Original article

Strategy for emotional self-regulation in virtual learning environments

MENDIVE

REVISTA DE EDUCACIÓN

Estrategia para la autorregulación emocional en los entornos virtuales de aprendizaje

Estratégia de autorregulação emocional em ambientes de e-learning

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ABSTRACT

Emotional self-regulation is essential in education, both in-person and online, for the academic performance and well-being of students. Accordingly, the Universidad Bolivariana del Ecuador uses Moodle as a virtual environment, but does not have a specific space for students' emotional self-regulation. Therefore, the following general objective was proposed: to design an emotional self-regulation strategy that favors academic performance in virtual learning environments for students of the Master's in Education. Consequently, a mixed research was carried out, combining elements of quantitative and qualitative research. The quantitative research involved surveys to measure emotional self-regulation and academic performance of students in the virtual learning environment. Meanwhile, the qualitative research included interviews with teachers and experts to understand

experiences and challenges. The population was 1,650 students, selecting a non-probabilistic sample of 52 students from the master's degree. The categories used were emotional self-regulation and academic performance, subdivided into dimensions such as emotional state and adopted strategies. Scales and open questions were considered to measure the categories. The results included a positive relationship between emotional self-regulation and academic performance. Therefore, a strategy was generated for the inclusion of a section in the subjects, focused on emotional self-regulation in virtual learning environments, to improve the academic performance and emotional well-being of the master's students. The importance of validating the proposed strategy through feedback from experts was highlighted.

Keywords: emotional self-regulation; virtual learning environments; academic performance.

RESUMEN

La autorregulación emocional es fundamental en la educación, tanto presencial como virtual, para el rendimiento académico y el bienestar de los estudiantes. En consonancia, la Universidad Bolivariana del Ecuador utiliza Moodle como entorno virtual, pero no cuenta con un espacio específico para la autorregulación emocional de los estudiantes. Por ello, se planteó el siguiente objetivo general: diseñar una estrategia de autorregulación emocional que favorezca el rendimiento académico en entornos virtuales de aprendizaje de los estudiantes de la Maestría en Educación. En consecuencia, se realizó una investigación mixta, que combina elementos de investigación cuantitativa y cualitativa. La investigación cuantitativa involucró encuestas para medir la autorregulación emocional y el rendimiento académico de los estudiantes en el entorno virtual de aprendizaje. Mientras, la investigación cualitativa incluyó entrevistas a profesores y expertos para comprender experiencias y desafíos. La población fue de 1650 estudiantes, seleccionando una muestra no probabilística de 52 estudiantes de la maestría. Las categorías utilizadas fueron autorregulación emocional y rendimiento académico, subdivididas en dimensiones como estado emocional y estrategias adoptadas. Se consideraron escalas y preguntas abiertas para medir las categorías. Los resultados incluyeron una relación positiva entre autorregulación emocional y rendimiento académico. Por lo que se generó una estrategia para la inclusión de una sección en las asignaturas, enfocado en la autorregulación emocional en entornos virtuales de aprendizaje, para mejorar el rendimiento académico y el bienestar emocional de los maestrantes. Se destacó la importancia de la validación de la estrategia propuesta mediante la retroalimentación de expertos.

Palabras clave: autorregulación emocional; entornos virtuales de aprendizaje; rendimiento académico.

RESUMO

A autorregulação emocional é fundamental na educação, tanto presencial quanto virtual, para o desempenho acadêmico e o bem-estar dos alunos. Nesse sentido, a Universidad Bolivariana del Ecuador utiliza o Moodle como ambiente virtual, mas não dispõe de um espaço específico para a autorregulação emocional dos alunos. Portanto, foi estabelecido o seguinte objetivo geral: elaborar uma estratégia de autorregulação emocional que favoreça o desempenho acadêmico em ambientes virtuais de aprendizagem para alunos do Mestrado em Educação. Para tanto, foi realizada uma pesquisa mista, combinando elementos de pesquisa quantitativa e qualitativa. A pesquisa quantitativa envolveu questionários para medir a autorregulação emocional e o desempenho acadêmico dos alunos no ambiente virtual de aprendizagem. Enquanto isso, a pesquisa qualitativa incluiu entrevistas com professores e especialistas para entender as experiências e os desafios. A população foi de 1.650 alunos, selecionando uma amostra não probabilística de 52 alunos de mestrado. As categorias usadas foram autorregulação emocional e desempenho acadêmico, subdivididas em dimensões como estado emocional e estratégias adotadas. Foram usadas escalas e perguntas abertas para medir as categorias. Os resultados incluíram uma relação positiva entre a autorregulação emocional e o desempenho acadêmico. Portanto, foi gerada uma estratégia para a inclusão de uma seção nas disciplinas, com foco na autorregulação emocional em ambientes virtuais de aprendizagem, para melhorar o desempenho acadêmico e o bem-estar emocional dos alunos de mestrado. Foi destacada a importância de validar a estratégia proposta por meio de feedback de especialistas.

