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LEARNING OF ALGORITHMS IN THE LICENSE COURSE IN COMPUTING OF THE FEDERAL INSTITUTE OF EDUCATION, SCIENCE AND TOCANTINS TECHNOLOGY – IFTO - DIANÓPOLIS *CAMPUS*: CHALLENGES AND POSSIBILITIES

Aparecida de Cássia R. Ávila
Students of the Degree in Computing at the Federal Institute of Education, Science and Technology of Tocantins – IFTO

Karine de Souza Araújo
Students of the Degree in Computing at the Federal Institute of Education, Science and Technology of Tocantins – IFTO

Laercio Alberto A. Ávila
Students of the Degree in Computing at the Federal Institute of Education, Science and Technology of Tocantins – IFTO

Michele Pereira Vilas Novas
Professor of the Degree in Computing at the Federal Institute of Education, Science and Technology of Tocantins – IFTO

Abstract: Over the centuries, the human being has been discovering more and more about the processes of learning and cognitive development. According to the evolution of society, this knowledge has also been evolving in order to better serve professionals, especially in the area of education, so that they know how to deal effectively in the teaching-learning process, aiming at a greater performance in the development of their students. In this sense, a man or woman stands out in relation to the other, mainly due to their intellectual capacity, that is, the ability to solve more complex problems is what distances the intellectual man from the common man. The work is based on LEFRANÇOIS (2013) and LOPES & GARCIA (2002), using bibliographic analysis as a research tool. The method used is a quantitative approach, with observation and recording of information in the field of research and completion of questionnaires. Through the data obtained, it can be concluded that, in general, the knowledge acquired before entering higher education largely contributes to the success of the Introduction to Logic and Algorithms course.
Keywords: Logic, Cognition, Learning, Representation, Enactive , Programming.

INTRODUCTION

This article aims to analyze the challenges and suggest solutions that contribute to a better learning and use of the Discipline of Fundamentals of Logic and Algorithms of the Degree in Computing, aiming at a better use for students and the institution Instituto Federal de Educação, Science and Technology of Tocantins *campus* Dianópolis.

This work addresses the challenges of students in solving problems involving the

Discipline of Fundamentals of Logic and Algorithms, at the Instituto Federal do Tocantins- Campus Dianópolis - TO , in the year 2017. Algorithm is a logical sequence of how to solve certain problems, such as, from brushing your teeth, to calculating large-order arrays .

A crucial factor in solving algorithms is the interpretation of the utterance, solving a problem requires the student to understand and assimilate the context involved, understanding the utterance is a very important requirement, a great pillar in the learning of Logic and Algorithms.

Another important factor is doing math operations. The study of Logic and Algorithms is unfeasible without mathematical knowledge, such knowledge is extremely important for giving a direction and initially preparing the student for the Discipline of Fundamentals of Logic and Algorithms, since algorithms are mathematical sequences translated and logically organized.

The study of mathematical logic among university students is often their first experience with the subject, learning another way of thinking, precisely when it is already necessary to have this cognitive process awakened to be applied in other challenges can be quite traumatic and laborious. for the student. Learning logic is like wanting the brain to recognize other paths to be followed in the way of thinking.

Among the many challenges for the student is the dissociation of Algorithms from the Programming Languages themselves, while the former, according to Anita Lopes: "[...] is a logical and finite sequence to solve a problem", the Programming Language is a way of translating the algorithm so that the computer can understand and compile it, therefore, learning Algorithm is independent of learning a Programming Language, however, it is impossible to learn any language without previous knowledge of Programming Logic.

THEORETICAL REFERENCE

The human being needs to solve problems from before the moment of his birth, and this process is an act of overcoming, as it depends on the effort of the small fetus. From then on, everything is a challenge. It is necessary to overcome steps to be able to move to the next level, when this does not happen, human nature itself, fails them , creates shortcuts represented many times by dropouts or change of Courses in the case of the student, these are quite common factors nowadays . In short, the whole life of a human being requires overcoming challenges and solving problems, and, whatever they may be, they depend on preconceived knowledge, aligned with new learning to obtain reasonable results.

