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Digital educational resources in the development of mathematical logical thinking in middle school students

Recursos educativos digitales en el desarrollo del pensamiento lógico matemático en estudiantes de Educación Básica Media

Recursos educativos digitais no desenvolvimento do raciocínio lógico matemático em alunos do Ensino Básico Secundário

Jessica Miossiotti Arias Tigrero*
Maritza Leonor Santos Santos*
Jessenia Estefanía Quintana Espinoza*
Florinda Jaqueline Quintana Espinoza*

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* Master's Degree in Education, mention in Educational Technology and Innovation, Ministry of Education.
miossiotti.arias@educacion.gob.ec
https://orcid.org/0000 - 0002 - 1849 - 9554
* Mater Universitario en Formación Internacional Especializada del Profesorado, Especialidad en Lengua y Literatura, Ministry of Education
maritza.santos@educacion.gob.ec
https://orcid.org/0009 - 0003 - 6433 - 9900
* Bachelor of Science in Basic Education, Ministry of Education
jessenia.quintana@educacion.gob.ec
https://orcid.org/0009 - 0008 - 8556 - 0555
* Master's Degree in Educational Management, mention in Organization, Direction and Innovation of Educational Centers, Ministry of Education.
jaquelinequintana1991@hotmail.es
https://orcid.org/0009 - 0006 - 0237 - 6134

Abstract

This article "Digital Educational Resources in the development of mathematical logical thinking in high school students" arises from the scientific problem: how do digital educational resources contribute in the development of mathematical logical thinking? The main objective is to analyze the importance of the contribution of digital educational resources in the development of mathematical logical thinking in high school students of the following educational institutions: Mariscal Sucre, Coronel Olmedo Alfaro and José María Velasco Ibarra. The research is descriptive with a mixed approach; for the development of the research techniques and instruments were used, where interviews and surveys were recorded, in addition, the difficulties presented by students in the development of mathematical logical thinking were detected, therefore, as an alternative solution to the problem, the guide of digital educational resources for strengthening skills in the subject of mathematics is presented.

Key words: Digital educational resources, development of mathematical logical thinking, middle school education.

Resumen

El presente artículo “Recursos Educativos Digitales en el desarrollo del pensamiento lógico matemático en estudiantes de básica media” surge del problema científico: ¿cómo contribuyen los recursos educativos digitales en el desarrollo del pensamiento lógico matemático?, presenta como objetivo principal analizar la importancia de la contribución de los recursos educativos digitales en

el desarrollo del pensamiento lógico matemático en estudiantes de básica de las instituciones educativas: Mariscal Sucre, Coronel Olmedo Alfaro y José María Velasco Ibarra. La investigación es de tipo descriptiva con un enfoque mixto; para el desarrollo de la investigación se utilizó las técnicas e instrumentos, donde se registraron las entrevistas y encuestas, además se detectaron las dificultades que presentan los estudiantes en el desarrollo del pensamiento lógico matemático, por tanto, como alternativa de solución a la problemática, se presenta la guía de recursos educativos digitales para el fortalecimiento de las habilidades en la asignatura de matemática.
Palabras clave: Recursos educativos digitales, desarrollo del pensamiento lógico matemático, educación básica media.

Resumo
Este artigo "Recursos Educacionais Digitais no desenvolvimento do pensamento lógico matemático em alunos do ensino médio" surge do problema científico: como os recursos educacionais digitais contribuem para o desenvolvimento do pensamento lógico matemático? O objetivo principal é analisar a importância da contribuição dos recursos educacionais digitais no desenvolvimento do pensamento lógico matemático em alunos do ensino fundamental das seguintes instituições de ensino: Mariscal Sucre, Coronel Olmedo Alfaro e José María Velasco Ibarra. A pesquisa é descritiva com uma abordagem mista; para o desenvolvimento das técnicas e instrumentos de pesquisa foram utilizados, onde entrevistas e pesquisas foram gravadas, além disso, as dificuldades que os alunos têm no desenvolvimento do pensamento lógico matemático foram detectadas, portanto, como uma solução alternativa para o problema, o guia de recursos educacionais digitais para fortalecer as habilidades na disciplina de matemática é apresentado.
Palavras-chave: Recursos educativos digitais, desenvolvimento do raciocínio lógico matemático, ensino secundário.

INTRODUCTION

Nowadays, Digital Educational Resources (RED) have become essential tools in the educational process, facilitating teachers and students a creative, innovative and participatory learning, as well as strengthening mathematical skills that allow problem solving more easily.

The development of mathematical logical thinking allows students to be competent and solve problems of everyday life, being mathematics one of the most important subjects of the common core, which should be considered essential in the development of learning, allowing the student to develop more efficiently in the construction of knowledge in this way enhance their skills.

