Teaching strategies used by online teachers: the pedagogical mediation in distant Degree Computer Science courses

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Abstract:

This paper analyses the pedagogical strategies used by teachers for a Degree in Computer Science in the distant mode, which emerged during the occurrence of the discipline of Computer Laboratory. Were identified the strategies presented in the literature, which occurred during the mediation in that course Virtual Learning Environments (VLE), in order to identify the relationships between the strategies and activities used by teachers. In addition, we related them to the characteristics of the discipline and students’ needs, using the Activity Theory as their analytical references for teachers’ practices.

Keywords: online teaching strategies, distant education, virtual learning environments.

1 Introduction

The educational performance in distant education seems to set a new time and space for the educators’ work, which can directly affect their teaching practice and knowledge. Considering educational performance in virtual environments for teaching and learning, some criteria are important for evaluating teacher performance in the tasks of mediation, such as their profile, skills and attitude, as cited in the programmed manual for university teachers’ training of Federal University of Rio Grande do Sul (UFRGS, 1974).

Although studies on the subject dating from the 70's, authors such as Gonzalez (2005) presented some factors that may be complementary to those previously presented, namely: motivation techniques, field tools, evaluation methods, theory and practical tutorial and as the art of seduction teaching, which demands didactic autonomy for teaching. In turn, this is only possible through the development of skills and expertise to this new educational context.

Thus, the objective of this paper is to analyze the teachers’ interactions in virtual learning environments in the specific context of Degree in Computing Science distant courses. To do so, we used the Activity Theory in order to identify teachers strategies for mediating virtual processes.

2 Teaching strategies

Concerning environments and strategies for online learning, Coscarelli (1997) presents the following classification that could be used by the teacher, namely:
a. Cognitive strategies: mental operations are chosen and used by students to increase the level and quality of learning;

b. Clustering strategies: facilitate the organization of knowledge to be constructed in a structured and synthetic way;

c. Spatial strategies: in addition to facilitating the grouping of a considerable amount of information in a synthetic way, they add visual space to the organization;

d. Connecting Strategies: work as a bridge between what students already know and new knowledge to be learned;

e. Strategies for multiple purposes: they are selected when the goal is learning the details of a particular area of knowledge;

f. Metacognitive strategies: help the student to coordinate the process of learning in order to make it more efficient. Becoming aware of the importance of incorporating the usual strategy of study is an example;

g. Linguistic strategies: the print media is the means of communication and dialogue more common in our educational practices. Reading and learning are two processes that are closely related and, therefore, the linguistic strategies are gaining more space in the context of formal education;

h. Affective strategies: are those strategies that deal with students' emotions, making them part of the learning process because there is no denying the importance of emotional involvement in learning;

i. Social strategies: the student is a social being and the classroom is one of the environments in which the dialogue takes place. It should be encouraged as we learn in interaction with the knowledge, including knowledge to be constructed.

Starting from the analysis of the data observed and based on the literature, it was possible to identify common elements of mediation strategies in the teaching-learning processes in virtual learning environment (VLE). These elements can envision a model of virtual-tutor interaction in VLE-content-student focusing the perspective of teacher-artifact-knowledge-student, which is the UAB model characteristic. It also look at the relationship between the UAB model characteristics and demands of computing and information technology courses.

Despite working with a small sample, consisting of an observation of tutors-students interaction in a single discipline and in one class, it was possible to identify some categories of analysis related to the activities carried out. Thus, we did not intend to exhaust the possible categorization but, on the contrary, to create an analysis guide to be applied in the main study. The categories are: a) technical activities - composed by technical problems, student VLE manipulation, student tools manipulation, VLE constraints and limitations; b) affective activities - consisting of motivation strategies and fishing; c) cognitive activities - addressing problems related to the content, learning materials and explanation of activity to be developed; and d) activities of didactic contract - such as information, warnings, agreements and important dates.

### 3 Proposal for using the Activity Theory

The basis of this epistemological theoretical proposition comes from the influence of three distinct lines of thought (Leontiev, 1975): a) (Kant and Hegel) the constructive role of the subject in the production of knowledge, b) (Marx and Engels) the concept of activity from dialectical materialism - the activity as a way to integrate awareness and objective reality and c) the School of Historical and Cultural Kharkov psychology (Vygotsky, Leontiev and Luria).
the mediation of symbolic tools and materials on mental processes.

