

Use of the Educational Software ISA'MATCH in the learning of Mathematics in 8th grade

Uso del Software Educativo ISA'MATCH en el aprendizaje de Matemática en 8avo de Básica

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Resumen

El presente artículo, tiene como objetivo principal integrar el aprendizaje de la matemática con el software educativo ISA'MATCH desarrollado en Haeduc. Para ello, se diseña una sesión para el conocimiento del software educativo y seis sesiones para el aprendizaje de la actividad, comprendida en la unidad de álgebra y funciones de octavo año de educación general básica, que incluyen contenidos, recursos, instrumentos y evaluaciones necesarias para lograr resultados de aprendizaje óptimos. Para complementar el uso del software educativo, se promueve el aprendizaje de las metodologías activa y el modelo flipped classroom, que facilita la interactividad de los alumnos con la actividad de enseñanza - aprendizaje y mejora de éste. Para esta propuesta fue necesario revisar la fundamentación teórica basada en

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el software educativo y la competencia matemática, para lograr emplear adecuadamente las técnicas instruccionales y metodologías que queremos combinar. Finalmente, la propuesta planteada ofrece una herramienta de enseñanza que promueve el aprendizaje y la motivación permitiendo al estudiante ser partícipe y responsable de su proceso educativo y el docente sea el guía de este.

Palabras clave: Software educativo, Flipped Classroom, matemáticas, metodología activa.

Abstract

The main objective of this article is to integrate the learning of mathematics with the educational software ISA'MATCH developed in Haeduc. For this purpose, a session is designed for the knowledge of the educational software and six sessions for the learning of the activity, included in the algebra and functions unit of the eighth year of general basic education, which include contents, resources, instruments and evaluations necessary to achieve optimal learning results. To complement the use of educational software, the learning of active methodologies and the flipped classroom model are promoted, which facilitates the interactivity of students with the teaching-learning activity and its improvement. For this proposal it was necessary to review the theoretical foundation based on educational software and mathematical competence, in order to adequately employ the instructional techniques and methodologies that we want to combine. Finally, the proposal offers a teaching tool that promotes learning and motivation, allowing the student to participate and be responsible for his educational process and the teacher to guide him.

Keywords: Educational software, Flipped Classroom, mathematics, active methodology.

Introduction

Nowadays, technology has become a great support in the teaching and learning processes, becoming an integrating object of knowledge, this support has been gradually evidenced in the classrooms, reflecting a positive change in the present digital natives.

It is important to emphasize that motivation in learning consists in the use of didactic tools that facilitate the teacher to capture the

student's attention, highlighting Montes, Escobar and Cadavid who affirm:

The lack of understanding of mathematical language, is presented due to the little reading that students do of mathematical texts, which brings as a consequence the lack of knowledge of the language, writing, notations, symbology and other mathematical structures present in the books (2018, p. 66).

However, the incorporation of Information and Communication Technology (ICT) in teaching-learning methods has favored new understandings and visions in modern schools without forgetting the traditional pedagogical foundations. Therefore, this has provoked the reflection of educational authorities, on educational programs establishing a link between technology and the content of the curricular program (Granda, Espinoza and Mayon, 2019).

Regarding the performance results and achievements of students in Ecuador, the National Institute for Educational Evaluation (2018) reveals that, mathematical competence corresponds to 29%, compared to the reading level which corresponds to 49% and 43% in science. These results reflect a high rate of students who fail and the knowledge acquired during the school cycle has not been sufficient or consequently assimilated during the process and the next educational stage continues with learning complications until reaching high school.

In sum, it is necessary to answer the premises of what for, what, how, when to teach and what, how to evaluate that respond to the essential elements of curricular planning that guarantees meaningful student learning (Ministry of Education, 2017).

Pedagogical use of Educational Software in the classroom.

Currently, the use of educational software lies in the modernization of educational tools with the objective of improving teaching and learning processes, creating new didactic environments that allow teachers to develop their classes in a creative, dynamic and participative way. We could highlight Cruz, where he defines Educational Software as:

A set of computer resources, specially designed to be used by means of a computer, to facilitate the teaching-learning process of different subjects. They are characterized by being highly interactive, based on the use of multimedia resources, such as videos, sounds, photographs, specialized dictionaries, explanations by experienced

teachers, exercises and instructional games that support the evaluation and diagnostic functions (2019, p.23).

