International Online Journal of Educational Sciences, 2013, 5 (1), 99-110

iojes
www.iojes.net

International Online Journal of Educational Sciences

ISSN: 1309-2707



The Use of Metaphors in the Processes of Teaching and Learning in Higher Education

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ARTICLE INFO

Article History:
Received 09.12.2012
Received in revised form 27.12.2012
Accepted 02.01.2013
Available online 10.04.2013

ABSTRACT

Due to growing concern about the quality of learning, higher education institutions are looking at their academic achievements and developing initiatives related to research into their teaching activities. The main aim of this article is to contribute to broader knowledge about pedagogical issues in higher education regarding reasoning structure used in the classroom. On a more objective level, the article focuses on the importance of analogical reasoning and the specific use of metaphors as vehicles for learning. It is a case study focused on the use of metaphors in a particular course, which seeks to research the mode and effectiveness of using metaphors as interpretive and explanatory models of scientific phenomena in the processes of teaching and learning. Research shows that the two main uses of metaphors served educational purposes and produced foundational knowledge. Additionally, the use of metaphors was an opportunity to promote teacher awareness of his/her own teaching.

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Keywords:
Metaphors, higher education, pedagogy, teaching , learning.

Introduction

Higher education institutions are looking at their academic achievements and developing some initiatives which examine their teaching activities in a pedagogical perspective. This occurs due to growing concern about the quality of learning that this level of education promotes, and with regards to the impact on external perceptions of the service that these institutions provide (Esteves, 2008).

Two main reasons are advanced by Leite (2007) to justify this growing concern: the mass and greater cultural diversity of students who come into the university and the corresponding concern of higher education institutions to ensure the quality of the certificates they deliver.

Starting from another point of view, focused on academic internal relevance, Vieira (2009) argues that pedagogical research value depends on issues such as dominant academic culture, professional teacher history and professional development. Such relevance also depends on the nature of the academic context, namely if it is favorable or adverse. Thus research on pedagogical issues shall be a factor of innovation if it could be seen as valuable in a collective environment.

The main purpose of this article is to contribute to broader knowledge about pedagogical issues in higher education regarding reasoning structure used in the classroom. On a more objective level, the text focuses on the importance of analogical reasoning and the specific use of metaphors as vehicles for learning.

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Analogical reasoning or analogies hold up in comparison. This reasoning is produced from different realities with which it appears to have some similarity in structure or function. Usually this type of reasoning is outlined by the next normally used proportion: a simple rule of three is an example: A is to B as X is to Y (Perelman, 1987). However, unlike the other three types of reasoning (inductive, deductive and hypothetical-deductive), normally considered more rigorous, analogy compares realities that are not in the same vein, facts that are not of the same nature by the admission of rule (expressed in similarity) that has another meaning because of the inapplicability of the idea of cause and effect. Without any possibility to establish the truth of the conclusion in the structure of the premises, reasoning based on analogies has long been regarded as hyperbolic and therefore referred to as a lower status of reasoning (Perelman, 1987).

Metaphors are a type of resource based on reasoning by analogy but which assume the characteristic of the removal of an explicitly comparative particle. Steen (2007) argues that all metaphor can be treated as analogy. Another key characteristic is their constitution as models, often associated with an iconic dimension, or that remain functional in time to process the similarity between the reference domain and target domain, and it is for the author to explore the metaphor.

As analogical reasoning, metaphors, understood as a field of production and reproduction of knowledge, now have to distance themselves from a traditional view that joined this feature to a more literary and poetic language, emphasizing the figurative and aesthetic character of texts (Lakoff & Johnson,1980). The metaphor as an object of the investigative field of linguistics is dual in its versatility and hybridity, one that works and finds itself as a linguistic resource, tool, component and instrument of thought and transmitter inductor (Lakoff & Johnson, 1980). The work entitled "Metaphors We Live By" written by the aforementioned authors uncovers the need to move beyond a purely linguistic field of study and literary production to fields of knowledge and education. The authors see in the metaphor a possibility for finding the essential. In short, the metaphor does not consist only in the discourse shaper but also in its content.

