ACTIVITY APPROXIMATION THEORY AS METHODOLOGICAL APPLICATION POSSIBILITY IN MATHEMATICS DISTANCE LEARNING APPRENTICESHIP

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Abstract

This study proposes a teaching methodological discussion applied to the undergraduate degree in mathematics distance learning of Federal University of Paraíba, in which we adopted as main study theory the Activity Approximation Theory. This theory arises in Vygotsky precepts and have been expanded and sequel by Talizina (2000; 2010). In Brazil this discussion still not much studied, however we believe that this proposal as a viable methodological alternative when applied aiming to improve the quality learning of students, as well as propitiate to the future teachers other mathematical contents discussion possibilities. Therefore, the study had as its central objective to identify the methodological teaching contributions of Activity Approximation Theory in mathematical teaching, when this was applied in an undergraduate degree in mathematics, in distance learning modality. The methodology had qualitative feature, in empirical way, using several tools for data acquirement. Thirty-one students in the 5th period of the investigated course participate in all stages, during eight successive investigative months. The outcome indicates that Activity Approximation Theory provide a good guidance to the participants, allowing them the concept and the mathematical concepts action assimilation, promoting the distance learning.

Keywords: mathematical teaching and learning; Activity Approximation Theory; teaching methodology; mathematics distance learning.

1- Introduction

Brazil haves today significant progress with regard to student's access to school, in particular in elementary school. Passed the stage of ensuring access of students in school, other social demands appear that drive the studies directed to improving education in our country, aiming to overcoming various problems in the school institutions, such as: violence at school; lack of motivation by students and teachers, among others also relevant. In this context we also we ask ourselves about school omission in its role to educate and form students for full exercise of their citizenship.

In general, Brazilian basic education presented advances in the last decades with regard to care coverage, nevertheless still facing problems of different natures, related to quality. In mathematics specific case, the low performance stages have marked the national and international evaluation results of which our students have participated.

Thereby, our efforts also should be focused on teaching quality offered by our educational institutions to children, young and adults that they are linked to them, having fundamental importance the reflection on issues to all education professionals, such as: *how students learn at distance? Is this apprenticeship longstanding? How promote a quality education to mathematical distance learning students?*

The spectrum from which we can analyze the mathematical teaching problems, particularly, is ample, and we never could embrace deeply some nuance if we propose a wide range of thematic discussion. Thus, the present study aim to discuss some teaching methodological possibilities developed and applied to 5th period of undergraduate degree in mathematics of Federal University of Paraíba – UFPB, in eight months of field research.

Against the complexity of these issues and many necessities crowded out, we have to answer the flowing research problematic: *Which methodological contributions we can observe in teaching and learning of mathematical contents process, considering the Activity Approximation Theory, connected to other teaching methodologies, when these are applied to an undergraduate degree in mathematics distance learning?*

Therefore we elected as general objective of this study identify the main methodological contributions of teaching based on Activity Approximation Theory to assimilate math content, applied to an undergraduate degree in mathematics, in distance learning modality. Aiming reach the main study purpose we elected as specific purposes: identify the students and investigated educational institution profile; diagnose the students cognitive development stage at baseline; structure a didactic system based in Activity Approximation Theory; and lastly, evaluate the necessary adaptations to the proposal application, respecting the students and distance learning modality specificities.

2- The mathematical teaching and learning

The teaching process in based in professor activity during their practice (education) and in student learning. Thus, when the process is successful, the professor teach (something) and the student learn (something).

The relationship between teacher and student is secular and through it we realized, nowadays, the need for collaboration between both of them. The student success requires not just teacher collaboration, but also from your peers. Although, the teacher's role still having fundamental importance in presentation of social knowledge to the student, using models that permit a good guideline. With professor's help, students can be able to discover the essence of the concepts.

So, the apprenticeship does not depend of the superficial part presented by knowledge object, but depends of effective relation between the character and this object. Based in this principle, we conceived that any teaching proposal success is straight linked to three basic factors: the study purpose (Why we teach?); the teaching contents (What we teach?); and the apprenticeship process (What are the methods adopted to teach? How to teach?).