On the other hand, educational software allows the acquisition and assimilation of knowledge, allowing learning through a dynamic environment that will contribute to the teaching-learning of students at their own pace, while involving parents in the educational process of their children von Feigenblatt (2021); Barros & Turpo, (2018); (Bernal and Zaldívar, 2017). Similarly, for the development of ISA'MATCH, the HaEduc tool has been chosen:

[...]. This application is intended for the development of educational computer resources, using different types of multimedia objects. Presentations, multimedia, educational software collections and other applications can be developed according to the user's creativity. It is a unique design of its kind in Cuba for the management of desktop applications. It has tools that allow two types of users: advanced users and teachers, who can find editors that allow them to perform different tasks in a very simple way. [...] (Tejera, 2018, para. 1).

The application is intended for the advancement of academic computer elements, using different didactic resources. It has the possibility of creating models, multimedia, academic program collections and other applications according to the user's imagination. Based on all these benefits, ISA'MATCH is developed to strengthen teachers in the use of contents in a single tool under their own planning.

The development of mathematical competence

"The teaching of mathematics is of great importance in today's knowledge society, in which, there is a growing need to master from basic to advanced topics in all training contexts" (Grisales, 2018, p.200).

In another order of ideas, Suárez, Duardo and Rodríguez define mathematical competence as:

Complex psychological configuration integrated by mathematical knowledge, skills, procedures and mathematical strategies, which together with metacognitive, motivational components and personality qualities self-regulate real and efficient performance in solving everyday problems, understanding the world, and making decisions as a constructive, committed and reflective citizen. (2020, p.121)

On the other hand, "successful achievement and learning in mathematics remains a challenge worldwide, and great efforts are made to advance improvement proposals, usually involving teachers, in terms of their training, improvement or classroom practice" (Cerdeira, Casas, & Ortega, 2017, p.1).

Currently, a variety of dynamic and collaborative learning scenarios are offered where the construction of knowledge is an essential sub-process in the development of competencies and skills of the teaching-learning process that the student must possess in mathematics (DGómez, 2019). In such a way, the student should gradually achieve to develop his mathematical ability favoring analysis, understanding, participation and sociability in the environment. Each method applied by the teacher for the achievement of these competencies becomes valid.

Therefore, in a digital society, teaching-learning should be framed in ICT support to achieve the skills required at each educational level, these should be duly complemented, improve the quality of education, save time in processes and deepen a method of cultural change (Gonzales, Trelles and Mora, 2017).

Materials and methods

The learning processes should be focused on the learner to improve his or her school performance, "it appears then as a process of construction of meaning. That is, the student is not limited to acquiring knowledge, but constructs it" (Moreira, 2019, p.3). The objective of this study is to propose the use of the ISA'MATCH software using the active methodology with the flipped classroom pedagogical model, as a response to the teacher's needs to use technological and pedagogical didactic resources, achieving the development of skills in students and lowering the high rate of failing grades in mathematics.

On the other hand, flipped classroom focuses on inverting traditional teaching methods in the classroom and includes collaborative learning among peers, solving activities and problems while the teacher guides the process. Cedeño and Viguera, (2020). On the other hand, with respect to learning processes, they should be focused on active methodological strategies, which allow the learner to prioritize the activity rather than the content. This means that there are important changes in the behavior of teachers and students in classroom work, incurring in the change of curricular planning, activities and evaluations, promoting constructivist learning (Silva and Maturana, 2017, p.45).

Consequently, the use of the didactic tool ISA'MATCH developed in HaEduc for the learning of mathematics corresponding to the algebra and functions block of the eighth grade math book being the following: Addition of whole numbers, Addition of whole numbers of the same sign, Addition of whole numbers of different sign, Properties of the addition of whole numbers, Addition of several whole numbers (Exercises), directed to 22 students between the ages of 11 and 12 years of the Educational Unit "Isabel La Católica" of the city of Babahoyo - Ecuador, Resolution No. 0212/1874.

As for the proposed methodology, it provides the opportunity to fulfill three phases for learning the activity that help to contextualize the work environment: first, a session is designed for the knowledge of the educational software, the second phase of knowledge acquisition, corresponding to three sessions: I clarify, reinforce and test myself, finally, the closing phase consolidation of knowledge: session I prepare myself, I am evaluated and I demonstrate my knowledge.