From another point of view, the importance of metaphor also has to do with the centrality of the communicative dimensions – discursive and dialogic – that exists in today's society in which it is not sufficient to produce knowledge but it is also needed to transfer it (Fernandes, 2008). Therefore the objective of this study on metaphors comes from its communicative and facilitator character of learning.

Paul Ricoeur (1983) balances the heritage founded in Aristotelian philosophy which understood the metaphor through patterns of words by which it established relations of similarity. The concepts inherent in the metaphor are offset by the substitution for the loan and the transposition of meanings. That is, metaphor employs a term in place of another, as a diversion or a replacement. The metaphor has as its first axis, a figurative essence. In this text, Ricoeur questions the classical figures with that rhetoric had fixed the metaphor. Simultaneously, he recreated the ontological features of the concept, which allowed him to think metaphor as a dynamic concept as it is currently assigned. To Ricoeur (1983), the argument is focused on the meaning that exists between the sentence and the word and its dynamic. The concept of meaning becomes the unifying link that explains this new use of metaphors.

In summary, the evolution of the concept of metaphor comes from a traditional line that is based on the unity of the being, in the primacy of the idea over the word, in the concept of representation, in comparison and likeness. The contemporary meanings of the metaphor are related to the iconic moment of metaphor, to the psycholinguistics and to the discussion of the concept of metaphorical truth. In combination, this conceptual change is itself founder of the new rhetoric. Henceforth the metaphor will be considered not only as an act of effective and persuasive communication but also as being able to postulate and transmit knowledge.

Crossing the literary and rhetorical view of metaphor operates an effective figure of thought. It is also the research line followed by Lakoff and Johnson (1980), known as Conceptual Metaphor Theory (or CMT, later evolved into the Contemporary Theory of Metaphor or CTM; Lakoff, 1993) who argued that metaphor is not primarily a matter of language but of cognition: people make use of some concepts to understand, talk and reason about others: "Metaphors as linguistic expressions are possible precisely because they are conceptual metaphors in the system of a person" (Lakoff & Johnson, 1980, p. 6). According to this order of reasoning, metaphors are characterized as being able to form and establish a conceptual relationship between a given source domain and a respective target domain, a relationship in which properties are

designed by inferences from the source domain (Lakoff & Johnson, 1980). Again, relations of similarity produce the initial binding loop that is inherent to how we think. Accordingly, this loop arises from experience: "The essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson, 1980, p. 5).

Education is a field where metaphors play a key role, both to identify the dynamics of educational processes and to clarify and classify the functions of educational actors (Jensen, 2006; Magalhães & Stoer, 2007; Patchen & Crawford, 2011). Also as Haggis (2004) inquires, metaphor can be used to shape thoughts, but also to shape the nature and scope of action, in both creative and restrictive ways. Her research about the use of metaphor in students' talk about teaching and learning, allowed to understanding different articulations of the nature and meaning of learning.

In all the metaphors mentioned by these authors we can identify two of the most important uses that are committed to metaphors: the use of constitutive or foundational concepts and the use of a more communicative nature, arising from the difficulty of proof. The foundational use of metaphor is a tool for conceptual innovation. Its main task is to make visible the invisible, to think what is not yet accessible to language, because concepts which express such reality have not been created and validated (Stengers, 1993; Fernandes, 2008). The communicative use relates mainly to communication purposes and is usually closer to the rhetorical tradition of metaphor. This nomenclature is associated with that used by other authors who separate the use of metaphors assumed as a rhetorical or conceptual nature (Low, Littlemore, & Koester, 2008).

The use of analogies and metaphors have received some interest in their function as enhancers of learning, especially in the science field and in the primary and secondary levels of education (Pramling, 2011), playing in the pedagogical discourse functions of explanation, highlight, offering a personal view, as well as boundary delimitation and clarification of the axes of change (Low et al., 2008). However, there is much less investigative effort that takes higher education as their field of analysis. That lack of research supports the relevance of the present study.

The aim of this article is to contribute to broader knowledge about pedagogical issues in higher education regarding reasoning structure used in the classroom. To what extend analogical reasoning and metaphors are vehicles for learning is the research question. This paper examines how effectively metaphors are used as modes of explanation and interpretation of scientific phenomena, both from the standpoint of production and from the point of view of teaching and learning.