In distance learning, the student is, usually, in geographically distinct place in relation to the teacher. To get success in the educational process of this public we need to formulate didactic proposes that anticipate the student difficulties. With this aim, when we produce didactical materials to distance

learning courses, Aretio (2004; 2006)[1] [2] indicates some quality categories that should be attempted in order to soften or extinguish future difficulties arising from distance learning ministered contents. These features are organized in sixteen classes: *programming; adequacy; accuracy and topicality; integrality; integration; openness and flexibility; coherence; effectiveness; transference and practicality; interactivity; meaningful; validity and reliability; representation; self-assessment; efficiency and standardization.* For a greater understanding of this discussion, we advise you to read Farias e Rêgo (2009)[3].

We also realize that the most curricula of educational institutions do not indicate, specifically, activities that develop logical means of interdisciplinary thinking. As result, the student logical-mathematical thought is not developed and when it occurs is in a spontaneous way, without the knowledge of the system of necessary means, of its content and the sequence of its formation. This behavior leads to many subsequent difficulties, in a most complex teaching stage.

Therefore, the student relies only on the system of the taught characteristics leading to concepts definitions in irrelevant features and isolated of the subject to be learned. They just memorize the concepts definitions, but they do not learn how to work with them. In this moment, the students have to know the necessary and sufficient features of the concept, being the professor the responsible for mediate this features differentiation, helping the student with his evolution.

2.1 The Activity Approximation Theory applied to Teaching

The Activity Approximation Theory proposed by Talizina (2000)[8] and Talizina, Solovieva e Rojas (2010)[9] was based on Vygotsky (2007)[10], Leontiev (1991)[7] and Galperin (2009)[5] and others researchers. Continuing the historical and cultural perspective, the author proposes seven action stages that enable the student to acquire a complete assimilation of any didactical content, believing that all human action is motivated by an activity. These stages are categorized in: material or materialized stage, concrete perspective stage, abstract perspective stage, external verbal stage, internal verbal stage, internal image stage and, lastly, mental stage.

Talizina (2000)[8] affirms that the knowledge on the plans (external and internal) and the actions forms (material or materialized, concrete perceptive or abstract perceptive, external verbal, internal verbal, internal image and mental) is essential to develop efficient methodological proposals for teaching and to correct apprenticeship institutional problems. In our study, we elected five investigation categories: *the creation* (present in Galperin (2009*)), the material or materialized, the external language, the internal language and the mental stage* (present in Talizina (2000)).

The first stage to be executed is the creation. At this stage the teacher should perform the preparation of an action project, composed by the guiding base that will serve as a reference in implementing the action by the student. After the creation stage, we proceed to material (or materialized) stage where the action passes through the first form of external construction in the student. The third stage is the external language, where the action become separate of things and goes to loud voice language plan (external language). Then, the action is realized by converting for yourself, however still inaccurate in yours verbal and conceptual compounds. Is the internal language stage. Going ahead, the action pass from the external plan to the internal plan in language to yourself, being complete assimilated in the next stage, the mental stage. In this last stage, the action becomes in an automatic process and, as a consequence, one comes to the individual's conscience, being assimilated (GALPERIN, 2009) [5].

The language participates in all formation stages of mental action, but in different modes. The actions that are included in scholar activity related to motivational aspects and goals lead to different systems. In traditional education, the knowledge is located in the center of attention. The teacher exposes the subject content existent in teaching programs, proceeding as follows: “passes” something (content) to the students that is not deeply explained (essence).

To solution this problem, the teacher needs a Guiding Basis of Action – GBA, understood as a conditions system in which the character should lean during the action realization. When moving from one stage to another of project, the action modifies itself and is assimilated by the student, turning in a new

knowledge with essential and relevant features, required and sufficient to learning establishment, being followed by control stages. But how accomplish such steps in distance learning? This discussion will be presented in the next section.

3- Methodological Proceeds

In our investigation, of qualitative nature, we adopted a methodological perspective predominantly exploratory, which is defined by Gil as being the main purpose to clarify and modify concepts and ideas, in order to formulate more accurate problems or searchable hypothesis to later studies (GIL, 2011, p. 27)[6].

