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Youtube tutorial videos on developing math competencies in high school students: A theoretical review

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ABSTRACT

Education is one of the substantial factors for the development of a country, this will be achieved if the educational actors promote educational actions in order to raise the level of development of mathematical competences and consequently the improvement of the teaching-learning processes in the educational institutions; For this reason, from an innovative perspective, it is necessary to implement technological resources in the pedagogical work in order to strengthen the preparation of students; in this sense, technological tools such as YouTube video tutorials oriented to pedagogical practice require a reflective and coherent analysis that make it possible to enhance the mathematical competences of secondary education students. The research is a theoretical review of scientific literature, using the method of analysis and synthesis, exhaustive search of materials such as thesis reports, scientific articles, specialized literature, databases and information platforms related to the subject of study. The design was non-experimental, the documentary analysis technique was applied, resorting to information bases. The general objective was to analyze the strategy of YouTube video tutorials in the development of mathematical competences in high school students.

Keywords: YouTube, Video tutorials, Mathematical competence, Didactic strategy, Motivation, Technological tool.

1 INTRODUCTION

The latent concern of educational institutions is the development of mathematical competencies, capacities, skills and attitudes of students in order to mobilize their possibilities for the resolution of mathematical problems in the context of everyday life. In this sense, Íñiguez (2015) argued that competency-based teaching aims to overcome those difficulties based on a traditional

model by one that promotes its application to situations in the real context. Meanwhile, Pérez and Cuecuecha (2019) pointed out that the use of YouTube videos as a didactic resource enhances the learning process of students. Likewise, Rodríguez and Fernández (2017) showed that the application of educational videos on YouTube supports the development of competencies in Latin American students.

Below we show the precedents at the international level such as that of Cartagena (2019) Chile, indicated that, from a pedagogical approach, video as a didactic aspect makes it possible to make innovations in a dynamic way in the teaching-learning process, being a medium that combines elements of a digital nature, images, information and audio in order to achieve the learning of students; Likewise, one function is to motivate, contextualize and inform in the process of developing the learning activity. It was concluded that the use of technological resources of an educational nature contributes positively to improving the learning of the educational community.

Arboleda (2017) Colombia, pointed out that video tutorials create a pleasant and adequate environment for the development of student learning, being the optimal classroom climate that facilitates meaningful learning; It also takes advantage of images, audio and information that is transmitted in various learning styles; However, it is necessary for teachers to accept, commit, train, practice and work on the part of teachers. The results showed that the experimental group achieved 8 out of 10, while the control group achieved an average of 5.2 out of 10. It was concluded that the application of video tutorials represents a tool that enhances student learning, providing a greater understanding of information and raising the level of achievement in learning.

Meza (2015) Ecuador, indicated that video tutorials represent a guide for student learning since they continuously provide extensive information on multiple topics that are required in the training process of students and that optimize the construction of knowledge in turn provides cognitive and procedural feedback. In addition, these self-learning-based instructional systems are compelling, motivating, and innovative. The results show that 76% of respondents say that video tutorials help in a functional way in the learning process of higher level students.

Similarly, precedents at the national level, such as that of Coronado et al. (2022), argued that video tutorials are a multimedia technological tool that promotes the development of cognitive processes effectively compared to traditional teaching; As for video tutorials, they have one quality, which is accessibility at any time and promotes meaningful learning. In this sense, the YouTube platform offers a range of audiovisual resources that facilitate learning in an agile and efficient way. The results obtained were that the association between the variable video tutorials and the competence solves data management problems and uncertainty was rho=0.933 and p=0.016<0.05. It was concluded that the use of YouTube video tutorials positively favors the learning of mathematics, improving the performance of secondary school students.

Gómez (2022) indicated that the use of video tutorials is a teaching strategy and that their use is pertinent to the process of enriching students' knowledge; They also make it possible to access a level of explanation in a degree of detail and that is considered one of the educational resources in accordance with the demands of contemporary education. The results showed that there was an association between video tutorials and AutoCAD learning (rho=0.752 and p=0.000<0.05); AutoCAD Fundamentals Learning dimension (rho=0.852 and p=0.000<0.05); AutoCAD drawing learning dimension (rho=0.727 and p=0.000<0.05); AutoCAD modeling learning dimension (rho=0.720 and p=0.000<0.05). It was concluded that the application of video tutorials significantly elevates the learning process of civil engineering students.

Arrieta (2020) argued that YouTube video tutorials have made it possible to substantially improve student learning through educational content such as YouTube channels in which learning lessons are taught in an enjoyable and friendly way. Likewise, the use of these digital resources as a strategy for the provision of pedagogical material with emphasis on the improvement of learning in a new and innovative way. The results showed that X2c = 19.09 >X2 t = 5.191 and p = 0.000<0.05, in this sense it was concluded that YouTube video tutorials significantly influence the learning process of communication students.