Specific objectives are as follows:

- To list the functions attributed to the use of metaphors in the learning environment;
- To assess the impact of the use of metaphors in motivating students to study course;
- To assess the impact of the use of metaphors in allowing students to reach the scientific field of the course.

Methodology

The research consists of a case study focused on the use of metaphors in higher education. As inquired object is metaphor in discourse and as it regards the study of contemporary events (Yin, 2002), qualitative inquiry and, particularly, case study was the most adequate methodology approach. Furthermore, case study is a kind of methodology that goes deeper on subject matter and collects different data from different sources and using a variety of instruments. As the main goal is to produce the most reliable picture of the research object, it aloud both qualitative and quantitative data and analysis, as it happens in present study (Yin, 2002).

Inquired object is metaphor in discourse and not in the word or phrase, as the project is embodied in the analysis of the modes as a course uses metaphors and promotes understanding of the content of the curriculum. Pragglejaz Group (2007) proposed a "metaphor identification procedure" (MIP). The main axis of procedure, that is similar to that one that is used in present research, is about to identify:

a) *contextual meaning*: For each lexical unit in the text, establish its meaning in context, that is, how it applies to an entity, relation, or attribute in the situation evoked by the text (contextual meaning). Take into account what comes before and after the lexical unit.

b) *basic meaning* For each lexical unit, determine if it has a more basic contemporary meaning in other contexts than the one in the given context. For our purposes, basic meanings tend to be

—More concrete [what they evoke is easier to imagine, see, hear, feel, smell, and taste];
—Related to bodily action;
—More precise (as opposed to vague);
—Historically older;

Basic meanings are not necessarily the most frequent meanings of the lexical unit.

c) *contextual meaning versus basic meaning* If the lexical unit has a more basic current–contemporary meaning in other contexts than the given context, decide whether the contextual meaning contrasts with the basic meaning but can be understood in comparison with it.

"Metaphorically used? If yes, mark the lexical unit as metaphorical" (Pragglejaz Group, 2007, p. 3).

This procedure is not significantly different from that it is used in present research as metaphors were identified if an expression from a source domain was transferred to a second - target domain. The main difference relates to expression wide. As it was referred previously, present research focuses significantly sentences as the research unit.

The decision to use a case study was due to the fact that it allows the study of metaphors both from the standpoint of its use in the production of knowledge, and from the point of view of the fact that learning involves entering into the epistemic structure of the scientific field concerned as well as within the processes of conceptual reorganization that mobilizes the teacher to promote students' learning.

In addition, the literature review has allowed to identify foundational, communicative and occasional uses of metaphors. If the latter may be the target of an inquiry of a quantitative and extensive type (the kind that quantifies the occurrences of metaphors in speech), the first two require a more in-depth and diachronic approach which allows us to go beyond the numbers, only compatible with qualitative methodologies. On the other hand, as mentioned earlier, it is interesting to study how to articulate the use of metaphors in an educational context with these students' learning. These two reasons justified the single case selection and the in-depth study. The case is a course of a theoretical nature which is part of a PhD in educational sciences and therefore has an inquisitive component in higher education. Course was delivered in Portuguese language.

Case selection criteria were: (1) previous knowledge of the course that ensure that it is characterized either by the use of metaphors, both at the level of teaching, and in terms of theoretical production; (2) course accessibility, including the availability of the teacher to participate.

The case study focuses on the teacher's pedagogic use of metaphors. Analysis focuses on classes and on teaching and students' speeches. Research instruments are as follows:

(1) Formal observation of the classes (N = 4)
(2) Interview with the teacher (N = 1)
(3) Interviews with students (N = 4).

Students were selected according to two cumulative criteria: to ensure cultural diversity and gender that characterizes the class of the doctoral course in question.

The semi-structured interviews followed a script that was used to interview teachers and students. The framework axes are: the characterization of the interviewees both in academic and professional dimensions, the relevance of the course to the PhD development and the role of metaphors in mediating teaching and knowledge production.

In the formal observation of classes, a grid was used to identify frequency and to characterize metaphors' uses in the teacher and students' discursive production according to the two differentiating elements: a foundational use or a facilitator of communication use.

