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Development of math skills in first semester students of public accounting

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Abstract. This research project describes the results of applying two pedagogical methodologies: problem-based learning and the use of new information technologies through GeoGebra in the development of the theme of functions for students of public accounting. The research was developed from a positivist paradigm, quantitative approach of quasi-experimental type of pretest and posttest with control and experimental group. In order to determine the development of competencies, a diagnostic test was initially applied to evaluate the mathematical knowledge with which the students enter; then pretest and posttest tests were applied to the control and experimental groups, in which by means of an intervention plan to the experimental group in the posttest stage, favorable results were evidenced by improving the proportion of correct answers and the development of competencies in geometric algebraic reasoning compared to the pretest stage. One of the conclusions reached in the research is that applying other methodologies in class such as problem-based learning with the support of GeoGebra software encourages the process of teaching learning and students find applicability to the topics treated by associating them with situations of practical life.

1. Introduction

One of the pillars of public accounting is education in mathematics as a fundamental piece to interact constantly with the accounting sciences, so it must be measured and one of the forms of measurement known for its effectiveness is the competency-based approach, being this concept considered by the Ministry of National Education an essential tool when evaluating the knowledge acquired.

The importance of the subject is such that some international research has addressed this approach, such as Marcos [1,2], who analyzed a model of mathematical competencies based on an interactive environment, due to the need to modify classical teaching and incorporate interactive virtual learning environments, supported by computer applications and the use of information and communication technologies (ICTs). Similarly, the work of Villalonga [3] and Arreguín [4] studied mathematical competencies through a project-oriented learning technique, so that students could voluntarily appropriate topics and improve the ability to identify, pose and solve problems [5].

The “Universidad Francisco de Paula Santander (UFPS)” public accounting program is offered in day and night modes. The research is carried out in the evening, where the students are older people who were not active academically for some time due to different circumstances, such as family, economic, social, among others. There are also young people who alternate their night studies with their daytime working life, but the time allocated to study is limited by daily commitments.

It has been observed from the academy that students do not develop adequate mathematical bases to face mathematics, evidencing shortcomings in the resolution of exercises, graphs of functions and



analysis of cases. Mainly there is difficulty in the interpretation of posed situations which also hinders the proposal of alternative solutions.

Therefore, the objective of the study is to design a pedagogical proposal for the development of mathematical competencies in first semester students of the night program of public accounting of the UFPS. As a first step, a diagnosis was made of the level of mathematical competencies with which these students enter the academic program, in order to later identify the topics that need to be developed in the classroom. In addition, didactic strategies for the development of mathematical competencies were implemented and their impact on the learning of the different subjects that correspond to the first semester curriculum was evaluated [6,7].

The importance of the study lies in the elaboration and implementation of methodologies so that students can see mathematics with greater functionality in their working life, closer and easier to understand, in such a way that they develop numerical competencies as a fundamental pillar for the study in accounting areas and the development of specific competencies [8-10].

The pedagogical proposal aims to contribute to the development of mathematical competences, based on the implementation of didactic strategies: problem-based learning and mediated use of GeoGebra for the analysis and understanding of problem situations and verification of the results obtained.

2. Method

The research was based on a quantitative approach [11,12], which is based on the study of numerical data analysis and the use of statistical techniques to weight the development of mathematical competencies in first semester students of public accounting at night. A quasi-experimental study [13] was used with control and experimental groups made up of students who take the subject studied and compare the results obtained pretest and posttest in the development of mathematical competences in the subject of functions when applying didactics of learning based on problems and the didactics of ICT use, specifically in the GeoGebra software. The design of the investigation was of work of in the classrooms both for collection of information and for application of the methodological proposal.

The working hypothesis is formulated according to the fact that the implementation of the problem-based learning model together with the use of GeoGebra represents methodological strategies that improve the development of mathematical competencies in first semester students of public accounting of the UFPS.

The dependent variable is constituted by the development of mathematical competences related to numerical, algebraic and geometric reasoning; the independent variable is constituted by the pedagogical methodology based on learning based on problems-based learning (PBL) with the use of GeoGebra. We worked with two groups of students enrolled in the mathematics course for accountants of the first semester of public accounting, night modality of the UFPS in the second semester of 2018, distributed as follows: 30 in the control group and 35 in the experimental group.