According to Leontiev (1981), the origins of the idea of activity analysis, as a method in psychology, are based on the concept of mediating artifacts and the importance of social context in the development of mind. It was studied by Vygotsky and his group from the early 20th century.

According to Lins (2004, p.87), by applying the Activity Theory (AT), “you can see the influence of interfaces in the mediation of educational quality, assuming the mediation approach with a focus on technology.” This is made possible by the analysis of teaching activity, through the identification of episodes during the tutor mediation in subjects listed. These episodes, despite being generated from working conditions, can become activities with their own purposes if observed as the interactions between teacher-student-artifact-knowledge.

The AT proposes four well-defined steps to observe such interaction, as follows: a) dividing the problem in activities, b) the context of design activities, c) description of the hierarchical structure of activities, and d) review of implementation / creation activities. For dividing the problem in activities, the units of elicitation of requirements to be used in the analysis of episodes should be listed. On the other hand, for the context of design activities it is necessary to identify the subject being observed, objectives of the activity, a tool used in achieving the task, the community in which the subject is inserted, and the rules and division of labor that occurs in it, ending with the results.

The description of the hierarchical structure of activity is divided into two phases: a) definition of the hierarchical structure itself, identifying the activity, the reason for carrying out the necessary actions, the goals set, operations and expected conditions of realization; b) identification of communicative spaces, allowing the identification of interactions, objectives, subjects and motivational elements.

The last step is the analysis of the implementation and execution of activities, developed on three levels, namely: strategic, procedural and attitudinal. At the strategic level different teaching strategies used in the intervention are evaluated, while the procedural level analyzes the construction / handling, representation, reasoning and conceptualizing of interaction. In the attitudinal level a subject's behavior during this interaction is analyzed.

The delimitation of the analysis is also an important step because it will identify the subject being treated, the objective of the lesson (reason), the lesson taught (interactions in the environment of teaching and learning), the proposed activities, and evaluation required. Starting from the AT, this study sought to identify the four stages and levels of implementation of activities, in order to understand the differences distant teaching, at different times of the pedagogical mediation process.

4 Methodological approach

Analyzing the limits and possibilities of each tool used to VLE classes, module 1, it can be seen that 3 from 4 tools chosen by the teacher-producer content were suitable for carrying out the proposed tasks. However, they must be configured correctly by teacher-executor and adequately used by the virtual tutor during the process of pedagogical mediation. Only one tool was considered inappropriate to perform tasks, the chat. Being a tool for synchronous interaction, it is hardly used one-to-one, from a student to a tutor, because it makes the
construction process difficult. On the other side, it is extremely relevant to be used when the needs involves to solve questions, brief explanations, etc..

The present study concerns the analysis of the strategies used in the teaching-learning VLE based on the AT through the empirical analysis of computer-mediated activities. Therefore, the theoretical principles of AT (Leontiev, 1975), which are offshoots of the Social-Historical Theory devised by Vygotsky and envisioned the formation of conscience from the mediation, is the focus of the debate here proposed.

The study was conducted in a university of the federal Brazilian system of education, which belongs to the Open University of Brazil. The course studied was Bachelor of Information Systems, one of the two courses covered by distant education in computing and information technology. As participants in this preliminary stage of research, we have students from one virtual classroom and the tutor of the course Computer Laboratory. The interactions between them were observed in the VLE forum of this course (implemented in Moodle). This choice is justified by the possibility of observation a teacher with technological training, for a discipline with technical component of the course, considered as basic rationale for the courses in the area of computing and information technology.

4.1. The context of activities

Each lesson or content module studied belongs to a discipline syllabus I which can be established the relationship between such content, the nature of them (continued, new, revision), the division of labor in production, as well as the capabilities of VLM that were used to develop these. Thus, to identify the context of class, they have used two approaches: a) the conceptual, and, b) the technological context. Another factor considered was the inclusion of the activity in the lesson, their relevance to the type of content and the tool used to develop it.

The conceptual framework is represented by the relationships between units of content covered in the module and its inclusion in the syllabus. Considering the content of the discipline Computer Laboratory and its offer in the 1st semester of the course, the observed lesson is characterized as a component of the basic framework of the curricular course. It has a different conceptual approach in relation to offered courses in other areas, where one assumes focus purely instrumental.