Solving problems directly affects the lives of individuals, the affirmation of men and women today is expressed mainly in work relationships, in which, even if vulgarly, the degree of success that the individual presents can be measured. Lívia Borges and Osvaldo Yamamoto (200, p. 33-34), express that:

> The history of mankind is the history of the relations of production, and that the productivity of the workforce varies with the development of science, its technological application, the process, conditions and efficiency of the means of production themselves, in addition to the available resources."

We can see the real need for the individual to play a leading role in the sense of being the link between the work to be done and the means available for its execution, the job market expects the perfect fit of this current.

But how is knowledge formed? Where is the frontier of knowledge? Are there stimuli we can give the brain that can help with problem solving?

These and many other questions are reasons for the study of several researchers, it is worth noting that, as human beings are endowed with several particularities, the formation of cognitive knowledge is not the same for everyone, but there are very convincing theories to demonstrate this development.

Cognitive Theory, initially developed by the American pedagogue Jhon Dewey (1859-1952) and later by the American psychologist Jerome Bruner (1915-1980), conceives learning as "problem solving. It is through the solution of day-to-day problems that individuals adjust to their environment [...]" (PILLETI, 2013, p.24). According to Hélio Teixeira, on his home page http://www.helioteixeira.org/quem-sou/

> Cognition is the act or process of acquiring knowledge that takes place through perception, attention, association, memory, reasoning, judgment, imagination, thought and language. The word Cognitione originates from the writings of Plato and Aristotle. It is the set of mental processes used in thinking in classifying, recognizing and understanding for judgment through reasoning for learning certain systems and problem solving. In a simpler way, we can say that cognition is the way the brain perceives, learns, remembers and thinks about all the information captured through the five senses. But cognition is more than simply the acquisition of knowledge and, consequently, our better adaptation to the environment – it is also a mechanism for converting what is captured into our internal way of being. It is a process by which human beings interact with their fellow human beings and with the environment in which they live, without losing their existential identity. It begins with the capture of the senses and soon after it occurs with perception. It is, therefore, a process of knowledge, whose material is information from the environment in which we live and what is already registered in our memory. (TEIXEIRA, 2015)

Understanding how the brain conceives learning, how it perceives events and makes associations, apprehending certain

experiences and disregarding others, learning how we learn is the first step to actually being able to provide our brain with tools and make it know how to use these tools.

In this book, dealing with Cognition, Gestalt psychology is considered the beginning of modern cognitive psychology because of its concern with perception, consciousness, problem solving and insight, Gestalt considered that these mechanisms are essential to explain the processes higher mental.

Knowing what to do and when to do it requires a series of previous events, cognitive knowledge that human beings accumulate throughout their lives. The formation of computational thinking requires the systematic use of cognitive resources, solving a problem begins with the abstract thinking of interaction with written content and capturing in cognitive knowledge which resources will be used, also, in case of failure, what other resources are possible .

An essay... Let's think about our way of learning like a bricklayer who set out to build a house, in his immediate thought, abstractly in his mental exercise, he lists the materials and equipment that he thinks are necessary to carry out the work, let's suppose that in At a certain stage, he realizes that something has gone wrong, let's consider this the first option, in which the mason knows what he needs and how to find such material, let's consider, in a second option, that the mason does not even know that something is wrong or that, if he did what would be wrong, would not know how to solve such a problem, in this case, the work would be canceled or would be stopped until someone else knew what to do, or the mason himself learned how to do it. We can see this model very present to our eyes, in the case of learning Logic and Algorithms, just as the house work would be paralyzed, the program would not be executed until the error was corrected, or the result would be defective.

Returning to our mason, to build the house, it is assumed that he already has previous knowledge of how to build it, but this knowledge starts from the abstract for reality, and in reality it is often proven that not enough has been learned, or that what has been learned is not useful for a certain area of activity, in this sense, wisely stated Severino, "Science, as a content of knowledge, is only processed as a result of the articulation of the logical with the real, of theory with reality. (SEVERINO, 2002, p. 30)

According to Jerome Bruner, in the book Theories of Learning, (LEFRANÇOIS, 2009, p.224-227) "In the beginning, human beings were far from being the fastest, strongest and fiercest predators on this planet. [...] This creature is so intelligent that it ended up taking the course of evolution in its hands [...]".