This process defines strategies with the students in each session, establishes groupings to favor the learning of the proposed tasks and evaluate the achievements obtained. The development of the activities will be carried out with master classes contained in the software so that the concepts are assimilated before each class, and then reinforce what has been learned in the group plenary through problems with individual and collective challenges that must be achieved to achieve in students a critical, analytical and reflective thinking, showing their results in the expository class.

First phase: Explanation of the use of the educational software ISA'MATCH, the teacher motivates about the advantages of the new learning method, exposes the concepts of educational software, ways of working in the inverted classroom, the benefits and possible obstacles that arise in the learning process shown in Table 1.

Table 1. *Getting to know ISA'MATCH*

Activity	Familiarization with the educational software ISA'MATCH	Time: minutes	40
Objectives: To orient students to the use of the educational tool.	N° of students: 22		
Contents: Visit of the windows	Grade: eighth grade		
Activities:			
<ul style="list-style-type: none"> • Presentation and guide on the use of ISA'MATCH, explaining installation, rules on the use of the contents of the unit to be worked on and definition of times. 			

- Explanation of the use of the contents, activities and videos. Students document in a portfolio the process and results of their work as evidence of their process.
- After reflecting on the use of ISA'MATCH, we proceed to the clarification of doubts.
- Delivery of the tool for installation on your personal computer.

Performance Indicators Students know how to use the tool.

Resources ISA'MATCH- projector, computer, speakers.

Note: Table authored by the authors.

Home screens: These windows correspond to the main environments of the software, where the menu of proposed topics is shown, each one of them has navigation buttons to facilitate its use.

Second phase (knowledge acquisition): in session one the student outside of class performs the strategy of the proposed activity for the execution of the final project. This activity is designed to work with the topics of addition of integers, with the help of the ISA'MATCH software, which has the contents, videos and activities for a guided learning and different from the traditional learning method on blackboard and paper.

Next, students must activate their knowledge by reading the didactic contents presented in ISA'MATCH before each class, according to the content to be covered (the teacher organizes the extension of time, according to difficulties that may arise). After observing the contents, they must elaborate questionnaires with respect to the doubts of the corresponding topic of the class. The planning of the programmed session is presented in Table 2.

Table 2. *Knowledge acquisition session*

Activity **Knowing the integers.** **Time:** **40 minutes**

Objectives: To guide students in the application of whole number addition exercises, developing and stimulating mathematical skills and multiple intelligences. **Methodology:** Active and Flipped Classroom model.

Grade: 8th grade

N° of students: 22

Contents:

- Addition of whole numbers of the same sign, Addition of whole numbers of different signs, Properties of addition of whole numbers, Addition

of several whole numbers, Problem solving.

Development

Session 1: Clarifying

- **In class, the teacher socializes and holds a plenary session on the contents reviewed before the session.**
- **The teacher clarifies doubts that the students have previously noted.**
- **The teacher conducts with the students a deepening of the topics studied and reinforces the previous knowledge of the videos and contents reviewed.**

Performance Indicators	Students make use of didactic material prior to classroom lessons.		
Verification Method	Review.		
Material resources	Desktop computer. Speakers. Notebook and pen.	Projector. ISA'MATCH	
Evaluation criteria	Direct observation.	Self-assessment	Measurement
Evaluation instruments	Heading		

Note: Table of own authorship.

Afterwards, the teacher conducts session two in class to reinforce the content reviewed by the students at home, followed by session three, which consists of testing themselves, carrying out individual and group activities, as shown in Table 4.

Table 4. *Reinforcement sessions and proposed activities*

Activity	My daily life problems in integer addition.	Time: 40 minutes each session
Objectives:	To solve integer addition exercises, using ISA'MATCH.	Methodology: Active and Flipped Classroom model.
		Grade: 8th grade
		N° of students: 22
Contents:	• Problem solving.	

Development

Session 2: Reinforcement

- The teacher mentions and exemplifies mathematical problems related to everyday life.
- Resources for class work are provided.
- Individual activities with ISA'MATCH are proposed to be solved in class (activities that do not exceed the scheduled time and the teacher is able to review the work are proposed).
- The teacher observes and guides the students in the problems that arise when solving the activity. (always encouraging the use of ISA'MATCH for reinforcement).
- At the end of the work, review the results of the activity performed.
- Feedback of the class and clarification of general doubts.

