability.

In English, we observed students working in pairs, an activity designed by the teacher according to the information gap principle: a student knows something his/her partner does not. In second language didactics, 'pairwork' activities are depicted as opportunities for the students to practice the language more personally and independently. To interact during the pairwork, the dyads of students had the documents below: the student called "Pupil A" had the document appearing on the left and his/her partner called "Pupil B" had the document on the right.

PAIR WORK

Pupil A

Ask your friend questions and tick or write down his/her answers

cousin? good friend?	Yes	No
Name?		
Age?		
video games?	Yes	No
Video games?	Yes	No
Quantity of video games ?		

PAIR WORK

Pupil B

Ask your friend questions and tick or write down his/her answers

cousin? good friend?	Yes	No
Name?		
Age?		
music ?	Yes	No
CDs ?	Yes	No
Quantity of CDs ?		

Table 1: Documents used in the English class

As can be seen from the document, pupil A had to ask his/her partner about the video games his/her cousin or good friend was supposed to have. As for the task concerning pupil B, it was very similar except that instead of asking questions about video games, pupil B had to ask questions about music and CDs. Apart from this difference, the documents were nearly identical.

In biology, the observed situation consisted of the debating phase of the inquiry-based approach described above. During this phase, the students had to confirm or disprove three initial hypotheses related to the problem they had to solve: how does an earthworm go into the earth? These hypotheses were the following: 1- it pushes the earth, 2- it eats the earth, 3- it uses its sharp head to dig into the earth. To make their observations the students, who worked in groups, used an experimental device they had designed the lesson before. It was a very simple device consisting of a stack of earth and a few earthworms.

Let us now examine what happened during the two lessons.

5. Results

In this part of our work, we produce a didactic analysis of both situations as they unfold *in situ*. On the basis of these analyses, we then try to identify the elements likely to foster passive didactic differentiation.

5.1. Shifts in the learning games: from the expected to the effective learning games

According to Marlot (2009), it sometimes happens that the expected specific learning games cannot be played. Then, more generic games, that are more easily available, are introduced either by the teacher or the students. These more generic games somehow substitute themselves for the expected games. We call this phenomenon *a shift in the game*. We will see in the following analyses how and why *a shift in the game* can occur.

a) What happens with the whole class in English?

In the English class, the pairwork activity is divided into two stages: a collective one and a phase during which the students work in pairs.

In the expected learning game, the students would have to produce personal sentences, the priority being given to fluency over accuracy. To win the game the students have to produce these personal sentences using the syntactic forms they have being working on in the preceding lessons. The main syntactic form involved is thus the use of the verbal form: ‘have got’.

A close *a priori* analysis of the documents reveals that several difficulties may arise during the activity. First, to perform the task, the students have to use a wide variety of structures involving different verbs (‘be’ / ‘have’ (‘got’) / ‘like’). Secondly, a close analysis shows that, far from being an open task, the students have to use a set of imposed questions. Indeed, Pupil B has to answer the fourth question (does your cousin like video games?) positively to allow his/her partner to ask all the expected questions. Finally, we note that the situation is unrealistic and lacks concrete references. Who knows how many CDs he/she has?

Finally, what is important to keep in mind is that the milieu created by these documents does not enable the students to practise the knowledge, as it is initially defined. Indeed, instead of putting the students in a position to produce personal and spontaneous sentences, this milieu limits the students' action to the repeating of pre-defined sentences as shown in the following extracts:

Teacher	Christian speak up speak up Christian it's correct so?
Christian	Has your cousin got CD's?
Teacher	Yes, could you repeat again?
Christian	Has your cousin got CD's?
Teacher	Repeat *[The teacher nods twice]*
Christian	Has your cousin got CD's?
Teacher	Yes *[The teacher writes Has on the board]* Has your cousin got CD's? What is the question Claudine for video games?
Claudine	Has/non + has got <…..?> ++ Have you got a cousin?
Teacher	It's not Alain it's his or her cousin so it is? +++ Mathilde
Mathilde	Has your cousin got video games?
Teacher	Claudine could you repeat?
Claudine	Have your cousin has your cousin has your cousin video games/ has got video games?
Teacher	The whole question and correct please
Claudine	Your cousin *[The teacher points to the HAS written on the board]* has your cousin got video games?
Teacher	so you repeat now has your cousin got video games?
Claudine	Has your cousin got video games?
Teacher	Be careful cousin
Claudine	Cousin

