Description of Parameter Variation Learning with Artificial Intelligence and GeoGebra in Students of a Differential Equations Course

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Jorge Olivares Funes
Academic, Universidad de Antofagasta, Antofagasta-Chile
E-mail: jorge.olivares@uantof.cl

Elvis R. Valero Kari
Academic, Universidad Mayor de San Andres, La Paz-Bolivia
E-mail: jorge.olivares@uantof.cl

Pablo Martin
Academic, Universidad de Antofagasta, Antofagasta-Chile
E-mail: pmartin@uantof.cl

Abstract. In this era of social and technological change, the advent of AI has had great impact on the lives of many people and especially in the educational field, as mentioned in [1], wich prove that the perceptions that students and instructors have about artificial intelligence are very positive to implement them in learning. In this [2] assert that it is possible to have a collaborations between the fields of mathematics and artificial intelligence AI.

Keywords: Learning, Artificial Intelligence, Dirferential Ecuations and Education.

1. Introduction

In this era of social and technological change, the arrival of AI has had a great impact on the lives of many people and especially in the educational field, as mentioned in [1], which manage to prove that the perceptions that students have students and instructors about artificial intelligence are very positive to implement it in learning. In this sense [2] they assert that it is possible to have a collaboration between the fields of mathematics and artificial intelligence.

Based on this, and given that in [3] it is shown, citing verbatim that "the use of GeoGebra as an academic support tool, positively affects the teaching-learning process of representing the results of the graphs of functions."

Finally, the purpose of this work is to make known, the important parts in the opinion of the researchers, the results of a qualitative research that was developed with engineering students from the course of differential equations of a university in Chile, during the first semester of 2023.

2. Particular solution of a linear second order differential equation using Artificial Intelligence YOU and GeoGebra.

In this section, we show the objective together with the research question and the type of activity posed to 6 engineering students, but we will only share two of them due to the great similarity of their answers.

Aim: Analysis of the description of the learning of variation parameters with Artificial Intelligence YOU and GeoGebra in the students of a course of differential equations

General question: What is the analysis of the description of the learning of variation parameters with Artificial Intelligence YOU and GeoGebra in the students of a course of differential equations?

The activity carried out consisted of the following:

Solve by variation of parameters:

$$\frac{d^2y}{dx^2} - 11\frac{dy}{dx} + 30y = x,$$

Through the help https://you.com/ and then use Geogebra to attach the screenshot of the Graph of the solution of the homogeneous equation, the particular solution and the general solution.

Afterwards, a written consultation was carried out, in which we shared the detailed responses of three students.

Question 1: What is the analysis of the description of your learning of variation parameters with Artificial Intelligence YOU and Geogebra?

Student answer 1:

My learning through YOU and GeoGebra are quite interesting because YOU has calculated the integrals well and GeoGebra is to place the solutions and the constants can be assigned any value.

Student response 2:

What I have learned through the AI YOU through the parameter variation method is that despite trying several times or on different devices, the AI ends up giving very similar answers to each other and about Geogebra I can say that it is a method that It helps to facilitate calculations of great difficulty, giving a speed and versatility to be able to find different graphs of any function.

Student response 3:

My analysis of describing my learning of parameter variation with AI and GEOGEBRA concluded that these tools that we have at our fingertips, we must know how to use them in a good way since they make learning more "friendly", and they also help me to better understand the exercises, apart from simplifying the work a bit since it is not recommended to use it to solve everything, I like this way of doing the exercises since without it I would never have found out about its existence or what technology is capable of.

Below are only the images of the answers to the exercise of student 1, the others turned out to be very similar.