Session 3: I test myself

- Form peer groups to solve practical problems of daily life posed by the teacher and assign resources.
- Enter ISA'MATCH, and review the orders described in the tool and resolve them on paper.
- After analyzing the contents to be covered, students should clarify their doubts and then provide feedback on the contents.
- Verify results by encouraging cooperative work.
- Document your work and attach it to your portfolio of evidence.

Performance Indicators	Students make use of didactic material prior to classroom lessons.
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Verification Method	Review.
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Material resources	Desktop computer. Speakers. Notebook and pen. Camera.	Projector. Cardboard portfolio. ISA'MATCH pen.
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Evaluation criteria	Direct observation. Self-assessment Measurement
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Evaluation instruments	Problem posing and solving. Rubric, Portfolio of Evidence
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Note: Table of own authorship.

Closing Phase (consolidation of knowledge): at the end of the development of the activities in Table 5, students should be evaluated to determine if the competencies of the proposed topic are achieved. To do this, each group must present the results of the final work applied to daily life, using the resources offered by ISA'MATCH as a guide. Each group must present an exercise and show how to solve it to the rest of the group.

Table 5. Knowledge consolidation

Activity	What I learned with integers.	Time: 160 minutes
Objective: To measure the students' performance in the development of the proposed activity.	Methodology: Active and Flipped Classroom model.	Grade: eighth grade
		N° of students: 22
Contents:	Problem solving.	
Development		
Session 4: I prepare myself		
To measure the results of what has been learned in the subject, it is proposed to the students:		
<ul style="list-style-type: none"> • Assignment of homework and organization of the material to be exhibited. • Indications of the time your expository work should last. • Indications of what they are expected to present in their final work. 		
Session 5: I am evaluated		
(This session is developed in two times in order to comply with the presentation of the work of all groups).		
<ul style="list-style-type: none"> • Statement of the problem posed. • Plenary of papers presented. 		
Session 6: Evidencing my knowledge		
<ul style="list-style-type: none"> • Delivery of the evaluation sheet. • Development of the test. 		
Performance Indicators	Master the skills required for the application of integers in everyday life.	
Verification Method	Diagnostic test.	
Material resources	Computer Speakers Notebook and pen Camera	Projector. Cardboard portfolio.

Evaluation criteria	Direct observation. Self-evaluation. Measurement	Registrations
Evaluation instruments	Heading Portfolio of evidence. Partial test	

Note: Table of own authorship.

Results

After using the educational tool ISA'MATCH, designed and elaborated based on the mathematical contents for the dynamic understanding of the subject, the students have been evaluated since "it is essential to apply mathematical thinking to problem solving, as a fundamental way for the development of skills and decision making in their professional life" (Navarro, 2017 p.1), we have observed the positive development of the student and their learning process, based on the rubric of attitude and performance, then each student has evidenced their work by filing them in the student portfolio prepared by them. In contrast, the evidence of the results in ISA'MATCH, the design of the practical activities does not show the final score of the correct answers, so it is not possible to verify a statistic of lessons learned.

It is important to highlight that the use of the strategy proposed in the innovation project allows the development of mathematical competence, improving the quality of teaching. It is inferred that, changing the traditional learning method for an innovative one to use the tool in conjunction with the proposed methodologies, must be accompanied by a well-designed planning, which implies that the teacher innovates his practice in the classroom and the student enhances his academic performance.

Discussion

Nowadays, "the way of learning has changed and, therefore, the way of teaching. Knowledge is networked and teachers must be the ones who accompany students in their learning process. Technology alone does not guide" (Viñals and Cuenca, 2016, p.103), favoring the technology-pedagogy relationship that has long been disconnected.

It is convenient to highlight that for the application of the proposal the students must have a computer to review the material at home and the teacher must make use of the technology for the development of the planning in the educational software.

In this sense, and taking advantage of the benefits of HAEduc, it is recommended that, since it is easy to use, even for inexperienced users, the teacher could update or design educational activities by creating his own resources, regardless of the educational level or field of knowledge. Therefore, in order to motivate students' learning, the teacher can request the creation of explanatory videos of the contents of the unit and add the most representative ones to the tool.

Finally, it can be considered that the use of these advances favors the student a new way of organizing, distributing, representing and codifying reality, that is, it develops skills and abilities to build their own knowledge.

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