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Relationship between emo tional intelligence and mathematical skills in high school students

Relación entre inteligencia emocional y habilidades matemáticas en estudiantes de secundaria

Relação entre inteligência emocional e habilidades matemáticas em estudantes do ensino secundário

Medalit Nieves Salcedo Rodríguez[1], Mateo Dolores Pérez Vázquez[2]

[1] Universidad Nacional Jose austino Sanchez Carrion. Perú.
ORCID: http://orcid.org/0000-0001-7790-6482
E-mail: Salcedorodriguezmedalitnieves@gmail.com
[2] Universidad Nacional de Cajamarca. Perú.
ORCID: http://orcid.org/0000-0002-1727-4089
E-mail: mateodoloresperezvasquez@gmail.com

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ABSTRACT
Several studies have reported that emotional intelligence is a predictive factor of academic performance, so this work aimed to establish the relationship between the traits of emotional intelligence and mathematical skills presented by students from the pre-university center of the National University José Faustino Sánchez Carrión (CPU-UNJFSC) from Lima Peru. A descriptive, cross-sectional and co relational quantitative study was proposed in a sample of 226 pre-university students enrolled in the CPU-UNJFSC, who applied a modified emotional intelligence questionnaire from the BarOn Emotional Coefficient Inventory and the EVAMAT test for the evaluation of competition in mathematics. 50.44 % of the students reflected a medium level of Emotional Intelligence (IE) and 72.57 % of the students presented a medium level in mathematical skills, observing a slight but significant association between both variables. Formal education must not only transmit cognitive aspects, but also include the emotional aspects, employing integrative strategies that allow the integral development of individuals and success in all the goals that are proposed.

Keywords: adolescents; stress; math skills; emotional intelligence; motivation.

RESUMEN
Diversos estudios han reportado que la inteligencia emocional es un factor predictivo del rendimiento académico, por lo que este trabajo tuvo como objetivo establecer la relación entre los rasgos de la inteligencia emocional y las habilidades matemáticas que presentan los estudiantes del centro preuniversitario de la Universidad Nacional "José Faustino Sánchez Carrión" (CPU-UNJFSC) de Lima Perú. Se planteó un estudio de corte cuantitativo descriptivo, transversal y correlacional, en una muestra de 226 alumnos preuniversitarios inscritos en el CPU-UNJFSC, a quienes se les aplicó un cuestionario de inteligencia emocional

modificado del Inventario de Coeficiente Emocional de BarOn y la prueba EVAMAT para la evaluación de la competencia en matemática. El 50,44 % de los estudiantes reflejó un nivel medio de Inteligencia Emocional (IE) y el 72,57 % presentó un nivel medio en habilidades matemáticas, observándose una asociación leve pero significativa entre ambas variables. La educación formal no solo debe transmitir aspectos cognitivos, sino también incluir los aspectos emocionales, empleando estrategias integradoras que permitan el desarrollo integral de los individuos y el éxito en todas las metas que se propongan.

Palabras clave: adolescentes; estrés; habilidades matemáticas; inteligencia emocional; motivación.

RESUMO
Vários estudos relataram que a inteligência emocional é um fator preditivo do desempenho académico, pelo que este trabalho visava estabelecer a relação entre as características da inteligência emocional e as habilidades matemáticas apresentadas pelos estudantes do centro pré-universitário da Universidade Nacional "José Faustino Sánchez Carrión" em Lima, Peru. Foi realizado um estudo quantitativo, descritivo, transversal e correlacional numa amostra de 226 estudantes pré-universitários inscritos no CPU-UNJFSC, aos quais foi aplicado um questionário modificado de inteligência emocional do BarOn Emotional Coefficient Inventory e o teste EVAMAT para a avaliação da competência matemática. 50,44 % dos estudantes mostraram um nível médio de inteligência emocional e 72,57 % mostraram um nível médio de habilidades matemáticas, com uma ligeira, mas significativa associação entre ambas as variáveis. A educação formal deve não só transmitir aspectos cognitivos, mas também incluir aspectos emocionais, empregando estratégias integrativas que permitam o desenvolvimento integral dos indivíduos e o sucesso em todos os objectivos que são propostos.

Palavras-chave: adolescentes; stress; habilidades matemáticas; inteligência emocional; motivação.

INTRODUCTION

In the last thirty years, several studies have strengthened the importance of the Emotional Intelligence (IE) in various fields such as health, welfare and the happiness, education and the business world; thus, theories emerge that define it according to criteria such as the ability of Salovey and Mayer 1990, personality traits of Bar On 1997 and by competencies of Goleman 1999, as cited in Sánchez Teruel & Robles Bello 2018). A way to define EI grouping all these aspects could be: the ability of a person to be aware of the emotions, reach and generate them in such a way that promotes thinking, its understanding and what they mean and, Consequently, to handle it so that help to their emotional and intellectual growth (Musonda, 2017). In this sense, a person's intelligence is what makes him think rationally and gives him the ability to deal effectively with his environment, which can be understood as the ability to cope with and adapt to new situations quickly and efficiently (Prafitriyani *et al.*, 2019).

One of the aspects of EI, which determines the learning outcome, is the personality, as it is influenced by the emotions experienced during growth and development. Someone who is unable to control their emotions will have difficulty overcoming the problems; thus, emotions are intimately linked with behavior (Prafitriyani *et al.*, 2019).