Bruner points out that human beings evolved at first with inventions that increased motor capacity, such as the lever, the wheel, etc... Following with inventions that expanded the senses, such as the radio, the telescope, and finally, inventions that broadened intellectual reasoning, are the symbolic system, languages and computer systems.

In Representation Theory, Bruner, as a child " [...] Things are represented in the muscles this representation, called Enactive representation when the emphasis was on the amplification of motor capacities [...] strictly motor (or Enactive) for what Bruner calls iconic representation. An icon is an image, therefore, iconic representation involves the use of mental images that refer to certain objects or events [...] [...] The most advanced form of representation available to the child is symbolic representation, which occurs in parallel with the development of inventions that expanded intellectual capacities [...].

All these stages of acting develop sequentially and one does not replace the other [...] Adults continue to act, so people know how to ride a bike, hit a billiard ball, or play a golf swing, not based on symbols or images, but in the body - which illustrates why it is so difficult to explain in words how these things are done. On the other hand, we recognize faces not in the activity, nor in the symbols, but in the images [...]".

Jerome Bruner conceives that this model of child representation is valid for adults, according to him, " [...] In short, adults have at least three different ways of representing not only the effects of sensory experiences, but also thoughts [...]". "A system of symbolic representation, notably, language, is essential for the reasoning of the thinker", says Newell (1990), in possession of the representation models, the human being, when observing a certain element, does what Bruner calls Categorization , he classifies it according to the information already obtained, for example, when a man sees a being with long hair and rounded shapes, he deduces that it is a woman, when he sees a large, four-wheeled object, he knows that it is a car, from then on, he applies particular elements to these objects, like a 30-year-old black woman, his neighbor, for example.

According to Jean Piaget,

> Intelligence is defined by an individual's interactions with the environment. These interactions involve a balance between assimilation (incorporation of aspects of the environment into previous learning) and accommodation (behavioral change in face of the demands of the environment). The result of this interaction (this functioning) is the development of cognitive structures (operation schemes), which are, in turn, reflected in behavior (LEFRANÇOIS, 2013) [...].

In view of the researched aspects, and, mainly, far from defining in a rigid way how knowledge is formed, it can be validated that several fitting pieces are being built throughout the individual's life and can be used at the most convenient time, depending on the challenges that it faces, referencing, in addition to the mentioned theories, also, and especially the Gestalt Theory.

In Gestalt Theory: The Laws of Perception "[...] the global perception when listening to a melody is not that of isolated notes, but the perception of bars and passages [...] In the same way, physical objects derive their identity from the way their parts are combined, and not just from the parts that compose them [...], in this understanding, notably, it is noticed that the brain makes associations of pre - acquired knowledge, such associations called *insight* by Gestalt , are the relational thoughts, our brain relates and organizes knowledge in order to satisfy a certain equation, we understand here by equation, any problem formulation."

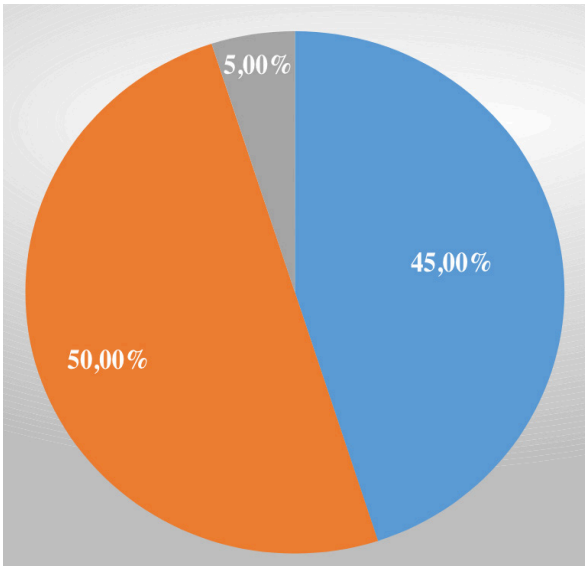
RESULTS AND DISCUSSIONS

During the project, which lasted six months, questionnaires were applied, targeting students of the Degree in Computing at night at Campus Dianópolis, with the central theme of performance and learning of the Discipline of Fundamentals of Logic and Algorithms.