The module observed in this study corresponds to the contents of Introduction to Computing Science, regarded as the basic rationale for studies in computing and information technology, therefore it is a new content (assuming students 1st semester) and, in the course analyzed, it corresponds to the following contents: a) history of computing, b) foundations of information representation, c) the areas of computing, and, d) the professional profile of computing. The relationship between the content units of the module 1 is described below:

a) history of computing - content that must be taught at the beginning of any discipline. It will provide students with contact with the area’s state of the art, identifying their historical development and influences suffered and generated by and about society. It is necessary for understanding the other units of the module content;

b) foundations of information representation - content to be taught at the end of the module because of the following reasons: to be used as a basis for the next module that deals with the fundamentals of hardware, it breaks the logical sequence between the history of computing and the areas of computing, it has a different degree of complexity compared with other units
of the module. Unlike other content, very few students have prior knowledge, even empirical, on numbering systems (subject matter on this drive). This learning involves making various calculations of reasonable complexity for students at the beginning of the course, so it could be considered a completely new content;  
c) areas of computing - content that matches with the continuation of the unit 1 (history of computing) and that may be known by the student, even if it is not systematic or empirical;  
d) the profile of the computer professional - content that is directly related to the Unit 3 (areas of computer), which allows the student to make clear the potential of the area and the different possibilities of professional experience. It can also be known by students even empirically, but not systematic and incomplete.

Regarding the division of labor in the production of content, it did not happen in this module of the course. The production of the study guide and other materials used was developed by the teacher-producer of content which, in this case, also worked as teacher-executor of the discipline.

With regard to the technological context, the didactic material related to the lesson was available through the tool “shared folder”, where the teacher allowed students to upload and download files, as shown in Figure 1. The files formats were the regular ones (.ppt and .doc), being one file for each unit 1, 3 and 4 and 2 files for unit 2, corresponding to the numbering systems.

The units of elicitation of requirements that will be used are the classes described above, in the unit format. In each class, the activities will be analyzed accordingly to the TA: listing episodes of these activities in which will be analyzed interactions between tutor-student and student-tutor. Thus, the data were collected in the lesson forums posted in the VLM and their feedbacks.

4.2 Description of the hierarchical structure of the activities

The hierarchical structure of activities presents the identification of the activity, highlighting its order or position, the reason - the conceptual point of view - for carrying out of the activity (the necessary action for its realization), the goal - the operational point of view - to be achieved with the completion of the operation and the conditions necessary for it to occur.

Concerning the nature of information, we took into consideration the following aspects: a) communicative spaces, b) purpose of the interaction c) subject interactions d) steps for implementation of activities; e) stages of implementation of activities in VLM, and, f) motivational elements. The communicative spaces used were forum.

Observing the interactions of the students, we could identify the following reasons: technical problems, difficulty in handling the environment, poor handling of tools, problems of environment limitations, problems of tools limitations, problems relating to the content, problems related to teaching materials, to explanation of the activity to be done, or provide information to the students. Concerning the type of relationship, we found the following types: teacher/student, student/student; vicarius; teaching material.

Regarding the teacher actions, the literature review identifies 5 phases, namely (ARAÚJO JR. And MARQUESI, 2009, p.358): a) welcome, orientation and motivation and b) facilitating the exchange of experience, c) indication and orientation of digital resources, d) orientation of the collaboration, and e) feedback.
Refering to the motivational elements, covered in the strategies of the tutor, we can mention the following (Bento, 2009, p.168): a) responsiveness to the problems of the student, b) preparing the student for each section; c) special instructions and objectivity d) demonstration of interest in the mentoring process, and) help to advanced studies f) prevention of withdrawal from the university; g) increasing the confidence of the student; h) time of attendance satisfactory, i) good treatment to the student, i) simple and efficient service, j) proper use of communication resources.

5 Discussion of results

The observation data pointed possible categories for classifying teachers actions, called here as the tutor interactions. Such interventions were used to classify the tutor mediation strategies at three different levels, namely: a) strategic, addressing cognitive strategies, grouping, space, connection, multipurpose, metacognitive, linguistic, affective and social, b) procedural, consisting of strategies for building / manipulation, representation, argument or conceptualization, and c) attitudinal, consisting of response strategies in relation to the objective of the activity, evaluative feedback to the tutor, the tutor's behavior (action). Such strategies were analyzed in each class (unit of content) observed in this study. Tables 1 and 2 below detail the strategies of these 3 levels.