Palavras-chave: autorregulação emocional; ambientes virtuais de aprendizagem; desempenho acadêmico.

INTRODUCTION

Emotional self-regulation has become crucially important in education, both in face-to-face and distance learning environments. In both contexts, the development of this skill in students becomes essential for good academic performance and general well-being. Emotional self-regulation is defined as "the ability to recognize, understand, and effectively manage one's own emotions" (Goleman, 1995). This ability is an essential component of emotional intelligence, which involves "perceiving, understanding, and using emotions adaptively" (Mayer & Salovey, 1997). From this point of view, it must be aimed to maximize the development of such emotional intelligence. "It is not simply a matter of suppressing emotions, but of using conscious strategies to modify the intensity and duration of emotional responses" (Gross, 1998). These strategies may include cognitive re-evaluation, which involves reinterpreting a situation to reduce emotional burden and seeking social support as a means of managing emotions in a constructive way; the view is therefore that every institution should have a department to promote the development of these emotional skills.

The importance of emotional self-regulation lies in its influence on psychological well-being and interpersonal relationships. By developing the ability to regulate our emotions, it can be made informed decisions and maintain healthy and harmonious relationships. Furthermore, "this skill is susceptible to improvement over time, providing opportunities for personal growth" (Gross, 1998). Students must regulate their emotions to develop their academic activities and recognize how these skills evolve.

In face-to-face environments, emotional self-regulation allows students to manage their emotions and moods effectively during classes, and as a result, develops greater concentration and the ability to solve problems more efficiently. In addition, this skill promotes a positive learning environment, which encourages empathy and collaboration among peers.

In parallel, the impact of virtual learning environments on society and education is undeniable. Technology has transformed the way it is accessed knowledge, and online education has been consolidated as an effective alternative. From a social perspective, virtual environments have democratized access to education by overcoming geographical and economic limitations, contributing to a more informed and empowered society. However, this transition has also triggered emotional and psychological challenges in the training of professionals.

In this context, the Bolivarian University of Ecuador (UBE) emerges as a key actor in the convergence of society and digital revolution in education, where it has an orientation towards "training professionals capable of applying science and technology to improve the quality of life of Ecuadorians, focusing on linking them to national and international academic and research networks"; it also undertakes to "To train and educate, in a climate of equality and plurality, through teaching, research and linking, humanist professionals and scholars, critical and competent, capable of generating and disseminating scientific knowledge-dialogue of knowledge to contribute to the good life". It also seeks to empower society; the UBE recognizes the emotional and psychological challenges that arise in this transition towards online education, underlining the need to comprehensively address professional training in a climate of equality and plurality.

The UBE implements a virtual learning environment in Moodle, in which various undergraduate, graduates, continuing education, certification and teacher training courses of great interest for the different levels of education in "The University for All" are available. In this context, the research is framed, specifically in the master's degree in "Education with a mention in pedagogy in digital environments of the Bolivarian University of Ecuador, corresponding to the graduate section in this virtual learning environment, as one of the main graduate programs of the university. Although it is a recently created university, its teaching staff is made up of prestigious professors with the highest scientific categories and with national and international recognition, for the scope of their research and scientific production. In this regard, it detects as a problematic situation that the education process in virtual learning environments in the master's degree in "Education with a mention in pedagogy in digital environments of the Bolivarian University of Ecuador, despite its recognition, does not have a space in its virtual environment that allows the development of emotional self-regulation, which can lead to poor academic performance or school dropouts.

In the scientific field, this analysis addresses a vital relationship between educational psychology and educational technology. Studying how emotions affect online learning will allow for the design of more effective pedagogical strategies adapted to the emotional needs of students. Furthermore, by understanding how to foster emotional self-regulation in virtual environments, a strategy can be implemented to improve academic performance, emotional well-being and reduce school dropout. Emotional self-regulation in virtual learning environments is essential for academic success and student well-being, as it "involves the ability to recognize and manage one's own emotions in a digital context" (Artino *et al.*, 2019). This develops both the academic part and the development of emotional intelligence. "The absence of face-to-face interactions and the autonomy of online learning

can generate negative emotions, such as anxiety and loneliness" (Richardson *et al.*, 2017). The human being is a biopsychosocial being and must develop strategies to deal with negative emotions in virtual learning environments. "Students must employ emotional regulation strategies, such as cognitive reappraisal and seeking social support in online communities, to maintain motivation and commitment to their studies" (Richardson *et al.*, 2017). It is important to highlight that "Educators also play a crucial role in fostering emotional self-regulation through feedback and creating a supportive environment" (Artino *et al.*, 2019). It is necessary to be trained as teachers in effective emotional education.