Table 2: Transcription from the English class (1)

Consequently, the learning games that were really played during the activity can be depicted with the following diagram[5]:

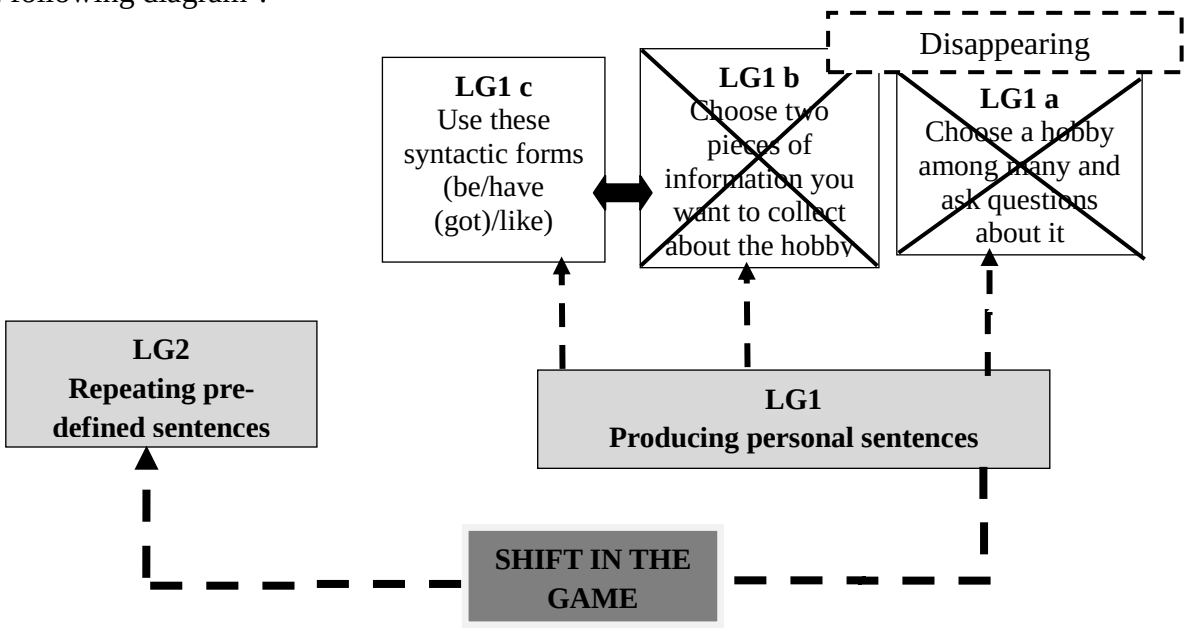

Table 3: The shift in the game in the English class

The short extract clearly shows that the initial LG « producing personal sentences » is given up and transformed into a substitution LG « repeating pre-defined sentences » which is less dense in knowledge. This transformation involves a modification of the initial didactic contract as from the

[5] In the diagram, LG stands for learning games and the dotted lines show on what specific games the main LG relied.

"correct and complete sentence contract" we shift to the "repeating contract". So the *shift in the game* is here mainly the consequence of a shift in the didactic contract.

b) What happens with the whole class in biology?
In the expected LG the students have to produce an explanation about the earthworm burying process. To produce these ideas, the students have to rely on elements of observation in relation to the 3 hypotheses.
A close *a priori* analysis of the knowledge involved leads us to think that answering the question "how does an earthworm go into the earth?" is similar to answering this new question: "does an earthworm have specific organs which enable it to go into the earth?" Besides, the *a priori* analysis of the situation set up by the teacher leads us to look more closely at the observation device in relation to the learning aims. It appears that the device doesn't enable the students to see whether the worms swallow the earth or not. Moreover, nothing in the device compels the worms to go into the earth. Thus, the students could see nothing at all.
Now let's examine the answers produced by the groups of students:
G1: "Earthworms swallow and reject the earth"
G2: "Earthworms push into the earth"
G3: "Earthworms push with their sharp heads"
G5: "Earthworms dig into the earth"