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), education is a fundamental human right that is firmly linked to the Universal Declaration of Human Rights (1948). However, millions of children are still deprived of educational opportunities due to a variety of factors. UNESCO assigns responsibility to each state to fulfill its obligations to quality education through educational processes that optimize meaningful learning for all, through a universal, collective commitment of political will to inclusive and equitable education.

According to the United Nations (UN) (2017) in its report on the levels of competencies in the area of mathematics qualifies the statistical data as a learning crisis worldwide in which it is evident that 9 out of 10 students between 9 and 14 years of age, have insufficient knowledge in the subject.

For this study, mathematical logical thinking is proposed as the tool that leads to reasoning and interpretation of problems in the area, through data processing, deduction and practice for solving numerical difficulties, through methods and techniques that allow developing the different skills of the contents of the area of mathematics and that students are able to demonstrate the skills acquired in their learning process in all areas of thought.

In Latin America, the difficulties in the development of mathematics are focused on the shortcomings of certain strategies and methodologies that teachers use, so the reform of school mathematics curricula is projected to support the cultural and social progress of Latin America and the Caribbean, educational reforms consist of changing the conception of mathematics and logical thinking skills according to CIAEM report (Ruiz, 2014).

According to the previous paragraph, curricular innovations are a perspective that challenges the educational system to achieve a change, that adapts and adjusts to the new technological era with the application and management of digital educational resources that will contribute in the mathematical logical development, to achieve significant learning that will allow the student to have access to new tools and thus strengthen their educational process.

Mathematical skills should be achieved at a basic level of competence, which includes carrying out arithmetic procedures through the interpretation and recognition of situations or problems that promote logical reasoning. In Ecuador according to the results of the Instituto Nacional e Evaluación (INEVAL), through the last PISA International test, the country has the lowest scores in the area of mathematics with 29% in acquired skills, that is, they do not achieve the learning levels, this problematic leads to a reflection on the educational model and the need for reform (INEVAL, 2018).

In the educational institutions of the rural communities of Canton Santa Elena, the students of the middle school level, present difficulties in solving problems of mathematical logical reasoning, which have been evidenced by diagnostic tests, in the process of developing an activity in classes and in the last report cards of the students of the middle school sub-level,Its causes are also due to the limited access to digital educational resources for both students and teachers, this causes educators to teach their classes in a traditional way, with printed educational resources generating in students little interest and lack of motivation in the teaching-learning process.

Among the main causes it can be established that the educational institutions in which the research was carried out are located in rural areas of difficult access, in addition to the limited assignment of teachers in the area of mathematics, who do not develop appropriate strategies in the construction of knowledge, generating that students are served with a deficit of specialized teachers and inexperienced in handling RED, resulting in shortcomings in the teaching-learning process, specifically in the logical mathematical thinking of the students.

At this point of the problem, the need for innovation in education should be emphasized, leaving aside traditionalism, resistance to change, the spontaneous rejection of technological instruments in the classroom by educators and focusing on an educational, didactic and interactive process that develops digital skills in the development of mathematical logical thinking.

How do digital educational resources contribute to the development of mathematical logical thinking?

In the current educational context, the use of digital educational resources has become essential tools for the different activities performed by human beings to solve problems of daily life, creating the development of a technological and innovative culture for both students and teachers. This reality requires the development of technological competencies in all members of the educational

community that allows them to challenge and overcome the different situations that can be generated in the educational field.

Through the research work, it will be possible to facilitate tools that allow motivating students, as well as providing digital educational resources to teachers, who through this contribution will be able to adapt an educational process that provides ease of understanding to their students to work and reinforce their knowledge, overcoming the difficulties that have been presented by the complexity of the development of mathematical logical thinking in educational institutions.

The general objective of this research is: To analyze the importance of the contribution of digital educational resources in the development of mathematical logical thinking.

The specific objectives are:

- To substantiate the contribution of digital educational resources in the development of mathematical logical thinking.
- Diagnose the usefulness of digital educational resources for the development of mathematical logical thinking.
- Develop a guide of digital resources for mathematical logical thinking.

Digital educational resources (RED) are the technological tools used by teachers inside and outside the classroom, and whose objective is that students can through these resources, acquire new knowledge or significant learning that raise their intellectual level and are protagonists of the educational process; however, due to the lack of internet access mainly in rural areas and the lack of training of some teachers, this has not been able to be consolidated at the educational level, as stated by Diaz (2018) in his work:

"An educational digital resource is any type of information that is organized in a digital format, that is, it is organized to be used directly on a computer by the teacher, the student or any member of the educational community; unfortunately it has not been given the proper use as a tool for learning despite being easily accessible, so it is necessary to consciously reflect on its use in the classroom" (p. 45).