Consequently, in the trajectory of the master's degree in "Education, mention in pedagogy in digital environments of the Bolivarian University of Ecuador, a crucial question arises, which is becomes the central axis of an investigation, aimed at exploring and understanding the emotional dynamics in the digital educational context: how does emotional self-regulation affect the academic performance of students in the virtual learning environment in the master's degree in "Education, mention in pedagogy in digital environments" of the Bolivarian University of Ecuador.

The object of study focuses specifically on the emotional self-regulation of Master's students. The Universidad Bolivariana del Ecuador, as the setting for this research, becomes a suitable laboratory to unravel the nuances of this relationship between emotions and academic performance. To do so, it has been proposed the following general objective: to design an emotional self-regulation strategy that favors academic performance in virtual learning environments for students of the Master's degree in "Education, mention in pedagogy in digital environments" at the Universidad Bolivariana del Ecuador.

To meet the objective, it is necessary to mention some background information that has been generated on this topic in recent years, which constitute valuable contributions to this document, in which the importance of emotional self-regulation in virtual learning environments is highlighted. In research carried out in Colombia by Vargas *et al.* (2023) at the Distance Education Center-CEAD-Duitama, Colombia, in which they sought To strengthen self-regulatory skills in first-year students at a virtual and distance education university in the context of the COVID-19 pandemic in Colombia, an academic self-regulation training program was carried out virtually, designed based on the sociocognitive theory of self-regulation, in which it was concluded that it is important that programs that seek to strengthen students' self-regulatory skills in distance and virtual modalities be integrated into the platforms and curricula of academic programs and courses, and not as independent sessions

for training self-regulatory strategies, in such a way that they encourage and strengthen autonomous learning integrated into their daily academic exercise.

In another study carried out in a distance learning program coordinated by the Education Secretariat of the Government of Mexico City, conducted by Berridi & Martínez (2017), whose objective was to identify self-regulated learning strategies and analyze their relationship with the academic performance of students in virtual learning environments, mentions that the results obtained raise various questions: one is the need to evaluate different variables, both personal and contextual, that may affect the success of students in virtual learning environments; however, it is suggested that it is necessary to continue specifying which self-regulated learning strategies are associated with academic achievement in these environments.

According to Puerto *et al.* (2023), in Manta, Ecuador, also conducted a study on teachers from the "Glenn Doman" Private Educational Unit, which sought to verify the real perception of the teacher about his functions as a tutor, immersed in an emotional education assumed from virtual learning environments. For this purpose, a study was conducted on 54 teachers, of which the selected sample were eight tutor teachers. It was concluded that virtual learning environments have not been susceptible to emotional education and emphasis is placed on an emotional education in which the functions of guidance and accompaniment of the tutor teacher to his students are unavoidable in the virtual learning environment. These aforementioned antecedents are fundamental, since they provide the necessary context to understand the relevance and importance of emotional self-regulation, identify self-regulated learning strategies, establish the theoretical framework of the research by reviewing and summarizing the existing theories, concepts and models related to emotional self-regulation. These done studies justify the research from a theoretical point of view, providing methodological guidelines.

MATERIALS AND METHODS

A mixed research was conducted, combining elements of quantitative and qualitative research. This combination allowed for a more complete and in-depth view of the relationship between emotional self-regulation and academic performance in the virtual environment. The research period was from July to November 2023. In terms of quantitative research, anonymous surveys were conducted to measure emotional self-regulation. These instruments provided quantitative data that could be statistically analyzed to identify possible correlations or patterns between both variables. Data could

also be collected from the online learning platform, from the evaluation reports provided by Moodle, to obtain relevant information on students' participation and academic performance. Likewise, from a qualitative point of view, in-depth interviews were conducted with teachers and experts to better understand the experiences, perceptions, and challenges related to emotional self-regulation and academic performance in virtual environments. These interviews allowed for obtaining valuable qualitative information on the emotional self-regulation strategies used by students and how they perceive that it affects their academic performance.

