Study on the Effect of an Individualized Intervention in High School Students Using Large Language Models

Gabriel Ojeda[a], Antonio G. Ravelo-García[b] and Daniel Moreno[b],
[a]Universidad de las Palmas de Gran Canaria, Las Palmas, España; [b]Instituto para el Desarrollo Tecnológico y la Innovación en Comunicaciones, Universidad de Las Palmas de Gran Canaria, Las Palmas, España

Keywords: ChatGPT, personalized learning, motivation, secondary education.

1. INTRODUCTION

1.1 Purpose

The purpose of the study is to investigate the impact of personalized learning activities, using ChatGPT-3.5, on student motivation and academic performance in secondary school technology courses [1]. The levels of the study are 1st, 2nd, and 3rd year of Compulsory Secondary Education in the subject of *Tecnología y Digitalización* (Technology and Digitalization), as well as for 1st year of Baccalaureate in the subject of *Tecnología e Ingeniería I* (Technology and Engineering I). Classroom research was conducted with the aim of improving student motivation and relating it to their academic performance [2].

1.2 Objectives

The primary objective of this study is to employ a Large Language Model (LLM) to customize prompts, resulting in a set of personalized exercises aligned with students' preferences and interests [3]. This aims to address the question of whether the incorporation of personalized exercises has an impact on both student motivation and academic performance [1]. As secondary objectives, this study seeks to analyze the motivational impact of meaningful learning facilitated by personalized exercises using the aforementioned tool [4]. This arises from the need to understand how adapting prompts to students' interests influences their motivation toward the subject [4].

1.3 Hypothesis

Null Hypothesis (H0): The implementation of personalized exercises based on students' preferences and interests has not had a significant impact on their motivation towards the subject. Also, the implementation of personalized exercises based on students' preferences and interests has not had a significant impact on their academic performance.

Alternative Hypothesis (H1): The implementation of personalized exercises based on students' preferences and interests has had a significant impact on their motivation towards the subject. Also, the implementation of personalized exercises based on students' preferences and interests has had a significant impact on their academic performance.

2. METHODOLOGY

The research involved dividing the syllabus into two parts. The first part of the syllabus served as a control and was carried out using a traditional methodology, while the second part was conducted using a personalized activity methodology. The activities were personalized through an initial survey where students reflected upon their interests, as well as their initial level of motivation towards the subjects. ChatGPT-3.5 was then asked to customize generic exercises based on the students' preferences. Part of the syllabus was then taught using generic activities, and another part with the personalized activities. Finally, the students were evaluated through an academic test and a final survey that reflected their final motivation levels and their experience during the intervention. The statistical study was conducted with a sample of 72 students distributed across different grades.

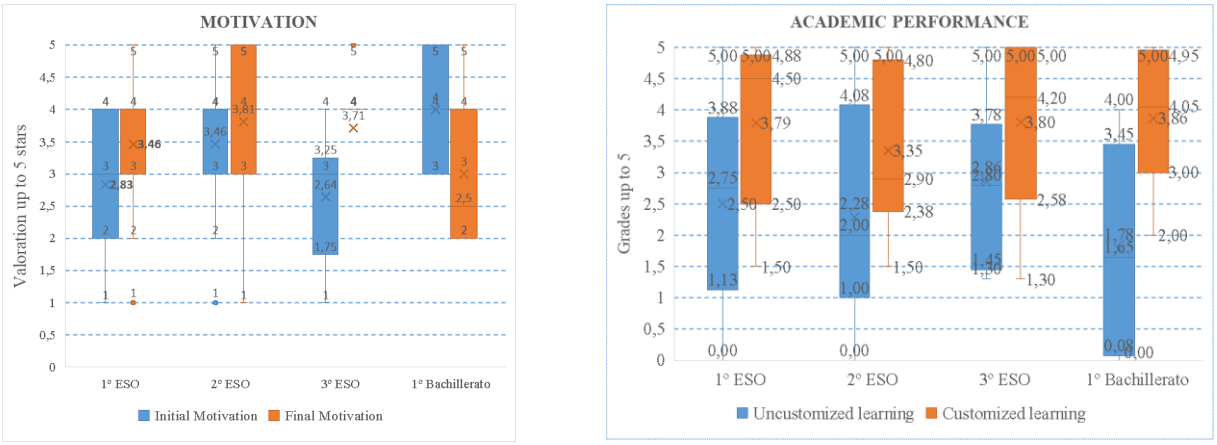
When analyzing the survey results, mathematical methods were employed to evaluate the data. Among these methods, box-and-whisker plots were used to visualize the motivation levels in each group before and after the intervention. To assess statistical significance, the McNemar test was applied. Additionally, the Wilcoxon signed-rank test was used as another mathematical validation of the results to determine their statistical significance. Furthermore, the Pearson correlation coefficient was calculated to analyze the relationship between the final grade obtained from the learning situation and the students' motivation when completing both personalized and generic exercises [1].

ISBN: 978-84-09-63206-0

3. RESULTS AND CONCLUSIONS

3.1 Results

Figure 1 (a), presents the initial and final motivation survey results, broken down by levels. The color scheme remains consistent with the previous graph, where blue represents initial motivation and orange reflects final motivation. These ratings are measured on a 5-star scale. Figure 1 (b), shows the exam scores collected for each group, based on the course material. In all cases, the academic test was graded out of 10 points and divided into two sections: the first section consisted of two problems related to the generic course material, with a maximum of 5 points, and the second section included two problems related to the personalized material, also worth 5 points. All problems in the exams were framed in a generic format. The comparison of the scores revealed that, overall, personalized problems had a positive impact. Students achieved higher grades on the exam for those exercises they had practiced through personalized problems. The students who completed the personalized problems achieved higher scores in that section of the exam, compared to those who worked on the generic problems, thereby increasing the average score relative to the generic problems.



(a) (b)

Figure 1. Box-and-whisker plot on: (a) the motivation of all groups. (b) the academic performance of all groups.

3.2 Conclusions

The results obtained revealed that the use of this methodology, based on the creation of personalized activities, had a positive impact on students' learning experiences. Additionally, an increase in student motivation was observed compared to traditional teaching methods. It can be concluded that personalized learning contributes to enhancing student engagement with their studies, which also improves their academic performance. The close relationship between academic performance and motivation was confirmed, with evidence of positive correlations between the two. Thus, it can be concluded that interventions aimed at improving student motivation may positively influence academic performance. Although a more thorough analysis with larger populations and different cohorts is necessary, this study provides an indication of how personalized learning can enhance student motivation and, consequently, academic performance.

REFERENCES

[1] D. Moreno, V. Guerra, and A. G. Ravelo-García, “Experimental evaluation of Large Language Models for in-class learning experience customization”.

[2] J. Filgona, J. Sakiyo, D. M. Gwany, and A. U. Okoronka, “Motivation in Learning,” *Asian Journal of Education and Social Studies*, pp. 16–37, Sep. 2020, doi: 10.9734/AJESS/2020/V10I430273.

[3] Morales-Chan and M. A., “Explorando el potencial de Chat GPT: Una clasificación de Prompts efectivos para la enseñanza,” Feb. 2023, Accessed: Oct. 09, 2024. [Online]. Available: https://biblioteca.galileo.edu/xmlui/handle/123456789/1348

[4] G. O. Suárez, “Estudio Del Efecto De Una Intervención Individualizada En Estudiantes De Secundaria Con El Uso De Large Language Models,” 2024.

ISBN: 978-84-09-63206-0