As mentioned by the author, the importance of RED facilitates the teacher to organize the activities that are directed towards the students, making use of tools that allow easy access to information and reflection of content in the classroom.

According to Sulmont (2005), digital educational resources are vehicles and inputs of content for the student in the process of knowledge construction; in this sense, they are instruments of content

mediatization. Therefore, their design requires a rigorous work on the instructional and documentary level, i.e., digital educational resources must have a clear structure, elements of information classification and guidelines that facilitate the student to develop search, relationship and critical skills on the content (p. 6).

Digital educational resources are characterized by being focused on the improvement of educational processes so that teaching-learning is more effective and allows to inquire more easily in the broad knowledge, in addition to correctly guide students so that they can take better advantage of the benefits offered by technology and avoid risks or dangers due to its misuse.

The characteristics of the REDs are as follows:

Innovative. - One of the characteristics of digital educational resources is that, thanks to the use of technology, they are innovative and dynamic that, being known by teachers, can contribute to more meaningful learning in all areas of knowledge, even with greater emphasis, where there are greater learning problems so that classrooms are transformed into true virtual learning environments.

They facilitate access to information. - Another characteristic of RED is that it facilitates access to information that is of great importance and relevance for all members of the educational community (directors, teachers, parents and students), who are committed to improving the learning process, each one from their respective positions, acting with responsibility and conviction in favor of education.

Open Educational Resources (OER) refers to free and freely available interactive educational resources on the World Wide Web (such as software, text, audio, video, and multimedia, among others), which have autonomous approvals for the production, distribution and use of such materials for the benefit of the worldwide educational community; exclusively for use by experts and students of various educational levels. Multimedia diversity. - Digital educational resources have a diversity of elements that should be used in the educational environment, since they favor the learning of students in a visual and auditory way through images, videos and different types of documents, as well as digital platforms and interactive programs that allow a more dynamic learning and according to the demands of today's society.

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Technology through digital educational resources seeks to make educational processes more attractive to become a strength within the social system, considering that education favors the development of societies, and at the same time reflecting that without quality education it is impossible to think of social progress. The REDs are available to all those users with Internet connection, however, the reality at provincial and national level is very different, since there are several sectors where there is no access to the Internet. Among the many advantages of the RED, are:

- Develops different skills
- Promotes creative learning
- Create virtual learning environments
- Encourages the spirit of research

Since mathematics is one of the strongest subjects for students, it is necessary that teachers promote a more interactive learning based on the use of digital educational resources easily accessible to students and that contribute to improve the quality of education, in this way this subject will no longer be considered as the most boring and perhaps the most complex, where students hardly see a real application in everyday life. This project seeks to strengthen mathematical logical thinking in middle school students (fifth, sixth and seventh grade) with digital educational resources, which are detailed below:

- Valgetal
- I love math
- Math Rapid
- Buzzmath
- Math Jump

The importance of digital educational resources lies in the fact that they are in line with the technological world, offering new opportunities to teach and learn using audio and video, images, games, among other elements including ICTs as a fundamental part

of an innovative educational process that keeps students motivated during their study hours by having access to a variety of platforms that allow them to consolidate their knowledge.

MATERIALS AND METHODS

This article was conducted in the Sugar Commune of the Province of Santa Elena in three educational institutions which are: Unidad Educativa Mariscal Sucre, U. E. Coronel Olmedo Alfaro and U. E. Vicente Rocafuerte belonging to circuit 4-5 of District 24D01, the educational institutions offer the following levels: initial, preparatory, elementary, middle, high, superior, and high school the research study conducted by the author focused on the activities developed by teachers of the middle level in the school period (2020-2021).

Different research works have directed their studies to discover the importance of the use of open educational resources as an instrument of reinforcement and interactivity of knowledge of students, with the forced changes that have been adopted by educational institutions trying to adapt to the new modalities of learning led by teachers with digital tools echoing the virtuality, the educational institution in question is also immersed in these changes whose teachers through the study conducted have demonstrated different shortcomings in the management of virtual tools.

The project diagnosed the information on the use of digital educational resources that have been applied in the educational institution as part of the teaching-learning process in the development of mathematical logical thinking in students with instruments that have allowed obtaining results that have directed to establish an inclusive proposal for a more equitable work between teachers and students.

The approach of the research is mixed qualitative and quantitative, the instrument used is the interview directed to the authority and teachers while a survey was applied to the students of the different educational institutions that from their point of view contributed with very valuable information of the variables digital educational resources and development of mathematical logical thinking and of the actions that have given in the management of virtual tools in the development of the activities of the teachers.