Lindo (2020) indicated that video tutorials allow the acquisition of cognitive, procedural, and attitudinal skills, enabling learning in an optimal and fluid way; it makes it possible to solve problems through specific situations; In this sense, the integration of virtual teaching resources promotes the development of competencies in students in an innovative and creative way. The results obtained were that the control group achieved a score of 12.82 and the experimental group of 17.38 and p=0.006<0.05. It was concluded that through YouTube video tutorials, the learning achievement of students in the area of statistics was achieved.

Castillo (2019) pointed out that YouTube video tutorials can be applied in the teaching of a variety of topics and that they have a high level of effectiveness through pedagogical activities aimed at the development of cognitive and procedural skills, enabling the acquisition and assimilation of knowledge. The results were for the academic performance variable, for the experimental group a grade of M=17.78 and SD=1.396 were obtained; in the control group the score was M=14.89 and SD=1.451 and p=0.000<0.05. It was concluded that the use of YouTube video tutorials effectively contributes to the learning process of high school students.

Palacios (2019) pointed out that YouTube video tutorials are a pedagogical strategy that decisively supports the improvement in the understanding of various topics; students perceive that motivation and interest in their learning process increases significantly; Also, you can use video tutorials as many times as necessary. In this sense, video tutorials are a didactic support for teachers in the development of learning sessions and easy to understand for students. The results obtained were

that in the pre-test he obtained a score of 11.20 and in the post-test 16.80 with a difference of 5.60, with a difference in standard deviation of 0.61 and a difference in the coefficient of variation of 12.76; Likewise, Student's t-hypothesis test for the Learning variable was to= 1.732 > te = 1.729 and p=0.000<0.05. It was concluded that there is evidence to affirm that video tutorials significantly influence the learning of secondary school students.

Wong (2019) indicated that video tutorials are an educational resource that facilitates learners' learning in the acquisition of information; Likewise, it consists of presenting in an organized way through an educational video whose content has been previously selected and whose purpose is to provide a set of details in a dynamic and didactic way with respect to the object of study. Likewise, the YouTube platform provides educational support in the development of cognitive skills in students; Feedback is a decisive factor in the achievement of student learning. The results were that video tutorials and three-dimensional projects were associated with rho=0.858 and p=0.000<0.05; with the dimension interface recognition (rho=0.825 and p=0.000<0.5); with the dimension import and creation of surfaces (rho=0.775 and p=0.000<0.05) with the dimension learning in creation (rho=0.725 and p=0.000<0.05) and the dimension design (rho=0.805 and p=0.000<0.5). It was concluded that video tutorials have a favorable impact on the learning process of engineering students at a university.

2 YOUTUBE IN EDUCATION

The YouTube platform has now become one of the most widely used teaching resources, basically to complement the learning lessons developed in school classrooms; thus, YouTube's planned intervention enables teachers to create virtual spaces to build a learning community based on the content selected by the teacher (Salas, 2020). Likewise, the YouTube platform is easily accessible and allows the creation of audiovisual content, open data and a space for knowledge (Medina, 2020). In this sense, video tutorials are one of the systems whose essential purpose is autonomous learning, using electronic elements in the format of pre-recorded learning sessions with a sequence of sound and images in a dynamic way (Cárdenas, 2013). In this sense, given the complexity involved in the development of pedagogical processes, it is recommended that technological tools that support learning, such as video tutorials, be the most used by students to resolve their doubts or questions and learn autonomously (Velarde et al., 2017). Consequently, the technological capacity of platforms such as YouTube enables the transmission of information and knowledge and incorporates valuable educational resources into the various scientific areas or disciplines, being an essential support for the pedagogical work of teachers and students (Sánchez, 2018).

3 VIDEO TUTORIALS IN TEACHING MATHEMATICS

At the present time, due to the need in their training process, learners have increased the use of video tutorials in the area of mathematics that are available on the YouTube platform, where they can be used to complement the learning activities of students (Vicuña & Liern, 2020). In view of this, video tutorials are positioned in a space of relevance in pedagogical work; since it can currently be inserted into pedagogical design and implemented to optimize teachers' curricular activities (Viñas, 2018). Likewise, video tutorials motivate and generate the need for analytical, critical and autonomous research (Cárdenas et al. 2018). In addition, it is of general interest to use the online resources available on YouTube for mathematics videos whose assessment for situations related to teaching becomes necessary; Its characteristics are: (i) Epistemic suitability, referring to the quality of the mathematical content; (ii) Cognitive suitability, which is associated with the ability to transmit mathematical content; (iii) Interactional suitability, is the ability of the speaker to show an engaging and motivating video for the student; (iv) Mediational suitability, referring to the loss of time and situations not taken advantage of by the speaker; (v) Emotional suitability, is the ability of the speaker to make his or her speech or personality friendly, creates an atmosphere of tranquility; and (vi) Ecological suitability, refers to when the mathematical treatment is not adjusted to the school level of the video title (Acuña et al., 2018).