In the questionnaire, objective questions related to the following topics were addressed: Performance in the Fundamentals of Logic and Algorithms course; knowledge of mathematical logic; knowledge acquired before entering higher education, as well as performance during the course, among others.

We got the following results:

3.1. How do you evaluate your performance in the Logic and Programming course?

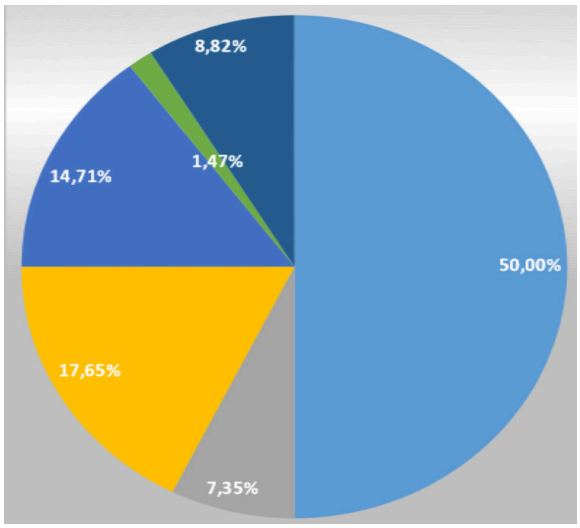


Graph 01: Result of performance in the Subject of Fundamentals of Logic and Algorithms.

Source: Researcher.

Of this item, 45% of the interviewees considered the performance Good, 50% considered it Bad and 5% considered their performance as Terrible, in this set of answers, it is clear that it is a result considered bad, because the number of students who have difficulties should be much smaller, a didactically acceptable proportion would be of a value that was not so significant, because when it is said that a total of 55% of a class is bad, it is verified that there are significant deficiencies in the learning process prior to the Higher Course.

3.2. Can you identify which subjects studied in High School and Elementary School were important for the study of Algorithms?

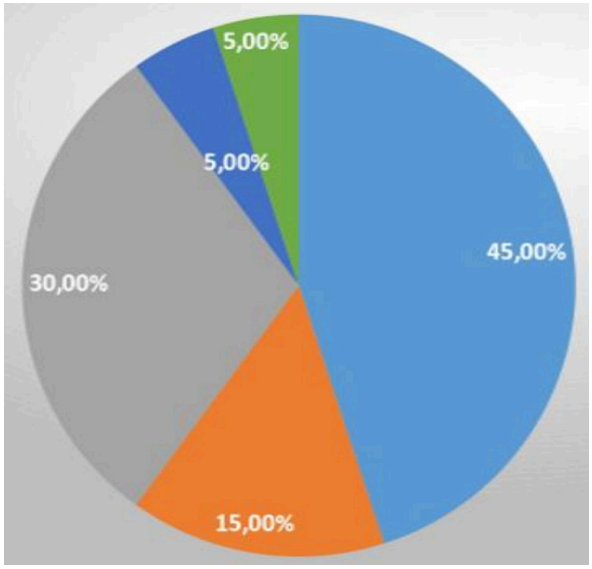


Graph 02: Result of important subjects for the study of algorithms studied in High School and Fundamental.

Source: Researcher

Of the 70 students interviewed, 50% answered Mathematics , 17.65% answered English, 14.71% answered logic, 8.82% did not know how to answer and 7.35% answered Portuguese. It can be concluded that in the Degree in Computing, previous knowledge in Mathematics, English and Logic has a very considerable value for better learning, but only half of the interviewees said that Mathematics was important, followed by English and Logic subjects. , a fact that makes us conclude that the learning deficit is even greater. It also remains to be noted that the 9% of people who did not know how to respond may be included in the 50% of those who obtained poor results in the discipline, as they do not even know how to identify what knowledge is necessary for better performance.