Firstly, it is important to notice that group 4 didn't answer the question; they made a mistake and dealt with a different question. Secondly, we can see that none of the answers even that of group 1 relies on the elements present in the observation (relevant observations) but rather on the 3 hypotheses. Thus what the students produce are pre-defined sentences, which is very similar to answering a multiple-choice questionnaire.
Consequently, the learning games that were really played during the activity can be depicted by the following diagram:

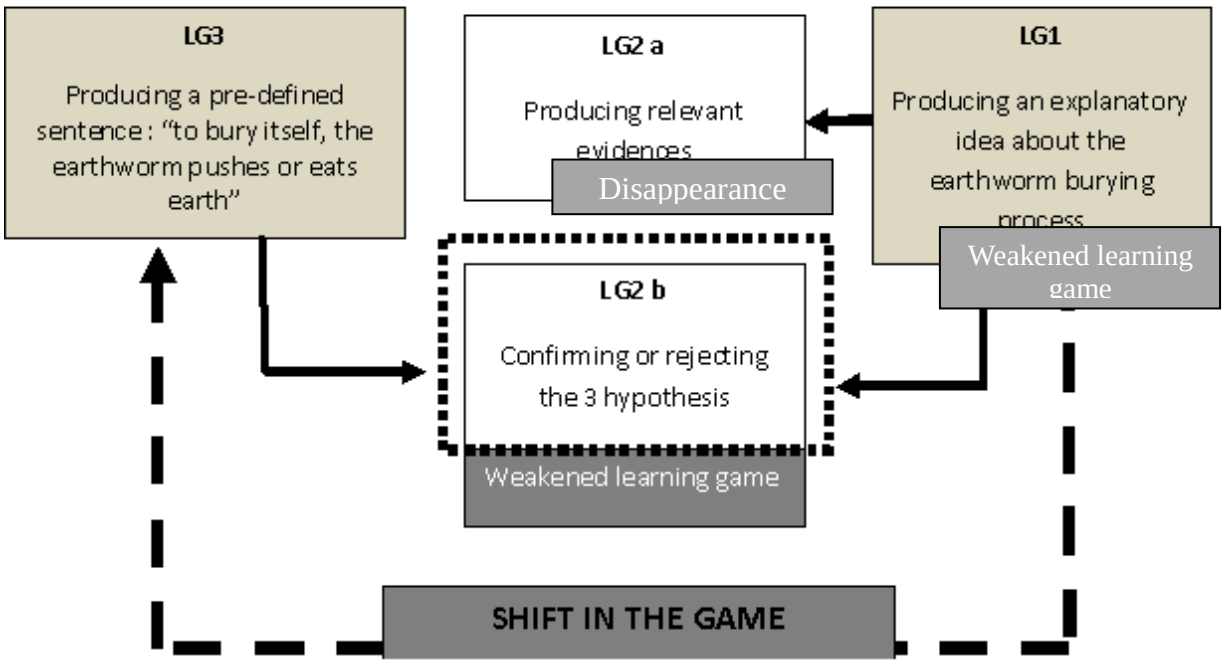

Table 4: The shift in the game in the biology class

This clearly shows that the initial LG "producing an explanatory idea about the burying process" is given up and transformed into a substitution LG "producing pre-defined sentences". Similarly to what happens in the English class, we notice that this second game is less dense in knowledge. But, unlike English, this transformation does not correspond to a modification of the didactic contract

but to a modification of the initial didactic milieu as the students' attention shifts from the ineffective observation device to the 3 hypotheses. So the shift in the game here is mainly the consequence of a shift in the didactic milieu.

5.2. An elective mechanism

In both situations, the English class and the science class, the students we chose to observe are all subjected to the same constraint: the milieu is not resistant enough and as such does not make the students produce the expected knowledge. In biology, the inability to rely on relevant observations makes the students' attempts at producing scientific argument impossible; in English, the documents on which the students depend prevent them from producing personal sentences and limit them to the repetition of pre-defined sentences.