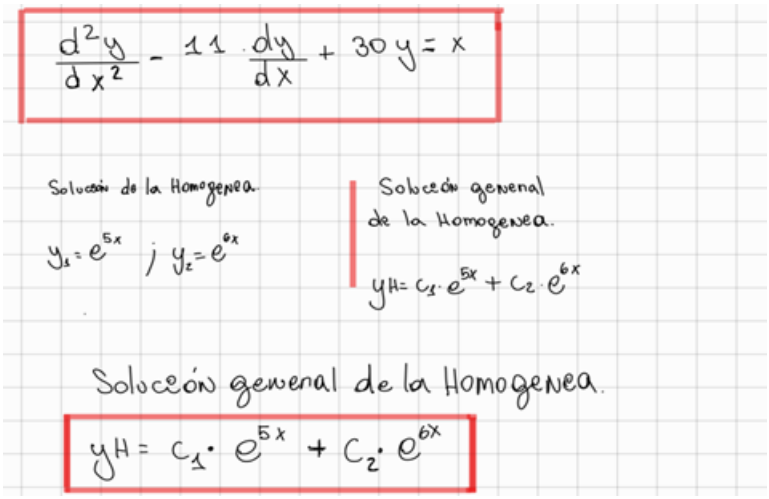

Figure 1. Description of the problem

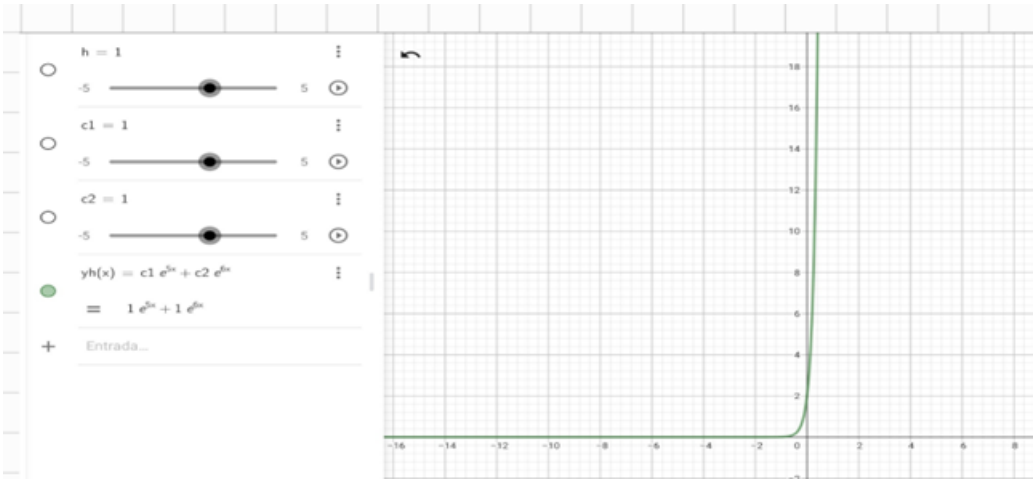

Figure 2. Adjustable parameters.

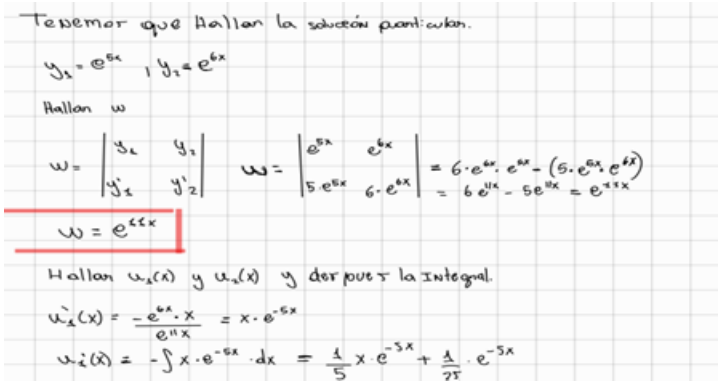

Figure 3. Solution steps of the problem.

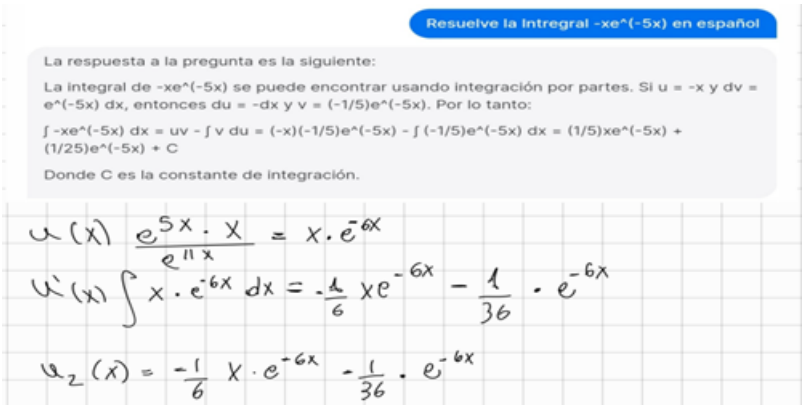

Figure 4. Integral solution.