3.3. Can you interpret texts or math problems with ease?

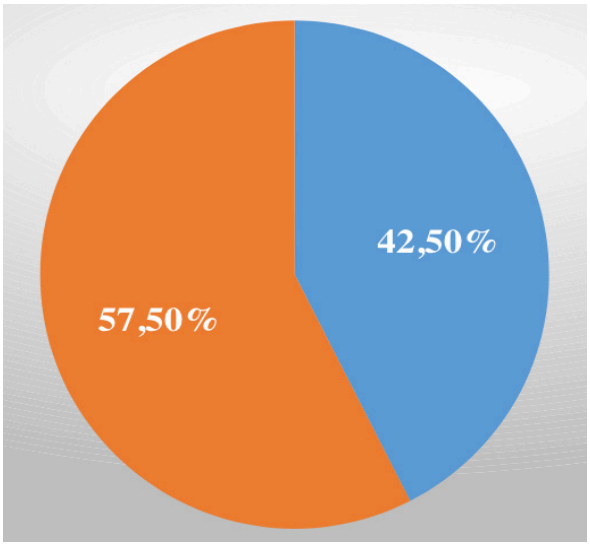


Graph 03: Result on the ease of interpreting texts and/or mathematical problems.

Source: Researcher

In this Item, in the item Interpretation of texts and/or mathematical problems, 45% of the students stated that they can solve them and this is in accordance with Graph 01, where 45% of the interviewees had a poor performance in the discipline. 15% said they had little reading, this data seems to be paradoxical. 30% said they had little knowledge of exact sciences, 5% did not respond and only 5% said they know how to interpret texts and mathematical problems. This result is quite discouraging, as the Licentiate Course deals with subjects both in the Humanities and in exact sciences and there are more than half of the interviewees with difficulties in interpreting texts and although only 30% say they have little knowledge of exact sciences, in fact, there are 55% that, according to Graph 01, have bad results. It is concluded, therefore, that there are deficiencies in the student's previous training and that knowing how to interpret a text facilitates the interpretation of mathematical problems, although only 7% of those interviewed said that Portuguese had been important for their results in Logic and Algorithms.

3.4. Have you already had the knowledge of Mathematical Logic before entering Higher Education?

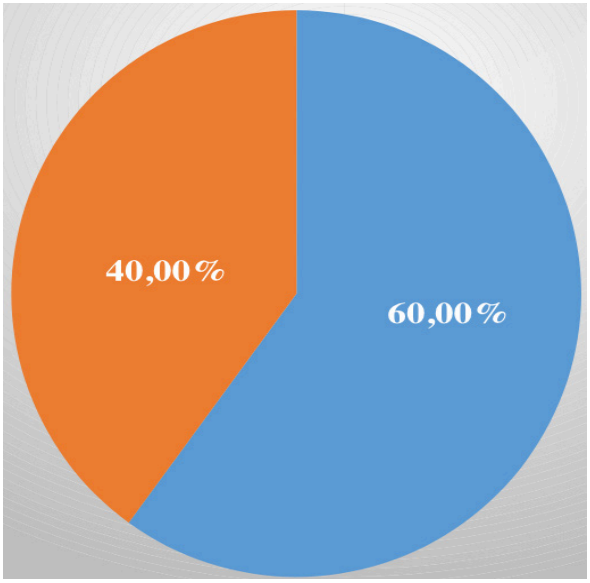


Graph 04: Result of knowledge of mathematical logic before entering higher education.

Source: Researcher.

In this graph, the results 42.50% of the students who already had knowledge of Mathematical Logic before entering Higher Education are in harmony with the students' performance, because in graph 01, of the interviewees, 45% claim to have a good performance in the Logic Subject and Algorithms, but did not recognize Logic as an important knowledge for understanding the discipline and 50% obtained bad results. In the Discipline of Logic and Algorithms, the knowledge of Mathematical Logic is of crucial importance, without it, the learning of the discipline is compromised.