The episodes below show how the students, depending on whether they have a high or low capital of adequacy, react to the shifts in the learning games resulting from the weakness of the 'milieus'.

a) What happens when the students work in pairs in English[6]?

The first very short episode shows what happens as two students, Charlène and Martin, who both have a high capital of adequacy, interact in pairs without direct supervision from the teacher.

Charlène	How many + how many CD's has ++ how many CD's has your cousin got?
Martin	Er…? Comment on dit déjà ? *(how do you say?[7])* +++ heu + twenty + heu + Twenty-five + au hasard + *(as a guess)*

Table 5: Transcription from the English class (2)

As can be seen from their two statements, Charlène and Martin both draw on the objects present in the milieu to produce their sentences despite the obstacles previously described. In doing so, they play the expected game as modified during the first part of lesson. However, if we examine Martin's answer more thoroughly, we observe that by adding the expression "as a guess" he clearly signals to his partner that his answer has no validity whatsoever. This indicates that Martin is not really involved in the situation but simply complies with the teacher's expectations. We can then argue that these two students' action is driven both by the milieu and the didactic contract.

By contrast, the second following extracts illustrate how Jimmy, a student with a low capital of adequacy, reacts to the situation making comments that reveal his relationship to the didactic contract.

Sylvaine	Has got + a cousin + a cousin?
Jimmy	Hein ? *(what?)*
Sylvaine	Has got a cousin or a good friend? +
Jimmy	Ca veut dire quoi ? *(What does that mean?)*

Jimmy	Eh, yes + Name, Ca veut dire quoi ça ? *(What does that mean?)* + What's your name? Vas-y, comment tu t'appelles? (*Come on, what's your name)* + Oh, Sylvaine, c'est magnifique, moi je m'appelle Jimmy, tu sais ? (*Oh, Sylvaine, that's great my name is Jimmy you know)*

Table 6: Transcription from the English class (3)

As can be observed, Jimmy refuses to draw on the objects present in the milieu to produce his sentences. He repeatedly indicates that he does not understand *(what? what does it mean?)* whereas the linguistic elements used by Sylvaine are very familiar to grade 6 students and even to Jimmy who translates Sylvaine's question (What's you name? Vas-y, comment tu t'appelles? (*Come on,*

[6] For a more thorough analysis of this situation in relation with the notions of didactic contract and milieu, see Gruson (2009).

[7] The sentences appearing in brackets correspond to the translation of what the students say in French.

what's your name) just after having said he cannot understand it. Moreover, at the end of the last speech-turn, Jimmy's comments clearly show that he thinks the situation is absurd. Consequently, he refuses to play the current learning game.

b) What happens in biology when we observe the action of two students of different ability after the shift in the game has occurred?

After the observation work made in groups, the teacher sets up a collective discussion that seeks to validate or invalidate the three hypotheses (1- the earthworm pushes the earth, 2- the earthworm eats the earth, 3- the earthworm uses its sharp head to dig into the earth).

His intention - expressed in the interviews – is then to invite the students to participate in a debate that has something in common with a scientific debate depending on the production of relevant arguments. This is indeed a way to help students become acquainted with scientific reasoning and the language of biology.

The extracts focus on two students, Kevin who is a student with a high capital of adequacy and Charlotte who has a low capital of adequacy. They both express themselves during the collective discussion.

181	**T:** Who is right? So, is it possible to have several different answers or not?

184	**T:** /For group 1 who is right? /Is it possible to have several answers or not? / Group 4 (*Charlotte's group)* **who has not observed yet**, what do you think?
185	**Charlotte**: It pushes
186	**T**: You think it pushes that means that groups 2, 5 and 3 are right /**then** we keep "they push" they push the earth

196	**T**: Could the earth get out through their mouths?
197	**Several students**: No
198	**T**: Why not?
199	**Kévin**: Because we can do this (*Kevin mimes the swallowing process*) and then we spit … but the earthworm cannot + er it has no tongue…well, we can't really know.
200	**T**: Well if the earthworm has no tongue, we can't know whether the earth gets out from the front /**then** the earth would get in from the front and out from the back.