About the data gathering and analysis, we elect this study as empirical, of the type case study research. Thus, we endorsed in data achievement by means of two research tools: semi structured questionnaire and field diary.

The methodology of action corresponded to the development and implementation of diverse tasks, coherent with each action assimilation stage and according to the required complexity of stages. Initially, the students was invites to build empirically these activities using the *grouping tool* in *Moodle* learning environment and *Geogebra software*.

During fourteen weeks, we prepare, present, discuss and execute the research. In last moment, we note that 34 students would be able to participate, voluntarily, of the final study stage among 97 students enrolled in the course.

4- Presentation and Discussion of Results

After we conducted a thorough study of our theoretical referential, we plan the research following steps and over seven months we realize the field activity phase, performing and evaluating the students directly and continuously, which enabled us to ask the objectives and hypothesis outlined at the beginning of our investigation. The research occurs from February to September in 2014,

which matches with the 2014.1 full semester and the start of 2014.2 academic semester in the participant teaching institution.

The first study stage was the creation. This stage was subdivided in two aspects: diagnosis and cognitive. We use *Moodle* platform, in a non-presential way, in fourteen participant poles, using a semi structured questionnaire compound by two parts: profile survey and problem situations. We initially identify the profiles of participant students, which we found as being very similar about gender, age, location, income and other relevant aspects, to the students of the mathematics presential course in Campus IV – Rio Tinto which is in the same institution. The profile diverges concerning to the study aims and the students access to the course.

Regarding the problems situations, these were proposed in order to diagnose the knowledge of students about triangle concept in a first moment of study. We note that 61,2% of the students, in a universe of 72 participants, have not assimilated central elements related to the triangle concept, missing in this moment of investigation.

In this regard it is necessary to reflect because the triangle study is present during the completely basic education mandatorily in school curricula (BRASIL, 1997; 1998; 2001), being worked for 12 years of education in our country. Although this content "visibility" we verify that, due to our education superficiality, most of our investigated students was not able to solve an simple triangle recognition situation, which should be in the any student's repertory in the end of yours basic education. That is a worrying fact since we are discussing a simple concept with future mathematic professors.

From the first step we started the preparation of tasks, according to the adopted theoretical assumption. Over all study period, 73 questions was applied, distributed in 23 activities, with many complexity degrees, categorized as follows: written production (14); class profile survey (1); group organization (1); thematic workshops (5); control measurement task (1); and the verification of qualitative control of the assimilated content (1).

In the study's second stage, we grouped the students in pairs using the *Moodle* platform. This group formation in learning environment was not used yet in the investigated course and so it required a detailed study tool so that students would use the modality of work in pairs, in a virtual way, in activities

achievements. The groups and subgroups can be built in *Moodle* learning environment in these software most recent versions, by using the *grouping* tool.

The group organization also was used in control stages accomplishment suggested by Talizina (2000)[8] when she establishes the pair control. The students, upon receive an activity, should organize yourselves so that while one works in an activity execution in an usual way (executor) the other executes the activity control of the first student (appraiser), paying attention to the execution mode. Then is given another task of equal complexity and exchanged the roles of students.

Thereby, we initially grouped 97 students (overall number of enrolled students) favoring yours origins poles. We form 15 poles groups with 48 subgroups, allocating two students in each subgroup. Thereafter, all tasks were configured to be carried out by the pairs.

In the material or materialized stage, 61 students participated which 39 of them were successful in the tasks performed.

In the extern language stage, 56 students participated, which 33 have been successful.

In the interior language stage, 56 students participated, which 39 of them were successful in the tasks performed.

In the mental stage, 55 students participated, which 19 have been successful. In final control, we note the success of 23 out of 34 students that are able to participate in this time of the research. At the end, we realized a written evaluation, presential, followed by tutors, where we aim identify the triangle concept retention already studied. We found that 68% of students have been successful at this time of the study.

After two months apart, without notice, we apply a new problem situation to participating students, this time in another subject, changing the entire last context. We verify that just 31 out of 34 students participated of this final stage. 28 out of these 31 students (90,3%) presented a satisfactory concept and action assimilation, having 100% hits while 3 out of these 31 students (9,7%) have not success in more complex situations applied in other knowledge areas.