Data were collected during the second semester of the academic year 2011/2012.

In the interviews, it was assured that the fundamental ethical principles related to the guarantee of anonymity and informed consent were followed. The interviews were taped, transcribed and validated by the interviewees.

The information collected in class observations was organized in a table of occurrences. Whenever it was possible, field notes were treated to illustrate metaphor use.

Analysis of the interviews was performed using the software Nvivo 9.2. The framework was based, primarily, on the structure emerging from the literature review. However, it also included the emerging categories deemed relevant during the analysis.

Findings

The results are presented according to the type of information collected and treated, namely, quantitative and qualitative.

Table 1. The type and number of occurrences registered in the observations of the classes

	Foundational use	Occasional and communication facilitator use
Teacher	14	96
Students	1	2

The recorded metaphors are mostly of a casual and discursive nature and they reflect the effort to facilitate communication. In this categorization, in the teacher's speech, we found that the most diverse metaphors have their origin in common language, or in the images and life experiences that are judged as being extensive to the people present in the classroom. Often linguistic puns were also used to gain new meanings in the use which is made in the context of this module of the course. Examples may include statements like "in science there are white seats", "the facial value of language" or even "what is in the skin of what is said", among others.

Apart from these, there was also a number of other metaphors that we classified as foundational which, despite being outnumbered, were subject to repeated use (more than once) and served not only as facilitators of communication, but as elements that structured the reasoning. To them we make a brief reference in Table 2.

Table 2. Foundational metaphors and contexts of use

Foundational metaphors recorded in the sessions observed	**Utilisation**
1. To have a companion on this trip I put a stick into gear.	1. To explain and clarify many concepts and terms such as "post-structuralist", changes in social structures, explanation of the concept of discursive struggle.
2. Metaphor of ready to wear.	2. Used to explain how they should present and teach a lesson.
3. How to build the shipyard.	3. Used to clarify the existence of tensions between the different modes of teaching
4. The reference to the use of a Polaroid camera	4. Used to explain the concept of discursive struggle.
5. The metaphor of the voice-off.	5. Used to clarify the role of a political commentator, Marcelo Rebelo de Sousa, reflecting the existence of the neutrality of the act of analyzing society.
6. Metaphor of the spider.	6. Used to describe the analysis of discourse.
7.Metaphors: a. surfing – the short-term policies b. ride – medium-term policies c. run – long-term policies.	7. Metaphors created by the teacher in order to explain the forms of construction and implementation of policies and how these can be analyzed.

With respect to student speech, despite their active participation in the sessions, there was a very small number of metaphors (Table 1).

The results presented in this part of the text derive from analysis of interviews of teachers and students of the course. The data were organized according to major categories emerging, namely: authoring metaphors; uses of metaphors; impacts of the use of metaphors.

In the category "Author of metaphors" were the sub-categories "creative moment of metaphors", "use of metaphors of others" and "nomadic metaphors" (Figure 1).