3.5. Were you able to assimilate and make use of Mathematical Logic?

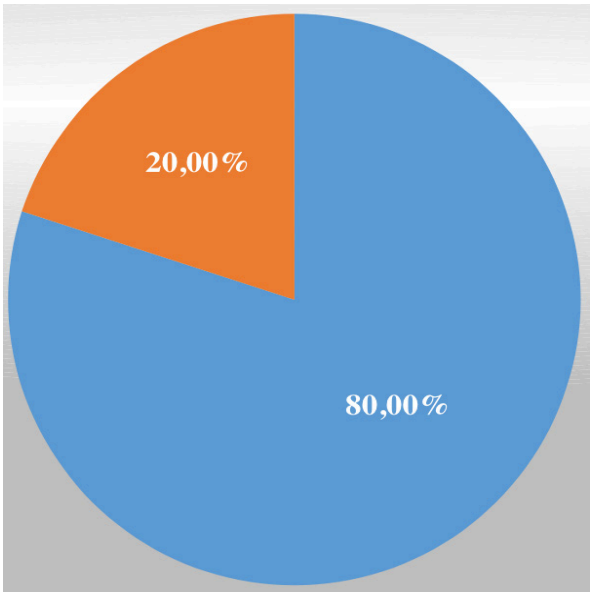


Graph 05: Result of assimilation and use of mathematical logic.

Source: Researcher.

In this regard, although 60% said they had assimilated Mathematical Logic, it seems absurd to us, because in Mathematical Logic one of the pillars is interpretation and in Graph 03, only 45% said they were easy to interpret and in graph 01, 55% had results bad/very bad, that is, there was an index of low grades of more than 50% of the interviewees. The total of 40% who responded not having assimilated is very close to the results obtained by the students in Graph 01, as 45% said they had good results with the Logic and Algorithms Subject.

3.6. Does looking at your code step-by-step make it easier to understand what needs to be developed?

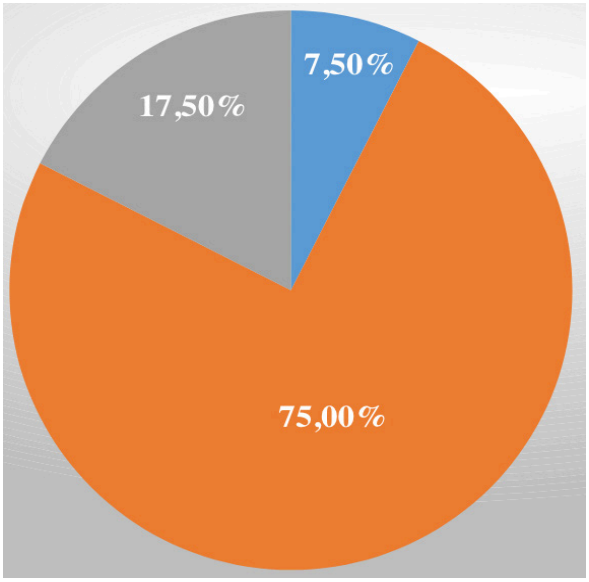


Graph 06: Result of the number of people who can understand the code easier by observing its step-by-step.

Source: Researcher.

In this graph, we can see that most respondents find it easier to understand what needs to be developed after analyzing their code step-by-step. Despite the performances seen above, it was mentioned that when the code is demonstrated step-by-step, that is, with an adequate methodology and tools, there is a substantial understanding of its understanding.

3.7. On a scale of 1 to 3, set your difficulty in Programming Logic.

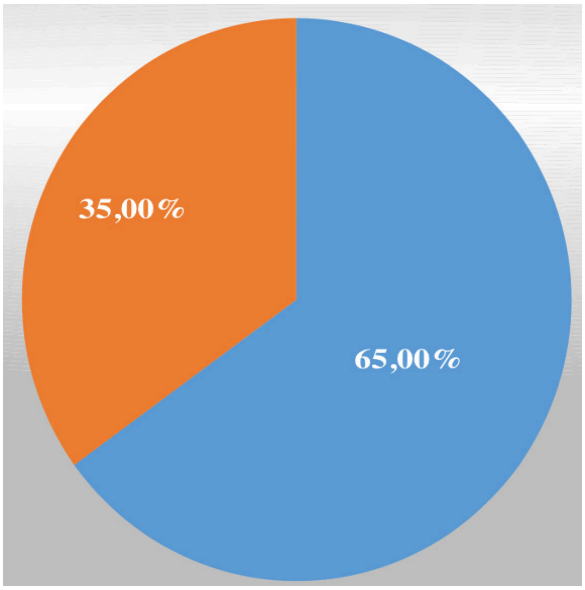


Graph 07: Result of the degree of difficulty in Programming Logic.