By combining these approaches, quantitative data were obtained that provided an overview of the relationship between emotional self-regulation and academic performance, as well as qualitative data that helped to understand students' experiences and perspectives in a virtual learning environment. This methodology allowed for an understanding of the results and provided a solid basis for proposing recommendations and strategies to improve emotional self-regulation and academic performance in virtual environments.

The type of research it was employed included field research (empirical), collecting data directly from the environment where the phenomenon studied occurs. In this case, empirical studies were carried out through surveys of students, which were allowed to obtain relevant information on how emotional self-regulation manifests itself and how it affects academic performance in real virtual environments. Qualitative data was collected through the survey method, with the adaptation of the Emotional Regulation Scale test (Emotion Regulation Questionnaire - ERQ), taken from Orozco-Vargas *et al.* (2021). The aim was to explore the experiences, perceptions and opinions of participants on how emotional self-regulation impacts their learning process and academic performance in a virtual environment. It was also carried out bibliographic research, in which a literature review on the subject was carried out, which was allowed to understand the current state of knowledge in the field of emotional self-regulation, virtual learning environments and their structure, establishing a solid basis for the analysis. In addition to this, it was carried out explanatory or causal research, through which causal relationships between variables were established. In this case how emotional self-regulation directly impacts academic performance in virtual learning environments?

The paradigm used for the development of emotional self-regulation in virtual learning environments is the interpretive one. In this case, the objective is to understand how emotional self-regulation affects academic performance in virtual learning environments, from the point of view of the students themselves. This paradigm was especially relevant to investigate issues related to subjectivity,

understanding of meanings and social contexts, as is the case of emotional self-regulation in distance education. Through interpretive approaches, it was possible to gain an understanding of how students face emotional challenges in the virtual environment and how these experiences influence their academic performance.

The analysis was carried out at the Bolivarian University of Ecuador on postgraduate students in education with a mention in "Master's in Education with a mention in Pedagogy in Digital Environments from the Bolivarian University of Ecuador". The population was made up of 30 groups, with an average of 55 students in the Master's in "Education with a mention in Pedagogy in Digital Environments from the Bolivarian University of Ecuador, giving a population of 1,650 students. The sample is non-probabilistic, made up of 53 students from the Master's in "Education with a mention in Pedagogy in Digital Environments from the Bolivarian University of Ecuador, group 12. The choice of the type of sample was made considering that it is a heterogeneous group with people from different areas of the country, with varied ages, they handle different subjects in their workplaces and of both sexes; 52 of the 53 students responded to the survey.

In this research, the following categories of analysis are declared: emotional self-regulation and academic performance of students. The first has been divided into two subdimensions or subcategories: the emotional state of students in the EVA, for which an adaptation of the 27-item ERQ questionnaire was used, each question with a scale of 0 to 4, with 0 being not at all, 1 seldom, 2 sometimes, 3 frequently and 4 almost always. The second subcategory is about the perceptions and strategies that students adopt on emotional self-regulation, which were answers to five open questions and one multiple choice question. In the second category addressed, an analysis was carried out based on the grades reported on the platform; they were categorized considering their quantitative scale, for which there is an indicator of whether they have been approved, failed or if they are dropouts.

RESULTS

After obtaining information through the application of the aforementioned instruments, it was found that there is a positive relationship between emotional self-regulation and academic performance. The quantitative data demonstrated an effective correlation between students' emotional self-regulation and their academic performance in virtual learning environments. In this sense, it was

found that aspects of emotional self-regulation, such as stress management or motivation, have a significant impact on academic performance.

To analyze the data obtained by applying the instrument, graphs based on Chernoft's faces were created. According to the author himself, "People grow up studying and reacting to faces all the time. Small, barely noticeable differences are easily detected and evoke emotional reactions from a large catalogue buried in memory"; one of the advantages of these faces as a method of representation is found in the "increased qualitative perception of what numerical calculations are relevant"

Chernoff's face technique, used to visualize multidimensional data, associates various variables with different facial characteristics. This analogy is especially significant in the field of emotional self-regulation. The following graph shows a representation of important indicators, in order to measure emotional self-regulation in students of the master's degree in "Education with a mention in pedagogy in digital environments of the Bolivarian University of Ecuador, the ability to consciously pay attention to feelings, the ability to consciously generate positive feelings; that is, emotional reactions, the ability to overcome and accept negative feelings, the level of perception of the physical effects that feelings have, are some of the indicators constructed through a deductive process (Figure 1).