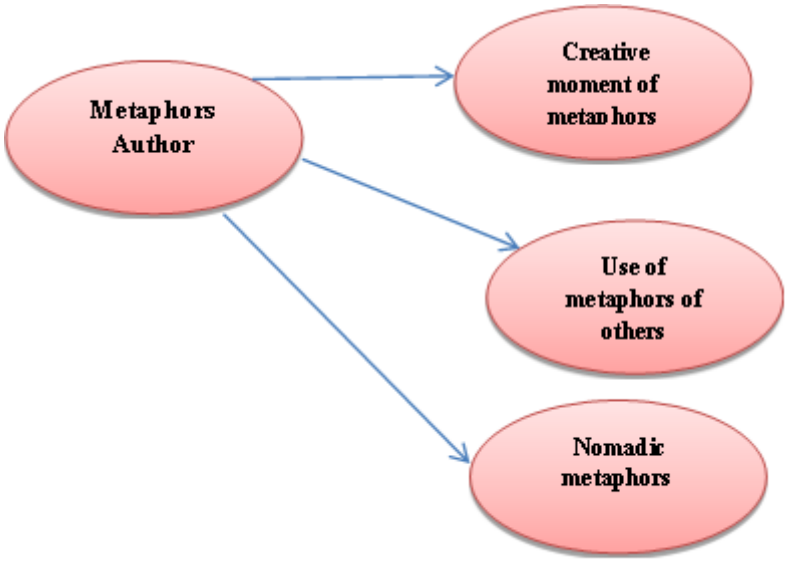


Figure 1. Authoring metaphors

It was found that many of the metaphorical images that circulate in the classroom of this class in particular are grounded in the culture and life experiences that are supposed to be usual and common to all the people present. This means that the authorship of these metaphors is often based on common sense and images of the culture and language of the people present, including outstanding cultural assets (movies, books, etc.). The sub-category "creative moment of metaphors" explicitly refers to those who have a greater heuristic power and a clear intention at the time of its production and it may be associated with an author. However, this setting seems to be taken for granted by teachers, suggesting the existence of a certain personal style, a fact that students recognize.

> Question: "I do not know if you can refer to this moment ... what we need here is a metaphor".
> Teacher: "No, it flowed naturally. The process of metaphorical speech is a creative process that induces creativity but, sometimes, someone plays over something that already exists in another form. That is carrying the name of one thing to another. It has often the comparison particle 'as' in the middle. The metaphor that fits here, it flows as naturally as the walk of the centipede (that nobody asks which leg it puts first when it walks), hence my embarrassment in this conversation".

The "use of other people's metaphors" does not seem to play an identical character to that of structuring ideas which builds on knowledge. Despite this, the teacher is aware that he uses metaphors that others have already used and often discusses them or makes personal reading of them.

> Teacher: "The network itself is a metaphor, built by other."(...) In the case of educational policies that gives families the opportunity to choose the school their children will attend, (...) I come to the conclusion that it is expected that giving school choice to families this will improve their children's academic success, it's like being at the train station waiting for a bus. (….)

The example of the creative potential on using others' metaphors, allowing to discuss their interpretations is given by the metaphor of the bridge.

> Teacher: "Here at the college people who are dedicated to the intercultural things have the dominant metaphor of bridges, bridges between cultures, the differences between bridges, put your hand in other's hand and stuff…(…) Unlike people with strong humanistic and anthropocentric thought,, I rather prefer the metaphor of bridges to banks, because building a bridge is very suspicious. Who decided to build the bridge? Which side of the margins is the engineer? Who is funding the bridge?..."

Conersely, the use of nomadic metaphors, which refers to the use of metaphors that migrate from one to other scientific fields (Stengers, 1993), was not very common in case studied. These uses seem not have been considered relevant by any of the respondents, despite the suggestion to refer to this topic. Thus it can be stated that other scientific fields do not seem to be the source of the metaphors used in our case.

The second category of data analysis refers to the use of metaphors and adds the following dimensions: "teaching resource", "device of deconstruction", "dimension of communication", "commonplace" and "foundational structure", but a more detailed analysis of the encodings revealed the existence of relations of association between the use of deconstruction as a device of reasoning, the communicative use and the use of metaphor as a pedagogical resource (Figure 2).