Source: Researcher.

In this graph, where the degrees of difficulty varied from non-existent to little, 75% of the students stated that their difficulty in Programming Logic is regular, that is, it is not bad, but it is not at the desired level, this is not such a value. interesting, but it is in agreement with the results obtained, that is, a little more than half of the students had a good performance in the discipline. However, when it comes to learning, this value is very low.

3.8. Was the knowledge acquired in the years prior to your entry into the Higher Course decisive for your performance?



Graph 08: Result of the importance of the knowledge acquired before entering the Higher Course.

Source: Researcher.

In this graph, a final question was used, with the objective of confirming all the other questions asked previously, here 65% say that the knowledge acquired was decisive for their performance in the Degree in Computer Science, in fact, through graph 01, we can It can be observed that 55% of the students did not have good results in the Logic and Algorithms subject and that, in graph 08, of the interviewees, 75% obtained regular results, that is, more than half of the interviewees were not successful in learning Logic and Algorithms .

CONCLUSION

In the learning models described in this work, we can see that the brain follows stages of cognitive development, there are mental processes on which the brain relies to, when faced with a given problem, know how to proceed to solve it.

According to the survey, even though 45% of the students consider their performance in the Fundamentals of Logic and Algorithms subject to be good and 50% consider it bad, at another time, 75% considered their performance to be regular, and that 65% considered that previous knowledge was decisive for this result, and of these students, 58% only had knowledge of Mathematical Logic in Higher Education. In this aspect, we observe the Gestalt Theory on the application of *Insights*.

In the questionnaires presented, it can be seen that the performance of the students was regular, reaching 75% of the total number of respondents who presented this value, that is, a value below satisfactory, a factor resulting from better performances in the subjects which the Fundamentals of Logic Discipline and Algorithms absorbs.

In view of the verified aspects, and, mainly, far from defining in a rigid way how knowledge is formed, it can be validated that several fitting pieces are being built throughout the individual's life and can be used at the most convenient time, depending on the challenges that it faces, referencing, in addition to the mentioned theories, also, and especially the Gestalt Theory.

It could be verified through the researches that in the Degree Course in Computing of the Dianópolis-TO Campus , there is a challenge for the Professor to pass on the Contents of the Subject of Fundamentals of Logic and Algorithms so that even Students who suffer from a lack of knowledge in basic matters for the understanding of the subject can be level with other students, it is also observed that this leveling may sometimes not occur so that one or another portion may be harmed, or students who need to repeat the subject, or those who had a better study base and do not advance in knowledge. to the detriment of the former.

The possibilities arising from learning the Discipline of Fundamentals of Logic and Algorithms open up many opportunities for growth in the areas of Information Technology, its best use corroborates so that students have many options for action in the various areas of computing and, consequently, to succeed in the labor market.

It was concluded that, as it was exposed, learning is built in stages, in the research carried out, it was observed that deficiencies in learning from Basic Education to High School had decisive effects on the results achieved by the students, and that, as explained, it is through the acquired experiences that, at a later time, our brain uses the resources available through *Insights*, we could here suggest that the studies of these subjects related to the matter were more in-depth, and the Institution Instituto Federal do Tocantins - Campus Dianópolis-TO, working in partnership with the State Education Network offering the study of Logic and Algorithms Disciplines for students from sixth grade grades from Elementary School to High School, through the Internship and Volunteer Academic Programs. Another alternative would be to offer mini-courses in these disciplines at Campus Dianópolis, which could help to solve this difficulty.

Knowledge is formed at all times, would the understandings about the cognitive processes in learning the Discipline of Fundamentals of Logic and Algorithms be concluded? We believe not.

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