Figure 1. Representation of general data when applying the instrument performed

Note: The figure represents the emotional state of the students of the master's degree in "Education, mention in pedagogy in digital environments" of the Bolivarian University of Ecuador

In the figure, similarities are observed between observations 2, 3, 4, 17, 19, 27, 38, 39, 40, 48, 51 in which the height of the face represents the ability to pay attention in a coherent manner with feelings; on the other hand, the width of the face represents the ability to consciously generate positive feelings, while the structure of the face represents the ability to understand emotional reactions.

Table 1. Percentage representation of the most frequent faces

Face type	Percentage representation
	30 %
	21 %
	14 %

Note: The table shows a percentage representation of the most frequent faces observed in the representation of the emotional state in the students of the master's degree in "Education, mention in pedagogy in digital environments" of the Bolivarian University of Ecuador

These faces, represented (Table 1), visualize multivariate data in the form of a human face. Each of the shapes represented, that is: eyes, ears, mouth and nose are reflections of the values of the variables by their shape, size, location and orientation. This notion is based on the innate ability of human beings to easily identify faces and perceive even the smallest subtleties in their facial expressions. The use of these faces as visual tools finds its roots in the evolutionary ability of the human species to interpret emotional and social signals transmitted through the face. This phenomenon not only reveals the acute perceptual skill of individuals, but also underlines the fundamental importance of non-verbal communication in human interaction. Consequently, the use of these facial representations stands as an effective resource to better explore and understand the rich complexity of facial expression and its nuances. It is important to note that only three of the most representative faces are shown, where the highest percentage (30%) is made up of those students where the highest predominance of their answers was "almost always"; on the other hand,

the opposite case stands out, represented by the red face with a representation of 14%, with "rarely" being the most common answer. Figure 2 shows a breakdown of some variables taken into account for the formation of these faces.
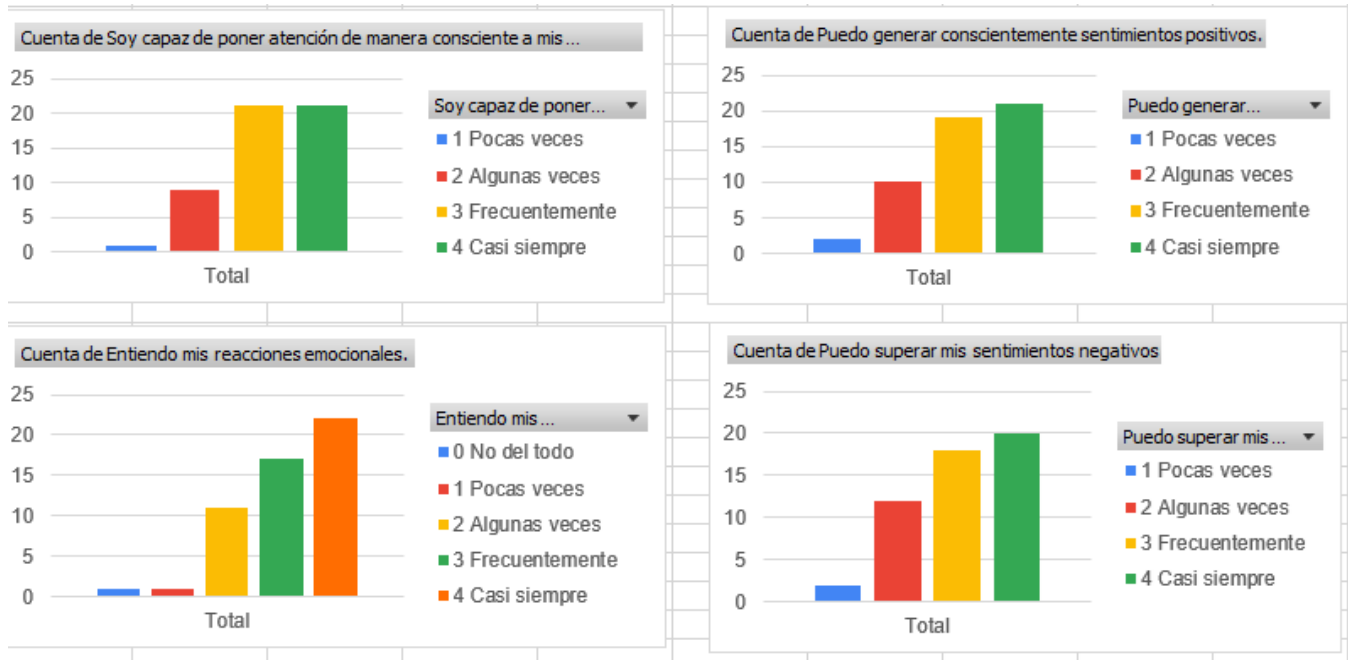