Table 5: Transcription from the biology class (1)

First, we can observe that these 2 students don't answer the same type of question. Charlotte answers the question "who is right?" whereas Kevin answers the question "can the earth be expelled from the worm's mouth?" It appears that each student is "attracted" by a type of question (a MCQ for Charlotte and a more open question for Kévin). Anyway, with both these students, we notice a shift in the elements of observation. But Kevin, engages in an attempt to reason based upon comparing human beings and worms. In doing so, he draws on his personal experience and his ability to reason (probably developed outside school). On the other hand, Charlotte substitutes a pre-conceived answer for experimental observation, which, to her mind, corresponds to the teacher's expected response: "the earthworm pushes the earth".

Secondly, we notice that the teacher uses Charlotte's and Kevin's answers to discredit the proposal made by Group 1: "the earthworm swallows and expels the earth". Here we see a mode of interaction that is the typical class dialogue corresponding to a classical format in school: the teacher asks a question, the student answers, the teacher accepts or rejects the student's response. In both cases, the teacher draws on Charlotte's and Kévin's answers to move the didactic time forward as economically as possible. With Charlotte, he tries to push through the validation of the hypothesis "it pushes" while giving the impression that this validation is supported by Charlotte. In doing so, the teacher revalues Charlotte's "social" value – or her capital of trust - artificially in the class. In a similar way, the teacher uses Kévin's proposal ("the worms cannot expel earth from their mouth") in order to support his own argument, although Kévin's proposal is not derived from observation. Kévin like Charlotte acts as an assistant whom the teacher uses to move his didactic

project forward, whilst seeming to cooperate with him in building knowledge. It is no coincidence that the teacher uses Kevin's remarks who has a capital of trust with other students, thanks to his high capital of adequacy. This way it is easier to get smoothly through what is in fact a "small *act of force*".

6. Discussion: a way to characterize passive didactic differentiation

As shown by sociologists, analysis of these two case studies shows that the joint action tends to increase the gap between students with a high and a low capital of adequacy especially when the milieu is inconsistent. Considering the joint dimension of action in class, we now examine to what extent the teacher and/or the students are accountable for the emergence and the development of passive didactic differentiation in the teaching and learning process.

6.1 The role played by the teachers

From the specific viewpoint of biology, passive didactic differentiation occurs across the range of questions students have to deal with. As we have seen in the study, some questions are likely to lead students to produce elements of reasoning on the object of study. This leads students to gradually develop during the course of their interaction with the teacher or peers, explanatory ideas about the phenomenon under consideration. In contrast, questions requiring closed, stereotypical or consensual answers greatly reduce the students' level of cognitive and didactic involvement.

In English, passive didactic differentiation occurs as, prior to the pairwork activity, very few students have sufficient command of the communicative skills needed to deal correctly with the linguistic situation. Thus, if the teacher does not provide the weakest students with the necessary linguistic tools so as to reduce differences between students, then they may never produce adequate sentences but simply repeat what the more able students say, or even refuse to speak the second language.

Finally, our study suggests that the phenomenon of passive didactic differentiation is more likely to occur when the students' action is more contract-directed (more attention is given to the type of response expected) than milieu-directed (more attention is given to action and feedback from the various objects composing the study milieu). Indeed, students with a low capital of adequacy, as we have shown in this study, can quite easily comply with superficial expectations (produce an answer, of some kind) whereas it is more difficult for them to produce relevant actions with reference to the milieu of the study (engage in reasoning by linking relevant observations, produce a correct personal statement taking into account syntactic constraints). If more attention is given to the contract, the teacher may validate not only relevant answers (those that move the collective construction of knowledge forward), but also all types of answers including those that are contract-directed. Students with a low capital of adequacy will then be confirmed in their position while they won't have learnt anything. In this case, students do not realise their ignorance, and are therefore misled.

Similarly, giving more attention to the milieu tends to undermine students with a low capital of adequacy. Deprived of the "rules of the LG" and of its goals, they cannot grasp the objects of the milieu: they use them differently or just do not use them. In this case, students are confronted with their ignorance without being able to overcome it.

Using the notions of 'contract' and 'milieu' allows us, we think, to identify more clearly the teachers' didactic responsibilities toward less able students: teachers must pay equal attention to elements of the contract and the milieu so that these are always well balanced (Sensevy, 2011).