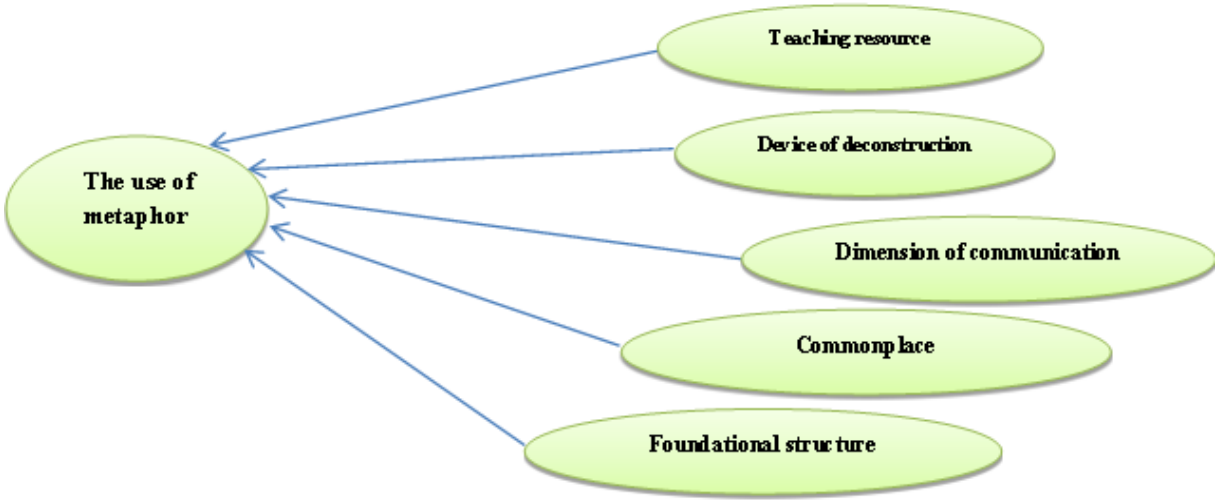


Figure 2. Uses of metaphors

As a teaching resource, the use of metaphors is justified because teaching is also translating knowledge to make it accessible to students and metaphors serve this purpose well. This justification is in turn legitimized by the massification of higher education and cultural diversity of students who come to the university as mentioned earlier.

> Teacher: "As a teacher, I think that metaphors are a way to translate what we intend to translate; that is, the teacher is a re-contextualizing knowledge, at university professor is also a researcher… so, teacher teaches what he researches (…) so, he must translate…".

From the perspective of students, this justification finds its correlation in the effectiveness of pedagogical mediation of metaphors, which mobilizes motivation, better and faster understanding as appropriate indicators of their demonstration.

Student I: "Yes I'm an advocate of teaching ability so to speak in metaphors (….) turns out to be a mental image that we realized immediately what was the main argument of the authors when used, but essentially functions as a symbol but also more immediately and we faster realize the concepts".

Student III: "(…) on the one hand it really serves to motivate the interest in class, because it motivates, it is true, but otherwise it serves to make this a little bridge, maybe if he did not use some of these metaphors or analogies as I said I do not know if the understanding, if our understanding would be as effective as that".

Similarly, but invoking the iconic structure that metaphor also involves, another student refers to viewing the grounds of its effectiveness.

Student III: "(….) it allows me a preview of what is being said, what is written, and allows me to access more easily reality. To me, this idea of viewing, permit, as I am reading the text, I can view what the text is telling me".

The use of metaphors does not relieve students from an effort to understand, requiring an active attitude of interpretation. Metaphors' uses require listeners to reflect both on cultural context and in a critical dimension.

Student II: "(...) also implies an attitude on the part of those who listen and who is in the role of student, they must also take an active role; i.e. hearing should not be a passive thing, so this also raises an interpretation, the person must make an effort to interpret what you hear, a critical effort (...) it is clear that the metaphor always implies a certain ambiguity and exactly for what you are saying, the hearer is also responsible to have a role in interpretation (...) when the message is not completely linear, which is the case, forces you to somehow put themselves before this speech, to think about it".

As noted earlier, the critical effort that metaphors require of students is also associated with the size of deconstruction that this always holds. It is using the domain of metaphor as regards the structure of analysis which serves to question the target domain and put it to the test.

However, the use of metaphors in an educational context also involves some risks, which are common: the risks of the use of metaphors as speech and significant fall of the idea of metaphor as a producer of truth.

Student II: "(...) even though the metaphor may serve to illuminate a certain reality to help clarify a certain reality, I am speaking in the abstract, but can also contribute to hide this reality; that is the metaphor is not alone at all times an advantage, you can hide anything".

Moreover, there may be a number of shortcomings that relate to the communication dimension and relate to the fact that not all contacts master the frame of reference of metaphor used. In this circumstance, the risks are the trivialization of the image, as well as the ineffectiveness of the remedy.

Student I: "a room where there are people who often are not already familiar with the subject, (...) and uses a metaphor whose reference point is not familiar, there may cause disruption in the communication. But I think that the overall effect is more, okay! It is a joke, (...) and is considered a more grace than as a teaching resource".