The research is descriptive, it allowed to observe the events and facts such as the difficulties that teachers have in making use of digital educational resources in the subject of mathematics in the research process, and then perform the corresponding analysis directing the

researcher to characterize the processes that facilitated to evidence the relevant features of the needs presented by the students in the development of mathematical logical thinking, this could be verified through the collection of information that was established with the interview and surveys that facilitated to draw general conclusions about all the processes that were investigated.

Through the descriptive research it was possible to summarize the information obtained from the interviews with teachers and directors and the survey to students, a general analysis was made and establishing actions to be implemented as a response to the problem that was raised in the research on the categories of digital educational resources and development of mathematical logical thinking of the educational institutions in question.

The authors Arias, Villasís, & Miranda (2016) define the following "The study population is a set of cases, defined, limited and accessible, which will form the reference for the choice of the sample, and which meets a series of predetermined criteria". (p. 202) Therefore, the population taken into consideration in the selected educational institutions were teachers and students corresponding to the intermediate level (5th, 6th, and 7th) of General Basic Education who were part of the object of study in the research.

RESULTS

The results obtained from the application of the data collection instruments applied to teachers, students and directors of the educational institutions Mariscal Sucre Vicente Rocafuerte and Coronel Olmedo Alfaro have been transferred to the analysis and interpretation of results that are represented on the answers obtained from the participants whose proportions allowed to know widely the assessment of the answers obtained in the research.

The surveys were evaluated through the tabulation of data with which the information collected from the students was consolidated, as well as the interview was categorized and analyzed with the atlas tic tool, the results of which facilitated the affirmation of the research problems.

The information gathered was processed by means of the corresponding analysis of the answers of the interviews and surveys obtained from the participants, as well as the respective validation of experts who, from their experience, contributed and approved the validity of the instruments applied in the research, whose established parameter was:

- (S) Sufficiency: The items that evaluate the same component are sufficient to obtain the measurement of this component.
- (Cl) Clarity: The item is easily understood, i.e., its syntax and semantics are adequate.
- (Co) Coherence: The item has a logical relationship with the component it is supposed to inquire about.
- (R) Relevance: The item is essential or important, i.e. it must be included.

In the student survey, the results obtained showed that 16% of the participants were close to the category that teachers do manage digital educational resources, 31% indicated that they do not know, and 53% of the responses from the interviews were close to the category that teachers do not manage these resources. This shows that most of the participants do not handle digital educational resources; only a small percentage of the interviewees indicated that teachers do master these resources for learning. This valuable information makes us understand that it is important the implementation of oriented activities for teachers in a training that provides resources that can be used with students, facilitating a more didactic and participatory access to different tools or platforms that provide actions for the use of digital educational resources in the classroom.

In the student survey, the responses were classified into categories grouped as follows: 83% consider that teachers should develop students' mathematical logical thinking, while 17% mentioned that they should do so occasionally. Analyzing the answers it can be clearly observed that almost all the interviewees mention that it is very important to develop these mathematical activities with students, so it is important that teachers emphasize activities oriented to the development of mathematical logical thinking agreeing with Nieves & Torres (2013) cited by Panchón, Parada, & Chaparro (2016) emphasized the importance of the development of logical thinking in students, mainly at early ages, because it is built from different activities, highlighting the interaction with the environment. (...) (p. 224)

The results obtained from the survey of teachers, students and interviews with managers show that teachers have difficulties in the use of digital tools such as RED, the lack of knowledge and training in the use of these tools have not allowed them to be used adequately in the educational process.

Teachers consider it very important to use digital educational resources as part of learning for the development of mathematical logical thinking, but indicate that they do not have enough knowledge

to apply in the classroom with students, in addition, they mention that they do not have tools or guides that urge them to prepare adequately on the subject.

Students state that teachers do not make use of technological tools in learning, or if they do use them, they do so rarely, which shows that there are many difficulties in preparation and knowledge in the management of the different technological resources that currently offer great facilities to develop learning.

CONCLUSIONS

The contribution generated by digital educational resources in the learning process has been very significant in the activities that teachers and students have been carrying out as part of the development of mathematical logical thinking, strengthening mathematical skills and making use of technological resources as an innovative and creative tool.

The review of the different bibliographic sources has supported the importance of Digital Educational Resources and their contribution to the development of students' mathematical logical thinking by strengthening students' mathematical skills.

The diagnosis established in the educational institutions Mariscal Sucre, Coronel Olmedo Alfaro and José María Velasco Ibarra in the rural sector through the application of different data collection instruments has allowed us to know the difficulties that teachers have in the management of Digital Educational Resources that develop the mathematical skills of students.

Therefore, it is suggested to develop a didactic guide of activities aimed at teachers to train the management of digital educational resources and through these tools can make use for activities aimed at the development of mathematical logic thinking of students in educational institutions.

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