5- Final Considerations

The study presented a discussion that we consider relevant with respect to: the use of theoretical proposal given by the Activity Approximation Theory, in undergraduate degree courses in mathematics in distance learning modality, being applied with adults; the planning, elaboration, execution and evaluation of the didactical system proposed to the discussion of triangle concept; the elaboration of the orientation scheme to the triangle study in elementary school and high school; and the use of group system tool in *Moodle* platform, considering the distance learning dynamics, never done before in the investigated course.

We verify at the end of study that, starting from the theoretical outline adopted, the students that participate of most study stages (34) developed a greater self-control, autonomy and logical-mathematical organization, with respect to the mathematical concept and action concerning to the triangle content. The importance of a good guidance that anticipates expected difficulties and that proposes a curricular organization based on essential and relevant didactical content features was decisive to the students success. These students, after two months apart and without previous warning, performed, in a successful way with properly and safety, the resolution of an more complex problem applied to other human knowledge area evolving the triangle thematic.

Therefore, We found that a good guide can facilitate the development of capacities and skills of students in distance learning courses. Unfortunately, 31 out of 97 students enrolled in this discipline participate of every study stages, this fact was corroborated by the participant course evasion.

By the exposed in the study, we understand that the Activity Approximation Theory proposed by Talizina (2000)[8] is an interesting teaching methodology, which allows a suitable guidance to the students on didactical contents, being capable of boost the mathematical teaching and learning process in courses that uses the distance learning modality.

Note:

[1] Article related to the doctoral thesis entitled: Ensino-Aprendizagem de Triângulos: um estudo de caso no Curso de Licenciatura em Matemática a Distância, guided by Professor Dr. Rogéria

Gaudencio do Rêgo of the Postgraduate Program of the Federal University of Paraíba, PPGE/UFPB, in 2014.

6- References

[1] ARETIO, L. G. *El material impreso em la ensiñanza a distancia*: actas y Congreso. 2ª ed. Madrid: UNED, 2004.

[2] _____. *La educación a distancia*: De la teoría a la práctica. 3ª ed. Barcelona: Ariel, 2006.

[3] FARIAS, S.A.D.; RÊGO, R.G. *Uma Análise da Produção Didática da Matemática a Distância*: o caso da UFPB. Dissertação de Mestrado do PPGE/UFPB, João Pessoa: UFPB, 2009.

[4] _____ . *Ensino-Aprendizagem de Triângulos: um estudo de caso no Curso de Licenciatura em Matemática a Distância* Tese de Doutorado intitulada: Ensino-Aprendizagem de Triângulos: um estudo de caso no Curso de Licenciatura em Matemática a Distância. Tese de doutorado do Programa de Pós-Graduação em Educação da Universidade Federal da Paraíba - PPGE/UFPB, João Pessoa: UFPB, 2014.

[5] GALPERIN, La dirección del Proceso de Aprendizaje. In: ROJAS, L.Q.; SOLOVIEVA, Y (Org.). *Las Funciones Psicológicas em el Desarrollo del Niño*. México: Trillas, 2009.

[6] GIL, A. C. *Métodos e técnicas de pesquisa social*. 6ª edição. São Paulo: Atlas, 2011.

[7] LEONTIEV, A. N. Curso de Psicologia General. Vol. I, II, III e IV. Tradução Paulo Bezerra. São Paulo: Civilización Brasileira, 1991

[8] TALIZINA, N. F. *Manual de Psicologia Pedagógica*. Universidade Autônoma de San Luis Potosí. Mexico: Potosína, 2000

[9] TALIZINA, N. F.; SOLOVIEVA, Y. ROJAS, L. Q. *La aproximación de La actividad em psicologia y su relación com el enfoque histórico-cultural de L. S. Vigotsky*. Revista Novedades Educativas. Nº 230, Febrero, 2010. pp 4-8.

[10] VIGOTSKY, L. S. *A formação da mente*: o desenvolvimento dos processos psicológicos superiores. Org.: COLE, M. et al. 7ª ed. São Paulo: Martins Fontes, 2007.