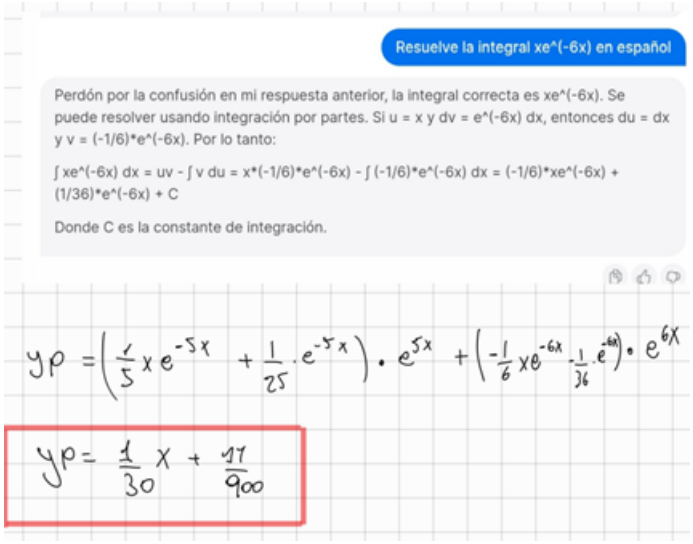

Figure 5. Special solution.

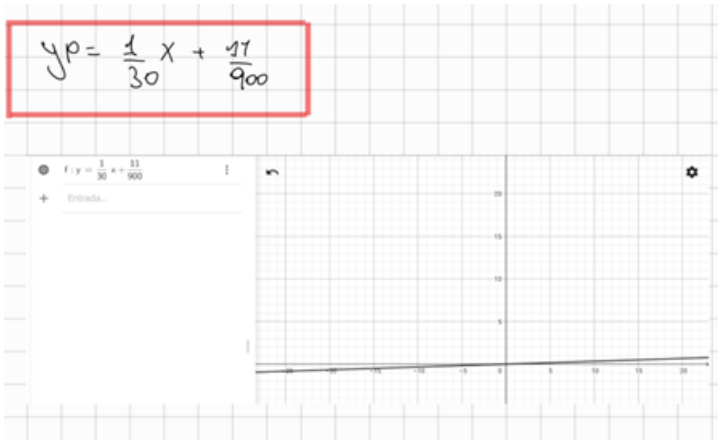

Figure 6. Graphical representation of the special solution.

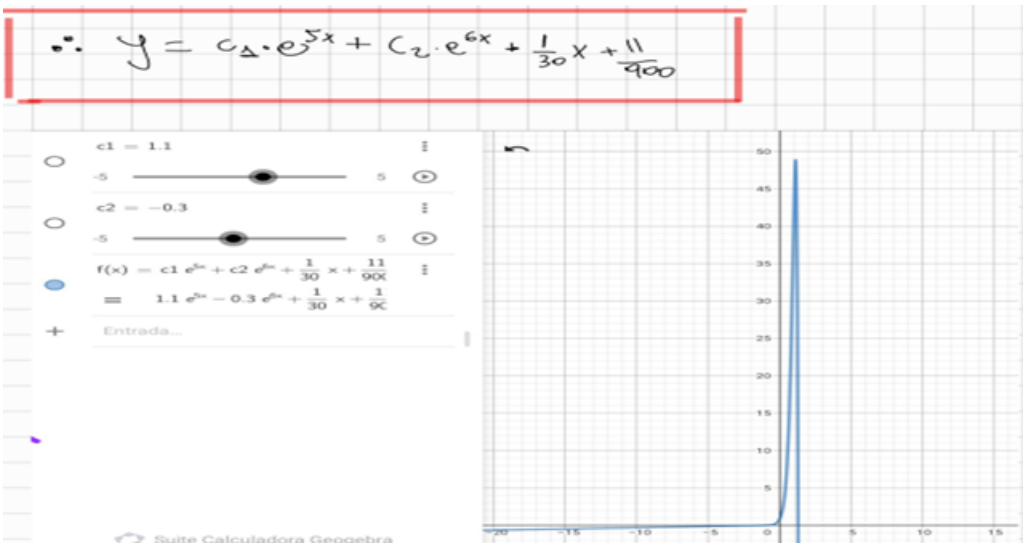

Figure 7. Final solution.

3. conclusion

By observing and knowing the answers given by the students, we can finally say that the use of the IA YOU with Geogebra is highly recommended, what the students themselves give us that affirmation and with it, they give the motivation to continue expanding these technological tools in other mathematical topics to promote learning.

Thanks

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References

[1] Perceptions of Learners and Instructors towards Artificial Intelligence in Personalized Learning.
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