6.2. The students' ability to reinterpret the milieu

The chart below allows us to compare the behaviour and learning status of students with a high and low capital of adequacy in the two subjects in question here.

	Students with a low capital of adequacy	**Students with a high capital of adequacy**
Biology	Charlotte: a game of imitation Over-adjustment to the contract	Kevin: producing analogical reasoning Adjustment to the contract

English	Jimmy: a game of mockery Under-adjustment to the contract	Martin/Charlène: playing the expected game Respecting the contract
Elements of comparison	Reinterpreting the milieu for social reasons (relation with the teacher and peers) Great distance from the culture of learning	Reinterpreting the milieu for learning purposes Little distance from the culture of learning

Table 6: Comparing students

This synopsis of our results suggests that, under the conditions observed, situations of "oral communication in pairs in English", and of "students producing devices for observation in biology", seem to be only useful for students with a high capital of adequacy.

Where the milieus organised by teachers are insufficiently adequate (i.e. they do not allow them to acquire new knowledge), these situations favour the logic of contract over the logic of milieu. Students with a high capital of adequacy being close to the culture of learning, are allowed to identify the expectations of the contract and reinterpret the milieu in order to learn. In contrast, students with a low capital of adequacy who are unable to reinterpret the inadequate milieu didactically are forced to either comply with "school formats" that limit them to representations of the practical experiences specific to each subject (over-adjustment to the contract in Charlotte's case, which leads her to produce an answer without reasoning) or waive any opportunity to learn (under-adjustment to the contract in the case of Jimmy who simply mocks the situation). However, these students still make use of these milieus, especially since they do not participate in the collective production of knowledge. They need to be accepted and recognised either by the teacher or their peers. Thus Charlotte sticks to her teacher's expectations and Jimmy entertains his classmates. This is why we say that these two students with a low capital of adequacy also reinterpret the milieu, not for learning however, but for socialization.

If this situation occurs frequently, we believe that students with a low capital of adequacy regularly exposed to such implicit "orders" will identify themselves with the lowest level tasks assigned to them. As a consequence, they may develop a particular relationship with learning (Charlot 2002) leading students with a low capital of adequacy to simply draw on their benefits and students with a high capital of adequacy to increase theirs, which is likely to foster inequality in the school situation with each type of student becoming attached to different fields or levels of knowledge. Then what we call the phenomenon of *passive didactic differentiation* may insidiously develop.

7. Conclusion

In our opinion, this set of results has strong implications for teacher training.

First, we need to make teachers aware of this elective mechanism, i.e. *passive didactic differentiation*, as an integral part of the didactic process. Then, if we want each student to find in the study milieu the material and symbolic objects needed to play the expected learning game so that all students are able to identify the "good objects", teachers must be adequately trained to seriously investigate the knowledge involved, mainly before implementing the situation. We argue that if teachers were able to produce milieus adapted to students with different capitals of adequacy it would avoid teachers lowering learning objectives. Resisting this elective mechanism would then mean that teachers would move from *passive* didactic differentiation to *active* didactic differentiation. One of our ambitions is to produce, in collaboration with teachers, tools that would help teachers identify the didactic variables responsible for this mechanism. Among those tools, we argue that one of the priorities would be to help them produce resistant and relevant milieus. By resistant milieus, we mean milieus that could offer enough resistance so that every student, whatever his/her capital of adequacy, could acquire new knowledge on his/her own with the teacher's assistance. 'Relevant milieus' means milieus tailored to the greatest number of students' learning needs and that would allow all of them to experience knowledge.

Finally, we argue that more teacher training focused on 'objects of learning' and 'knowledge-in-use' is necessary if we want to increase epistemic access (Morrow 2007). We strongly believe, as Adler

(forthcoming) explains, that we need "to create time for teachers out of school where they themselves have opportunity to participate in various [knowledge] practices, practices that 'deepen' their [..] knowledge for and in teaching [..], providing opportunity for teachers to appreciate that their knowledge-in-use is a key resource in their practice". So it seems crucial to us to develop professional practices that put the knowledge question at the forefront.

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