

CHARACTERISTICS OF TEACHER PRACTICES IN THE CLASSROOM – HOW DOES PEDAGOGICAL SEQUENCE FRAGMENTATION OCCUR?

Anne L. Scarinci^{1,a)}, Jesuína L. A. Pacca¹

¹*Physics Institute, University of Sao Paulo, Brazil*

1 INTRODUCTION

By observing the practice of Physics teachers who attend in-service courses, we notice they experience significant difficulties in suiting the knowledge learned in the course within the set of their actions in the classroom, and the forced attempt of inclusion of the conveyed proposals in their class planning often results in a rupture of the pedagogical sequence, which generates considerable discomfort to the teacher.

This work sought to locate objectively this rupture in the sequence planned and carried out by the teacher. We monitored an in-service formation group where teachers aimed changes in their classroom practices through the comprehension and employment of constructivist strategies. To disclose the occurrences of fragmentation in their pedagogical sequences, we utilized an instrument capable of collecting information about the performance of the teacher in the classroom, according to the constructivist framework in study by the group.

2 METHODOLOGIES

This research relied on the analysis tool (displayed on Fig. 1), that had been constructed for another research [1]. The original questionnaire contained 17 questions from which we selected a few that better addressed our aims towards providing data that characterize ruptures in the pedagogical sequence. For reference purposes, we kept the original numeration.

We highlight that the practices more closely related to constructivist theories are listed on the items (a) of the tool, while the ones furthest away from this theoretical trend are listed on items (c). For a more detailed description on the working up of the tool and the organization of the items, please consult Scarinci (2006).

The data resulted from information given by nine teachers. To gather it, as well as to analyse and interpret the results and to build up the proper tools for our analysis, we have relied on Lüdke & André (1996), Bogdan & Bilken (1994) and Pacca & Villani (1990) [2-4]. The two main sources used were accounts and interviews, taken by *in loco* notes and by audio recording.

The teacher group met once a week for 06 hours for the formation activities, and this group was monitored for a whole school year period.

^{a)} Corresponding author's e-mail: l.scarinci@gmail.com

ANALYSIS CATEGORIES

Teacher & strategies

2. How does the teacher operate alternative conceptions?
 - a) Employs them to the development of scientific knowledge.
 - b) With intention of connecting them to the sequence of activities.
 - c) Does not include them into the sequence of activities.
3. How does he/she lead the development of an activity?
 - a) Objectives of the activity are clear and teacher gives room to the student's manifestations.
 - b) Objectives of the activity are clear but does not give room to student's manifestations.
 - c) Teacher is not aware of the specific objectives of the activity.
4. How does he/she close a theme or activity?
 - a) Relates the scientific knowledge with what the student has constructed.
 - b) Does not explicitly make a closure.
 - c) Closes with ruptures between the constructed knowledge and the scientific one.
5. Which structure does the sequence applied by the teacher follow?
 - a) Content originated in a problem situation.
 - b) Logics of the established scientific knowledge.
 - c) Random sequence or suggested by a table of contents.

Teacher & abilities

6. How does the teacher unite the many activities belonging to the same theme?
 - a) Manages, in the classroom, to unite the sequence.
 - b) Does not manage to link the activities in the classroom.
 - c) Is not concerned with this in the classroom.
8. How does he/she operate the class planning in accordance to the practice?
 - a) Adds-on related to feedback and keeping the final objective.
 - b) Adds-on with no relation to feedback.
 - c) Adds-on irrelevant to planning.

Teacher & attitudes

10. How does the teacher take part in the construction of knowledge during a proposed activity?
 - a) Shares the construction of knowledge with students
 - b) Monitors it from outside
 - c) Focuses the activities and the implicit contents.
11. What is the teacher's reaction to a question when he/she knows the answer to it?
 - a) Assists the construction of the answer
 - b) Doesn't answer and repeats the question
 - c) Gives the answer
12. What's the teacher's reaction to a question when he doesn't know the answer to it?
 - a) Studies, with students, to discover the answer
 - b) Studies and brings the answer to students
 - c) Answers something meaningless.

Figure 1 Analysis tool utilized.

The interview, of a semi-open kind, was carried out based on the planning listed below (Fig. 2), adding, whenever necessary, questions about students' reactions and behaviours.