Figure 2. Summary of the results of some indicators of the applied instrument

Note: The graph represents the count of four of the indicators analyzed in the applied instrument

In the analysis of the indicators presented in figure 2, the graphic representation of various aspects evaluated by the applied instrument stands out. These aspects include the conscious ability to pay attention to feelings, the ability to cultivate positive emotions, the level of understanding of emotional reactions and the ability to overcome negative emotions. The data clearly reflect that the majority of the answers provided by the students are located in the categories of "almost always" and "frequently". This predominance suggests a general tendency towards a higher level of emotional competence in these aspects. On the other hand, a representation below the average is observed in the answers categorized as "rarely" and "sometimes". This pattern indicates a lower frequency in the manifestation of certain emotional skills, which could indicate areas of opportunity for the development of these skills. The relationship between the less frequent answers and the observed average suggests the existence of certain difficulties or challenges in the emotional management of students in these specific contexts. Exploring and addressing these less prominent areas could be

crucial to improving emotional well-being and emotional intelligence in general, reflected in a downward trend in the average of the subjects in terms of academic performance.
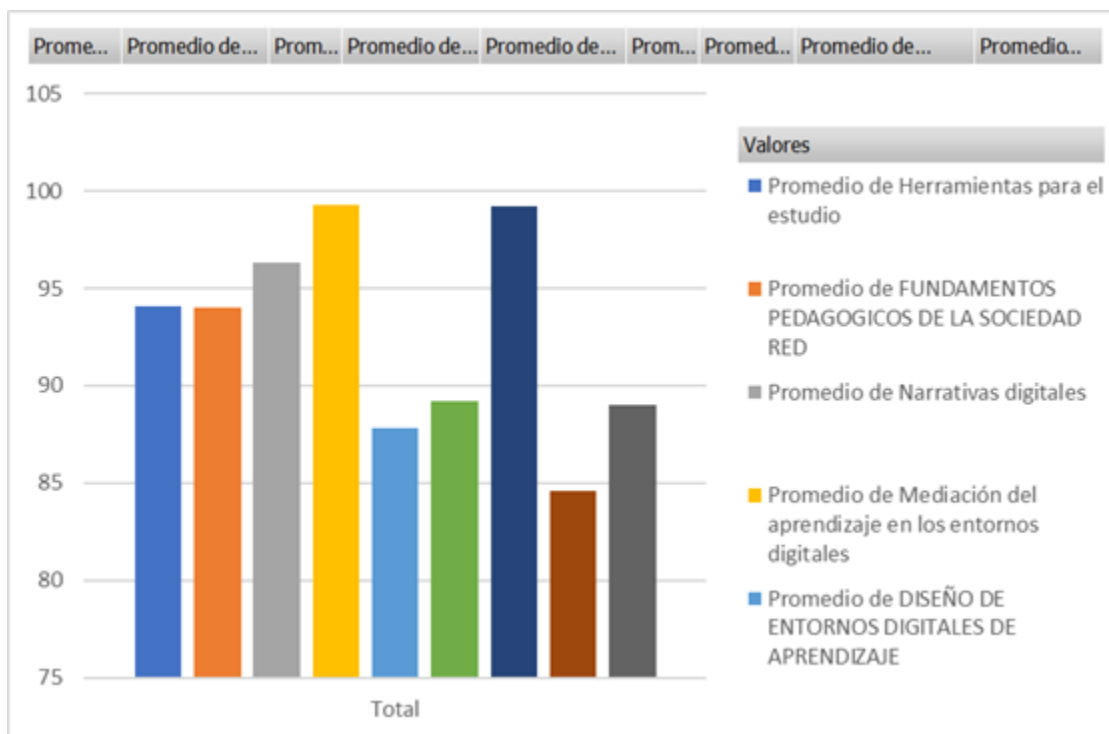

Figure 3. Average grades per subject in the master's degree in "Education with a mention in pedagogy in digital environments" from the Bolivarian University of Ecuador

Note: The graph represents the average of the grades of the subjects of the master's degree in "Education, mention in pedagogy in digital environments of the Bolivarian University of Ecuador

The graphical representation in figure 3 reveals a notable tendency towards a decreasing average throughout the first four subjects, as time progresses sequentially, during the two periods that make up the master's degree in "Education, mention in pedagogy in digital environments of the Universidad Bolivariana del Ecuador." On the *x axis*, which represents the chronological sequence of the subjects, a clear transition towards lower values in the average can be seen. This pattern could indicate various factors, such as possible specific challenges in the content of the subjects, emotional states or the progressive adaptation of students to the study program. On the other hand, on the y axis, *the* variation in the values of the average of each subject can be observed, providing a detailed view of how the average performance evolves over time. This detailed analysis helps to identify the subjects that present the greatest difficulties or those in which students show a particularly outstanding

performance. Identifying the underlying causes of the downward trend and addressing them strategically could be fundamental to optimizing the quality of the master's program and improving the academic performance of students in virtual environments.