The use of metaphors as a foundational structure relates to the production of scientific knowledge. In other words, it refers to the metaphors that are used repeatedly in the thought of an author, or that are used to give sustainability across a function, or a categorical structure that allow a procedural and a symbiosis and internal dynamics between the two domains (the reference and target). As a result of this proximity, the production of arguments, working hypotheses, the operationalization of the empirical domain and even theoretical validation can be done from the reference domain. Such metaphors contribute to the advancement of scientific production.

In this case, the use of such metaphors is recognized both by the teacher and students.

> Student I: "The use of metaphors or this kind of reasoning by analogy I think it helps the researcher who is or previously working in the construction of his reasoning, his argument".
>
> Student IV: "The teacher uses the metaphor not only to make it clear when he wants to explain to an outsider, what he is thinking, but he also uses metaphors to make himself a bit of significance in their own thinking. When in reality what he means or wants to think about, then uses the metaphor to find that function such that the model is metaphorical".

Finally, it is also found in the discourse that respondents refer to a use of metaphors as common place, which enhances the use of everyday expressions, but often has an associated load which is not scientific and even lacks transparency of the full speech which often turns into an epistemological obstacle.

> Student II: "Bridge's metaphor is heavily used. It is discourse of common sense. (…) it often has no actual content, in the sense that those who use it are finally making a speech empty and not a serious discourse...".

The third category relates to the use of impact of the metaphors on students. This category divides in four sub categories, such as: the questioning impact, the appealing impact, the mimetic effect and the inhibition effect (Figure 3).

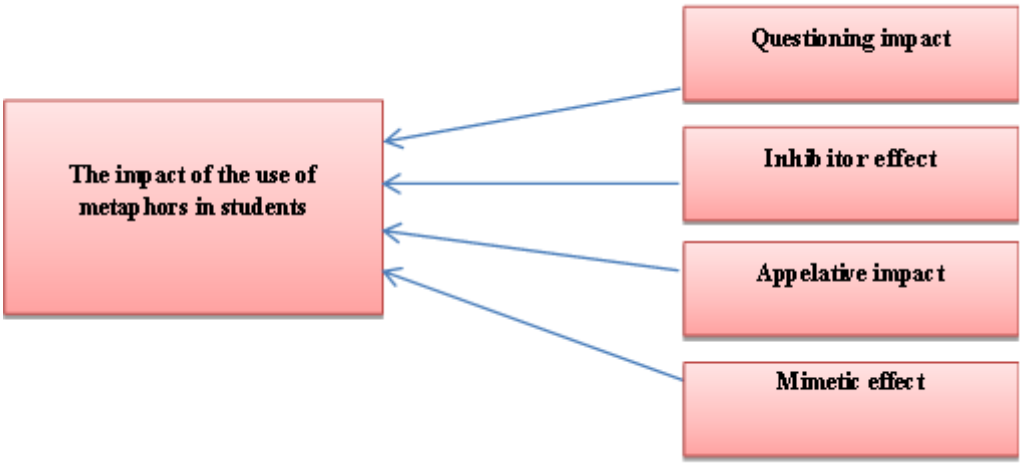


Figure 3. Impacts of the use of metaphors

The first sub-category of this impact relates to the promotion of community among students' questioning. Associated with the sub-category of the existence of a critical requirement, the ability of questioning transcends class and remains valid beyond.

Student IV: "What I feel is that (...) is like reading I spent to mobilize some action of understanding, it is like a reconceptualization, to think that theme in other aspects. Then, surely, I want to know more about it."

Question: "It worked like a sort of appetizer?"

Student IV: "Just as if he had awakened the idea that was still sleeping".

Another impact is due to a disability felt by students to replicate the ability of the teacher to produce metaphors and a student refer fear of lack of arguments in case of a debate. That is the inhibition effect. However, the teacher explained such disability by lack of self-esteem of students.

Teacher: "others have a fearful attitude in relation to what I say, possibly the result of a weak self-esteem as students find it better to invest in another area, do the minimum to say what I want to hear".

Question: "I come back again to the question ... You were primarily concerned with not being caught up in that kind of argument that later would probably run out of arguments to counter?"

Student IV: "Absolutely".