1. Tell us a class. We imagine the teacher chooses one class they've enjoyed.
 - a) How did it start?
 - b) How did it end?
 - c) What happened after the class? *How teacher followed up with the content in subsequent classes.*
 - d) How did you get to this class? *Teacher tells the previous part of the sequence.*
 - e) Do you think this was a good class? Why?
 - f) Would you use this activity again? What modifications would you make?

2. Tell a class you did not like.

Follow items a to f above. Item e is substituted by:

 - e) Why did you not like this class? Do you think the students shared this opinion?

Figure 2 Planned structure for the individual interview with the teachers.

3 DATA ANALYSIS

"I started by proposing a problem on the blackboard: In which situations does the bulb switch on?"

Coherent with the purposes of the formation group, the teachers sought to initiate a new sequence theme through a question to be solved. During the first phase of the theme, teachers also attempted to design activities to diagnose preconceptions. They were aware they would have to utilize these activities or their results in the subsequent teaching process. However, some great difficulties were detected at this point:

"Because I didn't know how to follow up with this, 'and now, do I tell (...)?' Because in the end I tell them the answer." [5]

"I don't make use of what the student says. I don't know how to make them have a conceptual change. It's not clear to me what I can expect from the student and what I have to tell him."

The two statements above show teachers included in item (b) of question 2: they intend to include the preconceptions in ulterior activities, though admitting they still ignore its *modus operandi*. The rupture of the pedagogical sequence happens next - when the teacher solves the situation with his/her pre-conception about constructivism, or when he/she returns to strategies of lecture teaching:

"[Teacher reproduces student speech and response] 'Oh, Ms. but how can you ask something if we haven't studied it?' 'Ah, it's exactly what I want, I want that you... to see how far you know what you imagine is happening so I can pass the definition for you later.'"

Another possible rupture point occurs within the course of an activity (question 3-b) when the teacher has started it in an interactive fashion, yet not knowing how to conduct the student's manifestation:

[*Activity on circuits*] "They didn't question me much about batteries. The fact that I explained that a chemical reaction took place inside (...) they were happy."

[*Electrical current sequence, about the question – how does a bulb switch on?*] "They don't talk about *charge*, they still talk about energy and stuff. If they don't talk about charge, they don't get at *charge*, how can I carry on?"

The two accounts above show that teachers were clear about the objectives of their activities but did not know how to include manifestations of students to develop those objectives. The first transcribed statement illustrates the single path of the teacher with the circuit activity. She comments that earlier students asked about what happened inside a battery and that she had given them an answer which 'calmed them down' (and not instigated them), as it wasn't the "right" time to work on the battery issue. The second passage shows a teacher who wants to take into account the student's manifestations as long as they fit the way she had imagined in her planning.

The rupture also happens when the teacher is not clear about the objective of the planned activity (question 3-c), or when he/she forgets it during the interactions in the classroom. In the next extract, the teacher realises, during her account of the class, that she could not have planned a demonstration activity for her desired goals:

[*Circuits demonstration class, answering the question: what was your objective for this class?*] "Oh, I wanted to teach them to work on a multimeter. That's why I got frustrated: Who worked on it was I."

For the teachers in our sample, the closing of a theme was often the point in the planning where most ruptures occurred. We had two quite recurrent cases within the group – the first of them, where the teacher does not perform an explicit closing (Q. 4-b of the tool), leaving unfinished discussions and ideas behind:

"What happened later is that these things weren't discussed, I think. (...) I think I've failed in these cases, (...) it ended up more with the phenomenon than with the explanation."

As said before, rupture occurs if the teacher, at the closing, recurs to traditional methodology to 'finally provide Science's answers' to students:

"They said there's an energy, which has positive and negative electrons going out of the wire (...) and then what did I do? I went on to define what a conductor was."

"I then defined Ohm's Law (...) I didn't like it. I wished it had made a little bit more sense and I think it didn't make much sense."

At question 5 in the tool we used, we clearly observed a rupture in activities, in occurrences from items (b) and (c). The teacher establishes a guide axis which forgets questions-problems previously aroused, or does not establish any axis for

their planned sequence, in a way activities do not have where to fit in. Here is an example in item (b):

“I think that there, (...) I think I told them we more or less did a study of the causes of electricity. Of the *causes*, you know? And that now we would study the effects.”

It also occurs that the teacher has, to himself, a unity in the sequence he plans but cannot involve the students into also realizing this unity. Such data was visible from question 6-b:

“I fragmented the content into many parts and thought students would link them. But for them it wasn't like that. Because I was the one who felt the need; it didn't come from them.”