The question asked 52 master's students about whether they perceive that their emotions affect their ability to concentrate on academic tasks in virtual learning environments provides information about how students interpret the connection between their emotional states and their academic performance in digital contexts. This question reveals a widespread perception among master's students regarding the influence of their emotions on their ability to concentrate in the virtual academic environment. The fact that 69.20% of participants answered affirmatively suggests that there is a consensus among students about the relevance of their emotional states in the success of their learning activities in virtual environments.

It is important to note how students perceive their emotions and how this affects their motivation to complete virtual academic tasks. Therefore, it is classified into various thematic categories, offering a nuanced view of their experiences and perceptions in relation to this aspect. As a starting point in these categories, a prevalence of responses related to fatigue and tiredness is observed, expressed through terms such as "tired", "not very productive", "I feel very tired" and "mental tiredness". These responses indicate a direct connection between the state of fatigue and the motivation to complete virtual academic tasks. On the other hand, expressions emerge that highlight positive emotions that positively influence motivation, such as "enthusiasm", "positively influence" and "I perceive them in a calm way". This suggests that some master's students find in positive emotional experiences a motivational boost to address their academic responsibilities. Although a group of 30.80% maintains that their emotions do not affect their ability to concentrate, this perspective should not be overlooked. It may indicate that some master's students have developed effective strategies to separate their emotions from academic tasks or that their learning style is not significantly influenced by emotional factors.

This set of responses opens the door to the implementation of emotional and psycho-educational support strategies, especially aimed at those master's students who recognize the influence of their emotions on their academic concentration. Collective awareness of this connection between emotions and academic performance serves as a valuable starting point for designing programs that strengthen students' emotional management skills and ultimately improve their experience and success in virtual learning environments.

Accordingly, the proposed strategy focuses on promoting emotional self-regulation to improve the academic performance of students in the virtual learning environment of the Universidad Bolivariana del Ecuador in the subjects corresponding to the master's degree in "Education with a mention in pedagogy in digital environments of the Universidad Bolivariana del Ecuador. In this regard, a section within generalities dedicated to emotional self-regulation is explained in each subject of the master's degree in "Education with a mention in pedagogy in digital environments of the Universidad Bolivariana del Ecuador. This section provides resources, practical activities, tests to assess the emotional state and guidelines that will allow students to develop skills to manage their emotions, thus creating an environment conducive to learning and academic success. This approach seeks not only to improve academic performance but also to contribute to the general well-being of students in virtual learning environments, thus strengthening the quality of distance education.

The strategy referred to presents a set of sequential and interrelated actions that, starting from an initial state (given by the diagnosis), allow directing the step to an ideal state resulting from planning. Its components are: the mission, the objectives, the actions, the methods and procedures, the resources, the persons responsible for the actions and the time in which they must be carried out, the forms of implementation, the forms of evaluation.

Each course or subject will contain: detailed information on emotional self-regulation; a test to measure the emotional state of students and practical activities such as active breaks, meditation and relaxation, and a discussion forum for open topics. It must also be designed in an interactive and accessible way, with clearly defined sections to maximize its effectiveness. The information on emotional self-regulation includes key concepts, practical strategies and case studies relevant to students of the Master's degree in "Education with a mention in pedagogy in digital environments of the Bolivarian University of Ecuador. In this space, multimedia resources must be provided, such as educational videos and podcasts, to enrich students' understanding of the subject. On the other hand, it is important to highlight that the test to measure emotional state must be designed in collaboration with psychology professionals, preferably from the institution, and adapted to the specific nature of the tensions and challenges that students face in virtual environments.

An adaptation of the Emotional Regulation Questionnaire (ERQ) test is recommended. The test results will be confidential, but students will be provided with tools to interpret and reflect on their own results. Practical self-regulation activities include active breaks, brief guided meditation exercises and relaxation techniques, and a discussion forum for open topics adapted to the digital context and

the curriculum of each subject. It will be provided in a micro-learning format to facilitate integration into daily study routines, thus promoting consistency and adherence.