<table>
<thead>
<tr>
<th>Strategies (singular)</th>
<th>Category frequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cognitive</td>
<td>4,76%</td>
</tr>
<tr>
<td>2. Clustering</td>
<td>4,76%</td>
</tr>
<tr>
<td>3. Spacial</td>
<td>0%</td>
</tr>
<tr>
<td>4. Connecting</td>
<td>19,05%</td>
</tr>
<tr>
<td>5. Multiple purpose</td>
<td>4,76%</td>
</tr>
<tr>
<td>6. Metacognitives</td>
<td>4,76%</td>
</tr>
<tr>
<td>7. Linguistics</td>
<td>0%</td>
</tr>
<tr>
<td>8. Affectives</td>
<td>4,76%</td>
</tr>
<tr>
<td>9. Social</td>
<td>14,29%</td>
</tr>
<tr>
<td>10. Didactic contract</td>
<td>23,81%</td>
</tr>
<tr>
<td>11. Technical</td>
<td>4,76%</td>
</tr>
<tr>
<td>12. Conceptualization</td>
<td>14,29%</td>
</tr>
</tbody>
</table>

Table 1: Frequency of teacher strategies by category

Analyzing the Table 1, we could see the concentration of teaching mediation strategies in 4 of 12 categories shown, totalising 71.44% of the strategies used by tutors. Among the 4 categories of highest frequency (Didactic Contract 23.18%, Connecting 19.05%, Social 14.29%, Conceptualization 14.29%) we noticed a well-defined profile of Didactic Contract, specially about Dissipating Activities Doubts, as could be seen in Table 2.
Table 2: Frequency of teacher strategies by categories and subcategories

The second highest frequency is the Connecting strategies with 19.05%, which represents a positive trend to implement constructivism in VLMs, trying to make the student go over what he produced, expanding his view from the correlations proposed by the tutor. The Social strategies, with 14.29%, appeared as the category with the third most frequently used by tutors, along with the Conceptualization strategies. These Social strategies were entirely related to the world of Work, representing a tendency to discuss the social impacts of the course. It happened according to the content of the module, which connected the lessons to the professional profile of egress student.
As for the other strategies that appeared only once, with the percentage of 4.26%, we could consider that these were not significant events in this set of data. Comparing the distant strategies of low occurrence (as Clustering, Multiple Purposes, Metacognitives and Affectives) with those that occur in regular classroom learning, we could argue that all of them, but Cognitive strategies, occurred in both teaching situations considering higher education.

The categories of strategies that did not appear in the data analyzed are: a) Linguistics strategies, and b) the Spatial strategies. The non-occurrence of both categories might be related to the nature of content handled in the classes considered - the contents of numbering systems.

In Cognitives strategies presented in Table 2, we verified that all the Cognitive strategies applied were related to the Content addressed in the subject lesson, not showing the occurrence of Cognitive strategies related to Problems with the teaching material. However, when checked the frequency regarding interactions, we observed that these strategies represent only 4.76% of the total.

Considering the Multiple Purposes strategies, only 1 out of 6 categories were presented in Table 2. That one was the strategy of Connecting and Conceptualization with only 4.76% of the total frequency. We inferred that it could indicate that these actions were actually done through the original isolated category. Thus, they were not a combined of Multiple Purposes strategies. Considering both strategies by themselves and added we had 33.34% of the total frequency of strategies, making them a very common teaching action. Further studies will be done in order to understand this situation.

Concerning Affectives strategies presented in Table 2, it was found that the frequency fell only on Acknowledges strategies, representing the ratio of affectivity that can be developed between students and tutor, but it also had a low percentage of occurrence when checked against the total frequency of strategies. Regarding to Fishing strategies, related to the recovery of missing students, the absence of these strategy might be related to the fact that the data collection were done only through the forums observations and this tool might not be used for that purpose.

Analyzing for Didactic Contract strategies presented in Table 2, we found a great concentration of Dissipating Activities Doubts, covering 60% of the total frequency of the category and 14.29% of the total frequency of interactions. This might mean that the employment of Didactic Contract available in the VLE were not sufficient to Dissipating Doubts of students.

Looking at the Technical strategies in Table 2, we could see that the category of Technical strategies appeared only 1 time (4.76%), and fully focused on the sub-category of Tools, meaning the adequacy of the tools to perform the tasks. Thus, we inferred that this type of problem is decreasing because of the large use of the VLE. Still about Conceptualization Strategies we observed that the strategies that the tutor chose were according to the problems presented by students (student demand), rather than planned by the mentor for the activities in the VLE. This can be found in the frequency of strategies related to the Conceptualization-Correction (greater than 14%).