Another impact of the metaphors' uses is the appealing effect. Teacher's discourse, structured upon metaphors was recognized as captivating and enhancer of students' interest.

Student II: "In a different way, now I notice that in classes of the teacher M there is great interest on the part of most students (...) they are attached to the speech, to the surprise that may come in the speech".

Finally, the mimetic effect concerns the use of metaphors by students. It is recognizable both in the mobilization of metaphors in the context of classes, as in other contexts, namely in the production of scientific writing. In the first case, all students reported that often during classes.

Question: "Do you use more metaphors in such particular class, or not?"

Student II: "I think that's a tough question, I did not think about it and do not know if it has a direct effect on my type of discourse and influences it. I believe that with a greater exposure to his style, to his texts, to his discourse, these effects will happen, (...) namely at the level of writing..."

Student III: "…our thought turns out to fetch other thoughts and maybe we feel authorized. (...) I think it has, I do not know if it is intentional, but it is curious that ends up happening, then we have to explain what we're trying to say it seems that we get also some metaphors or analogies. It's funny thinking about it now".

However, one of the students felt that this practice could not be extended to speech writing under penalty of loss of scientific reliability and that it appeared that the teacher himself would not subscribe to such use. Such idea was endorsed by teacher, considering the academic practices in use.

Student I: "The use of metaphors or this kind of reasoning by analogy, I think it helps us think. It helps who is working in the construction of his/her reasoning, his/her arguments. On writing work is another dimension. (...) This richer language and less ruled academically is used in the classroom and is used in

the oral record. However, it is not even allowed by teacher to the level of writing, for example in academic work".

Teacher: "I have not seen (metaphors in students' writing), because the academic habitus is much stronger that this way of looking at things …"

Discussion and Conclusions

The metaphors that circulate in the classes of the case study come from the teacher's personal style and are selected according to their heuristic power as perceived at the time of production. The use of life experience, but also cultural artifacts in circulation (movies, books, pictures/paintings etc.) are the main references of domain of the metaphors. The teacher assumes that these are appropriate reference domains as they are known by all. In addition, transposition into the target domain is a kind of authorship that both the teacher and students consider a "natural" creation (without effort). Nevertheless, and regarding the foundational metaphors, there is much work to reflect in its production, which can be seen from texts referring to some of the metaphors used in the sessions (Magalhães & Stoer, 2007) and is coincident with the investigation of Jensen (2006). In this sense, and strictly speaking, one can consider that there are others metaphors, because the metaphors that others have used are usually the object of further readings.

The two main uses of metaphors serve educational purposes and foundational knowledge is produced, which corroborates the uses found in the literature (Fernandes, 2008; Pramling, 2011).

However, the primary purpose is clearest in the representations of the respondents and more evident in the observation notes of the lessons. Moreover, it is more easily associated with the massification of higher education and cultural diversity of students who come into the university and the need to find motivation and devices that enhance their critical thinking. If this is the farthest end of the effort of teaching and learning, metaphors can get to the nearest goal to translate that knowledge to make it more accessible to students, thus ensuring the communicative function.

Regarding the impact of metaphors on students, we found that the use of these in classes is synonymous with greater attention from students and, in some cases, it serves as intellectual "food", even beyond course requirements. However, although they consider that the teacher would accept that they did, they did not feel authorized to produce their own metaphors. This opinion is not fully supported by all students, particularly regarding the production of written discourse. The teacher himself also admitted that he would not accept texts that used reasoning by analogy, using as a main source of support the decision to protect the students – after all they have to perform academic work and submit to the rules of the game of academic output.

In summary, it is possible to conclude that analogical reasoning and metaphors are vehicles for learning as it is recognized their pedagogical power to enhance students motivation and to deep knowledge production and acquisition.

The main aim of this article was to contribute to broader knowledge about pedagogical issues in higher education regarding reasoning structure used in the classroom. To conclude, it seems that metaphors and reasoning by analogy are important to introduce students to a scientific field, but they are not expected to remain valid in the records of scientific production, at least those who are novices at it. It seems that metaphor production needs a deep level of knowledge in a field and it explains why the uses of metaphor belong, mainly, to teacher.

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