The implementation and evaluation of the mentioned section is proposed to be implemented during one academic period and, after that, to evaluate the participation of the students within the evaluation module of the subject, the change in their academic performance and their *feedback* on the section. It is expected that the master's students participate in the mentioned section and experience an improvement in their emotional self-regulation, which will be reflected in a more consistent academic performance and a reduction in stress.

A consultation was conducted with experts on the aspects to evaluate the strategy in terms of improving academic performance and reducing stress. The following were taken into account when selecting the experts: the students' knowledge, skills and previous experience in emotional self-regulation. Once three experts were selected, instructions and templates were prepared to be given to them, mentioning the objectives of the study and the instructions regarding the criteria they were expected to meet.

DISCUSSION

In a study conducted in Ecuador in 2020, which aimed to analyze the relationship of emotional states with the academic performance of students in Portoviejo, Ecuador, it was found that the results showed how favorable emotional states lead to high grades, while negative emotional states can hinder learning (Palma-Delgado & Barcia-Briones, 2020). In exploring the results obtained, a positive connection was evident between emotional self-regulation and the academic performance of students in virtual learning environments. The meticulous evaluation of quantitative data revealed a significant correlation, highlighting certain aspects of emotional self-regulation, such as stress management and motivation, which exert a more marked influence on academic performance.

The above research reveals the significant influence of emotions on students' academic performance. It is highlighted that emotional states play a determining role in the construction of learning, suggesting that a state of emotional well-being favors satisfactory academic results. Conversely, unfavorable emotions are associated with low performance indices. This finding converges with the results obtained in our study, which focuses specifically on emotional self-regulation in virtual learning environments. Here, a positive connection is established between students' ability to

manage their emotions, particularly stress and motivation, and their academic performance. The meticulous evaluation of quantitative data reveals a significant correlation between emotional self-regulation and academic performance, emphasizing the importance of these emotional skills in digital educational environments.

For their part, Moreno Núñez *et al.* (2023) demonstrate, from similar research, that students present difficulties in the self-esteem dimension, as well as poor confidence in their abilities; in addition, they note that the group does not always perceive their ability to maintain adequate academic performance or in qualifications Likewise, they proved that there is a direct relationship with strong to moderate tendencies between self-esteem, anxiety and academic performance. On the other hand, there is a relationship between anxiety and self-efficacy. In addition, there is a relationship between feelings of guilt and academic self-concept.

These results reinforce those obtained in the framework of the present research, which jointly suggest that emotions are not only fundamental for the learning action, as highlighted in the first study, but are also intrinsically linked to academic performance, especially when emotional self-regulation in virtual environments is considered. Both conclusions support the idea that emotional education is presented as an essential component in the school context, contributing to the development of emotionally healthy students and, therefore, improving the quality of education.

This finding led to the identification of key areas for a specific improvement strategy. In response to the growing importance of emotional self-regulation in virtual environments, a strategy designed for the master's degree in "Education with a mention in pedagogy in digital environments" of the Bolivarian University of Ecuador was proposed. The designed strategy focuses on the implementation of an interactive and accessible section on emotional self-regulation within each subject. This comprehensive section covers detailed information, a confidential test to assess emotional state, and practical activities, such as: active breaks, meditation, and discussion forums. This intervention is expected to not only raise academic performance, but also contribute to the overall well-being of students.

To ensure the effectiveness of the strategy, a sequential action approach is proposed, with implementation and evaluation planned over the course of an academic period. The collection of *feedback* from students, along with data on their participation in the section and changes in academic performance, will serve as an indicator of the effectiveness of the intervention. The expectation is

that those students who participate in the section will experience notable improvements in emotional self-regulation, manifested in more consistent academic performance and decreased stress. The strategy was also subjected to a preliminary evaluation through consultation with experts, selected for their expertise in emotional self-regulation. These experts provided valuable insights to refine the strategy, ensuring its alignment with the study objectives.

The research conducted highlights the importance of addressing emotional self-regulation in virtual environments, advocating for holistic approaches in planning online educational programs. Continuous evaluation of the strategy throughout an academic term will allow for adjustments and improvements.

The results obtained confirm that students' emotional self-regulation is positively related to their academic performance in virtual learning environments. The importance of considering emotional factors in digital education, especially stress management and motivation, is highlighted.

Integrating a section on emotional self-regulation into subjects within the virtual environment constitutes a way to strengthen the academic performance and well-being of students, which becomes a model for other institutions.

According to the experts' criteria, the proposed strategy favours academic performance and promotes the general well-being of students, through interactive sections on emotional self-regulation in each subject. The collaboration of the experts reinforces the robustness of this strategy.

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Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.

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