<table>
<thead>
<tr>
<th>Occurred</th>
<th>Not occurred</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Cognitives</td>
<td>Spacial</td>
</tr>
</tbody>
</table>
From 12 categories proposed for the classification of pedagogical intervention strategies used by tutors 10 had been recorded, corresponding to 83.3%. Only 16.7% of the proposed categories (2), had not been recorded in the observations (Table 3).

Looking at the activities proposed such as categories of analysis, only 3 categories have not occurred in the data set. The ones that occurred were: the Activities Orientation, Activities Completion, Post Orientation, Questioning, Concepts Validation, Activities Expansion and Notices (Table 4).

The three categories of activities most frequently reported were: a) Activities Orientation - 28.57% b) Questioning - 28.57%, and c) Concepts Validation - 19.05%.
The three categories of activities that had not been recorded in the observations correspond to 30% of the proposed categories (Table 5).

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Activities</th>
<th>Occurrence</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitives: Content</td>
<td>Questioning</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Clustering</td>
<td>Activities Expansion</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Connecting</td>
<td>Activities Orientation</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Connecting</td>
<td>Activities Completion</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Connecting</td>
<td>Questioning</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>Connecting and Conceptualization (Multiple Purpose)</td>
<td>Activities Expansion</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Affectives: Acknowledges</td>
<td>Activities Orientation</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Social: Work</td>
<td>Questioning</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>Social: Work</td>
<td>Activities Expansion</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Didactic Contract: Dissipating Activities Doubts</td>
<td>Activities Orientation</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>Didactic Contract: Notices</td>
<td>Activities Orientation</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Didactic Contract: Notices</td>
<td>Notices</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Technical: Tools</td>
<td>Activities Orientation</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Conceptualization: Correction</td>
<td>Concepts Validation</td>
<td>3</td>
<td>15%</td>
</tr>
</tbody>
</table>

Table 6: Intersection of strategies and activities by categories

Analyzing Table 6, which shows the occurrence of interbreeding between the strategies and the activities, we identified that 2 out of 9 strategies appeared in larger quantities: Clustering and Didactic Contract. In addition, referring to the activities, those that appeared most frequently were the Activities Orientation and Questioning.

Using the approach of analysis based on the strategies, we could see that the highest frequency strategies were the Connecting strategies, with 25% of cases. Contemplating also the Conceptualization strategies (Correction), which were the same kind of to Connecting strategies, we obtained the frequency of 40%, which shows the pattern of tutors. The Didactic Contract strategies appeared linked to Activities Orientation and Notices, totaling 25% of cases. If we add these to the Connecting and Conceptualization strategies than we will end up with 50% of all the strategies chosen by the tutors.

Starting from the approach to analysis from the activities, the data showed that the Activities Orientation appeared as the highest frequency with 30% of cases, followed by Questioning activities (25%). Both together made 55% of the activities chosen by the tutors to enable the implementation of the strategies he adopted. Only 10% of activities were correlated with the higher incident strategies (Connecting). The others activities were related to strategies less frequent, such as Cognitive and Social.

With regards to the single occurrence of Technical strategie, related to the use of Tools, the activities used to sustain the application were the guidance of posting, revealing the use of “posting task tool” by the students.
6 Final considerations

Comparing the most frequent strategies with the less frequent strategies, we found that strategies were focused on Connecting and Conceptualization actions (working with correction of concepts). It revealed that the work of the tutor was directed to the skills students needed to be developed. Therefore, the cognitive work with content itself, with the ideas, seemed be left in the background.

However, when analyzing the actions taken by the tutors and considering that in the context of research data, we found that tutors developed a type of reactive action. It appears to be the pattern of distant shared teaching in courses at UAB. In this model who would plan the teachers actions would be the teacher-executor and the tutor would only be reactive to the students demands. The tutors had a limited autonomy for tasks proposition, because of the profile of his function in the course.

It is clear, therefore, the tendency of a tutor as a reactive actor. This tendency to act in that way was identified in the data, but one must question whether this type of guidance was the best for the student and resulted in a good quality education. We did not want to train professionals with specific skills only, but to help people thinking and consciousness of their role in society.

In addition, we realized that the analysis of interactions in the pedagogical mediation in VLE based on Leotiev’s AT, highlights the descriptive and analytical possibilities of these ideas for discussion of educational practices in different contexts, whether physical or virtual, regular or distant.

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