3.1 YOUTUBE EDUCATIONAL VIDEOS ON LEARNING MATH

Currently, the learning of mathematics through educational videos on YouTube is of interest to students of educational institutions because of the contribution of a wide diversity of educational content that helps students to better understand mathematical concepts and therefore to the development of mathematical skills (Rivadeneyra, 2013). The content of a video tutorial must be in accordance with the curricular subject to be learned and considering a certain level of complexity depending on the students participating in the activity; similarly, considering the student's motivation and the mathematical symbolism pertinent to the students learning the conceptual material (Cárdenas, 2015). In the field of mathematics, it is extremely necessary to use ICT resources that optimally provide a set of strategies that enable the acquisition and transformation of knowledge by the student; Likewise, mathematics plays an essential role in the learning process of a formative, instrumental and evaluative nature, whose contribution is vital in the process of building mental structures and the development of cognitive skills whose usefulness and scope are fundamental for the development of students.

3.2 MATHEMATICAL PROFICIENCY

In relation to mathematical competence, Niss (2003) defined it as "the ability to understand, judge, make and use mathematics in a variety of intra- and extra-mathematical contexts" (p.218). He proposed eight mathematical competencies:

Competencies involved in asking and answering about mathematics and through mathematics.

Competencies involved in asking and answering about mathematics and through mathematics.	▪ Think mathematically. ▪ Pose and solve mathematical problems. ▪ Know how to build models mathematically. ▪ Reason mathematically.
Comprehension of mathematical entities.	▪ Representation of mathematical entities. ▪ Handling of mathematical symbols and formalisms. ▪ Communication in, with, and about mathematics. ▪ Use of resources and tools.

Note: Niss (2003).

Regarding the general objective: To analyze the strategy of YouTube video tutorials in the development of mathematical competencies in high school students.

4 METHODOLOGY

The research is a theoretical review of scientific literature in which the method of analysis and synthesis of information was used, an exhaustive search of materials such as thesis reports, scientific articles, specialized literature, databases and information platforms related to the subject of study was carried out. Pino (2018) pointed out that scientific research is the search for information for a better understanding of reality. Carrasco (2017) indicated that scientific research is a systematic, rational, dynamic, continuous and intentional process in search of explanation of facts and phenomena of a natural or social nature. The design was non-experimental, the technique of documentary analysis was applied using information bases.

5 RESULTS AND DISCUSSION

In this section, the results of the research carried out by: Cartagena (2019) argued that educational videos are a medium that combines elements of a digital nature, images, information and audio in order to achieve the learning of students; Likewise, one function is to motivate, contextualize and inform in the process of developing the learning activity. It was concluded that the use of technological resources of an educational nature contributes positively to improving the learning of the educational community.

Arboleda (2017) pointed out that the results showed that the experimental group achieved 8 out of 10, while the control group achieved an average of 5.2 out of 10. It was concluded that the application of video tutorials represents a tool that enhances student learning, providing a greater understanding of information and raising the level of achievement in learning.

Meza (2015) pointed out that video tutorials are instructional systems based on self-learning, they are convincing and motivating and innovative. The results show that 76% of respondents say that video tutorials help in a functional way in the learning process of higher level students.

Coronado et al. (2022) pointed out that the results of the association between the variable video tutorials and competence solves data management problems and uncertainty were rho=0.933 and p=0.016<0.05. It was concluded that the use of YouTube video tutorials positively favors the learning of mathematics, improving the performance of secondary school students.

Gómez (2022) pointed out that, according to the results, there is an association between video tutorials and AutoCAD learning (rho=0.752 and p=0.000<0.05); AutoCAD Fundamentals Learning dimension (rho=0.852 and p=0.000<0.05); AutoCAD drawing learning dimension (rho=0.727 and p=0.000<0.05); AutoCAD modeling learning dimension (rho=0.720 and p=0.000<0.05). It was concluded that the application of video tutorials significantly elevates the learning process of civil engineering students.

Arrieta (2020) indicated that the use of these digital resources as a strategy for the provision of pedagogical material with an emphasis on improving learning in a novel and innovative way. The results showed that X2c = 19.09 >X2 t = 5.191 and p = 0.000<0.05, in this sense it was concluded that YouTube video tutorials significantly influence the learning process of communication students.