First, a diagnostic test [13] was performed to identify the students' competencies upon entering the program and to verify the homogeneity of the groups in terms of the variables being studied. The test measures knowledge based on statistical, algebraic, financial mathematics, numerical and logical skills.

The second phase involves the application of a pretest that bases the training needs and constitutes the empirical basis for the elaboration of the methodological proposal. Once the intervention consisting of the application of the proposed pedagogical methodology has been carried out, a post test is applied that evaluates competencies similar to the pretest but with items of greater complexity and applicability for the public accountant. The instruments were validated by experts and pilot tests were carried out in a daytime group in order to avoid contamination of the process as much as possible. The results were compared using descriptive and inferential statistical methods.

3. Results

As a first measure, the content of the micro-curriculum of the subject under study was reviewed and related to the competencies that students must develop. Among the mathematical competencies we can

mention the following: logical competence, numerical competence, geometric competence, metric competence, algebraic competence and statistical competence.

Taking into account the micro-curriculum of the subject mathematics for accountants of the UFPS, the units that make it up are listed below, relating in turn the mathematical competencies that students should develop according to the programmatic content: logic and theory of sets, functions, limits and continuity, mathematical analysis and mathematical projection in accounting.

Secondly, didactic strategies were implemented for the development of competencies in mathematics learning in first semester students of the public accounting program of the UFPS. For this purpose, a pre-test was carried out with 8 questions referring to the topic of functions to the two groups studied, the first called control group made up of 30 students and the second called experimental group made up of 35 students.

The analysis and interpretation of the results obtained during the application of the pretest about the study related to the topic of functions and the application of didactic techniques such as the use of ICT, particularly the GeoGebra software and the problem-based learning in students of the first semester of public accounting, night mode of the UFPS for the development of associated mathematical competences, which for this case is algebraic - geometric.

It was found, both in the control group and in the experimental group, that about 70% of the students do not dominate algebraic competition, 60% have faults in geometric reasoning, 50% do not have a clear concept of function. It can be inferred from the pretest that there is difficulty in the conception of the theme of functions on the part of the control and experimental groups, which is evidenced by the results of the applied test in which the geometric algebraic competence has not been developed.

Thirdly, the intervention plan was designed and implemented for the experimental group, starting with the problem-based learning methodology and complementing it with the use of ICT, GeoGebra.

Finally, the didactic strategies implemented for the first semester students of public accounting at night were evaluated. Next, the data obtained from the application of the test are listed, after using the methodology proposed for the development of mathematical competencies related to the subject of functions of the subject mathematics for accountants. An increase was found in the development of algebraic competence, showing that the application of problem-based learning didactics together with the use of ties contributes significantly to its development. The methodology motivated the students, who expressed it explicitly.

4. Discussion

Based on the results of the tests, the pretest was compared with the posttest and it can be said that there was a marked positive difference in the experimental group, which shows that the students to whom the treatment plan was applied with didactics of learning based on problems and use of the ties specifically GeoGebra for the resolution of content related to functions responded well to the intervention that sought the development of geometric algebraic competence.

Therefore, it turned out to be a significant learning, in which the interaction between teacher and students was fundamental for the achievement of the proposed objectives, the students found applicability to the topics treated, there was companionship since several of the activities had to be done in pairs, so there was teamwork and that helped the academic process.

5. Conclusions

It could be observed that the students were motivated with the use of the ICT tool GeoGebra to graph functions that model situations of application to public accounting. In this sense, it can be inferred that the use of new pedagogical alternatives captures the attention and interest of the students to learn mathematics and this was reflected in the favorable results after the intervention to the experimental group in the posttest.

As for the pretest, it allowed to identify aspects to improve with the design and implementation of strategies of pedagogical intervention in pro of the development of competence related to the algebraic and geometric aspect own in the elaboration of mathematical functions.

Based on the results of the posttest it can be synthesized that the control group did not present a significant variation, quite the opposite to the experimental group that managed to improve the results of the pretest, demonstrating in this way the proposed objective of developing geometric algebraic mathematical competence, which for the present project focused on the theme of functions.

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