In a similar way, in question 6-c, in which a teacher is not concerned with the unity of a sequence in the classroom, he realises that ruptures occur:

“Then I wanted to skip directly to Ohm's first Law. (...) Then a girl says, it was really nice the expression she used, - she said “*fragmented*”. From electric current to resistors. She said *fragmented*, you know, as if it didn't have a linking...”

In question 8 we assessed situations where teachers felt appropriate to include some activity into the original planning. In item 8-b, the adds-on belong to the objectives of the theme, they fit the teacher's sequence; however they appear unrelated to a need aroused by students, as they were not attached to a feedback. Usually, the teacher realises the 'shortfalls' of the add-on:

“I was too eager to go into the surprise box activity. Because (...) I wanted to talk about the model and thought it was fundamental. But it wouldn't flow.”

Obviously, the rupture in the sequence also occurs when the teacher operates adds-on that are irrelevant to the planning (item 8-c).

Question 10, specially the item 10-c, gives more clues about the rupture of the dialogue with students than direct clues about the fragmentation of the sequence itself. The latter, however, may happen as a result, when the teacher realises the rupture in the dialogue has brought losses to the learning process.

Question 11 deals with procedures adopted after students' questions on the subject. Mostly, teachers did not want to give an answer right away, but also didn't know how to guide construction of that answer:

“They don't arrive at the concept of charge. They talk about an energy that passes but they don't say what charge is. Then, at the summary I made the question so they would write it down: *What is charge?*”

This example was included in item 11-b. In 11-c, the accounts did not bring a feeling, to the teacher, that there was any rupture in the sequence. The student asks, the teacher answers and goes ahead.

With question 12, fragmentation is usually perceptible (items 12-b and 12-c) when the student's question visibly belongs to the core of the contents which the teacher wishes to teach:

"It was a boy who said, 'otherwise the battery will run out, won't it?' (...) After that I defined, I told them, (...) in reality, those charges are circulating, which doesn't mean the battery won't run out."

In the extract above, the teacher got insecure from students' consistent arguments on the hypothesis that the electrical charges would not return to the battery. The teacher knew the answer as far as to tell it to the student but not as deep as to explain why the battery runs out even though the electrons that leave it return to it. Thus, the "definition" was an interruption that protected her from entering a discussion which she wouldn't know how to get out of.

4 CONCLUSIONS

Where are the conceptual obstacles met by a teacher who wishes to be constructivist?

At the beginning of the constructivist learning path, many teachers go through a stage where they wish to throw away everything that once made their traditional practice, believing that a completely different methodology will also require "opposing" procedures.

Next, the teacher realises this does not work, for he lacks necessary tools for both classroom management and learning. On the other hand he doesn't want to be incoherent with his adopted educational theory - and the impasse is generated until he is able to re-signify those "old" strategies and incorporate the new ones.

The complication that dwells at this step is that the most needed change is the one which primordially happens at the attitude level: knowing to listen to the student and include them within activities and explanations, checking if there's understanding of the intended answer, developing an investigative eye and engaging in investigative procedures, looking at knowledge as responses to questions about the functioning of the empirical world, etc.

Our results showed that few teachers managed, in all stages of their classroom sequence, to preserve the engagement with students. Some teachers started with this planned intention but ended up losing track along the activities.

To include the student is a totally new learning process and here seems to lay the fundamental issue, to which the teacher does not usually possess previous references. Teachers who manage to effectively include students are the ones who believe in the importance of their contribution and trust the worthiness of their protagonism: it is necessary to think differently in order to act in a constructivist form.

How does one learn to think differently? Once the teacher is convinced he/she needs to change, it will be the very exercise of different procedures and activities which will enable a more flexible act of thinking. That's the reason attitudes are stronger clues of change than strategies: these are adopted from the beginning of the process, while those are modified when the theory is more interiorised, i.e. when the thinking aligns in another direction.

REFERENCES

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- [3] Lüdke M and André M A 1996 *Pesquisa em Educação: Abordagens Qualitativas.* (São Paulo: E. P. U.)
- [4] Pacca J L A and Villani A 1990 *Revista de Ensino de Física* **12** 123
- [5] In the extracts from the teachers, *italic shows emphasis given by the teacher, underlining is our emphasis.*