Lindo (2020) indicated that video tutorials make it possible to solve problems through specific situations; In this sense, the integration of virtual teaching resources promotes the development of competencies in students in an innovative and creative way. The results obtained were that the control group achieved a score of 12.82 and the experimental group of 17.38 and p=0.006<0.05.

Castillo (2019) specified that, according to the results for the academic performance variable, the experimental group obtained a grade of M=17.78 and SD=1.396 and the control group obtained a grade of M=14.89 and SD=1.451 and p=0.000<0.05. It was concluded that the use of YouTube video tutorials effectively contributes to the learning process of high school students.

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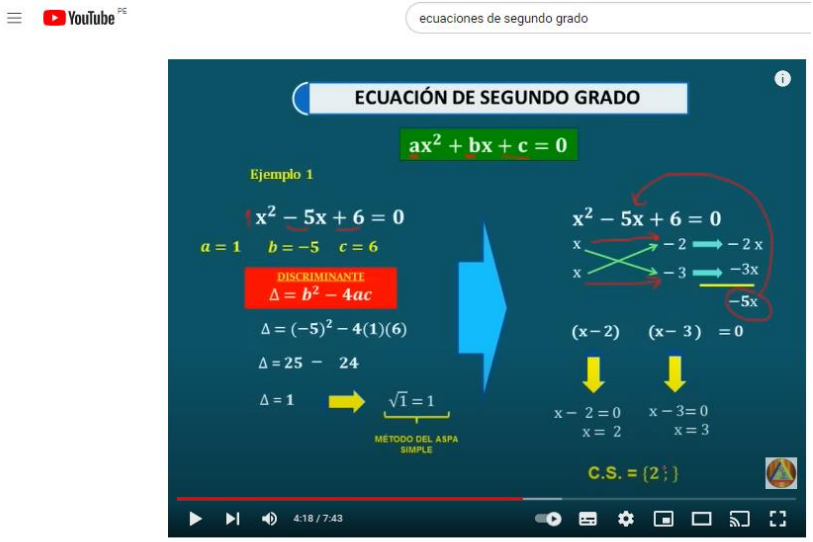
learning in creation (rho=0.725 and p=0.000<0.05) and the dimension design (rho=0.805 and p=0.000<0.5).

5.1 ILLUSTRATIONS, TABLES, FIGURES

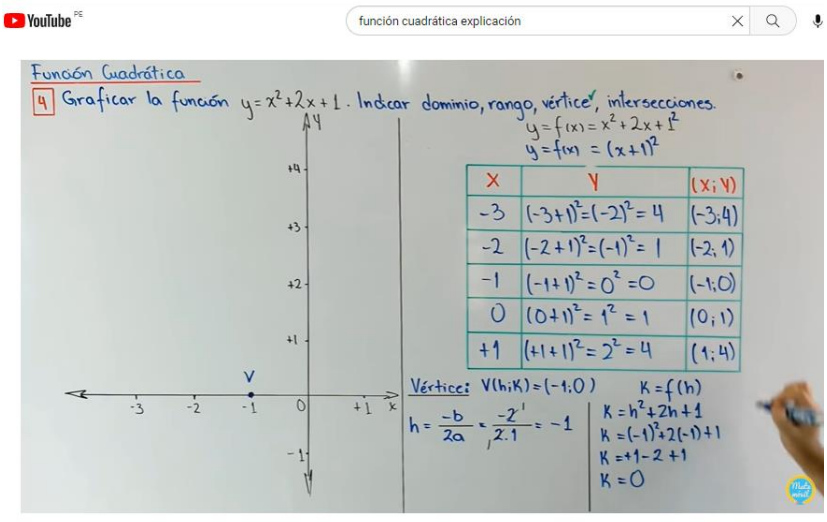
Figure 1. How to Solve a Second Degree Equation by Single Blade



COMO RESOLVER UNA ECUACIÓN DE SEGUNDO GRADO POR ASPA SIMPLE

https://www.youtube.com/watch?v=Zco9zv9dwpE

Figure 2. Quadratic Function Explained



Función Cuadrática - Ejercicios Resueltos - Nivel 1

https://www.youtube.com/watch?v=Ql8L09-HsI0&t=830s

6 CONCLUSIONS

YouTube video tutorials are an audiovisual strategy that contains a variety of educational videos and helps to improve the level of development of mathematical skills in student learning; Likewise, the content component is designed in such a way that it motivates and generates interest in deepening the knowledge of mathematics from the cognitive, procedural and attitudinal point of view; Through

the use of this resource, it provides a pedagogical complement in the process of learning mathematics of secondary school students in educational institutions.

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