EI is an important component of students' cognitive skills (Musonda, 2017) and youth age is the most important stage in the development of emotional self-regulation, being recognized as a period of active assimilation of knowledge and acquisition of necessary skills for the next professional activity. Intellectual activity to be effective, it is necessary to be prepared to think with certain degree , backed by the emotions that arise in the process of cognitive activity; level of development that provides an internal regulation of their own emotional states, thus affecting their success in the educational activities that are proposed.

In connection with academic performance, several studies point out that it can be predictive factors of the success in learning aspects of IE of the students as the adaptability, empathy, awareness, understanding emotions, self - control, the social relationships, etc. (Colomeischi & Colomeischi, 2015; Musonda, 2017; Santamaria Villar & Valdés Muñoz, 2017; Prafitriyani *et all.*, 2019).

Mathematics, for example, for most people, is considered difficult to understand and many have problems solving mathematical problems (Prafitriyani *et al.*, 2019). Akben Selcuk (2017) points out the existence of external and internal factors, associated with performance in mathematics. Among the external factors are the socio economic, from the point of view of resources school; and among the internal factors: personality and motivation, which were decisive in explaining the achievements of the students. Then, the students who were intrinsically motivated, that is, those who learn math because they have a personal interest and get joy in their study, they performed better than the extrinsically motivated students, that is to say, those learning math because "they have to" for the future chosen profession, for example.

Likewise, Colomeischi & Colomeischi (2015) point out that attitudes towards learning mathematics depend on the quality of the emotional life of students, observing that success is due more to internal factors of an emotional nature, such as the level of anxiety and motivation; being in turn related to age, that is, they found differences between students' attitudes towards mathematics that varied according to age.

Considering then EI as a multidimensional complex, various authors design models that explain it in various areas; in education, frequently, it has used mixed models of Goleman and BarOn, as quoted in Sánchez Teruel & Robles Bello (2018). Thus, the score competencies that make up the IE, according to Goleman (1995), cited by Ros (2015) are: the *Self Awareness* or awareness himself, who is referred to the internal state, recognize strengths and weaknesses, resources and insights; the *Self-management* or self-control, which is referred to the domain of the state , of internal pulses and internal resources; the motivación (*Motivation*), which explains the trend emotional guidi ng or facilitating the achievement of the objectives ; empathy (*Social-awareness*), which is understood as the awareness of the feelings, needs and concerns of others; and social abilities (*Relation - ship management*), such as the ability to induce responses desirable in others , but not understood as control capabilities over another individual (García Fernández & Giménez Mas, 2010; Sanchez Teruel & Robles Bello, 2018).

On the other hand, BarO n (1997), as cited in Sánchez Teruel & Robles

Bello (2018) explains the components of EI on five scales: the intrapersonal, which refers to whether the individual recognizes their emotions and feelings, positive and negative, it involves self-concept, self-knowledge, self-expression and self-realization; the interpersonal, which represents the ability to understand the feelings of others, empathy, the ability to establish satisfactory relationships and to form a team, cooperate; adaptability, related to the ability to adjust your emotions, solve problems, be flexible; managing stress, which refers to the ability to overcome stressful situations related to impulse control and strong events tolerance; and the mood component, which involves motivation , the ability to feel action and optimism (García Fernández & Giménez Mas, 2010).

Based on these models, if people have different emotions, feelings, attitudes, talents, abilities, skills and knowledge, then it is a necessary condition for the effectiveness of education using methodology teaching having into account real psychological mechanisms for the appropriation of educational information, as well as methods, innovative teaching means, organizational forms of the process , different forms of evaluation, among other aspects, that stimulate the cognitive activity of students, contributing to the assimilation of information and the development of cognitive abilities. Among students, there will be different levels of intelligence, for what, teachers must co nsider in planning the process of teaching and learning, appropriate strategies and teaching resources, designed in order to promote the development and growth of students (García Heredia *et al.*, 2017).

For this reason, and taking into account that there are few instruments that assess emotional intelligence in children and adolescents, it was raised as a goal to establish the relationship between traits of emotional intelligence and mathematics skills of the students of pre - university of the National University Center "José Faustino Sánchez Carrión" (CPU-UNJFSC), which is a study center that provides a specialized educational service that helps students of the last years of high school and those who have already completed this level, to get the success in the entrance examination of the university in question.

MATERIALS AND METHODS

This study was proposed with quantitative approach of non - experimental design, of descriptive, transversal and co relational kind, in a sample of 2 26 students of the pre - university Center of UNJFSC, Lima , Peru , from a population of 843 students enrolled for the exam admission 2019. The students answered a questionnaire on Emotional Intelligence changed from the Inventory of emotional coefficient (BarOn-ICE, its acronym in English: EQ- I) (BarOn, 1997), as quoted in Sánchez Teruel & Robles Bello (2018), been formed by 23 questions based on five ratings of the Likert scale (1=never, 2=rarely, 3=sometimes, 4=almost always 5=always), oriented in the five principles or powers of the emotional intelligence described by Goleman: self - awareness (self), self (self), motivation (motivation), social awareness (empathy) and relationship management (social skills). In the process, the results of yhe dimentions of the IE were qualified in levels: Low 23 to 53 points, half of 54-84 points and high of 85 to 115 points (Ugarriza, 2001). The instrument

was assessed in a pilot group (n=30) of the same studies center, and when applying the rate Cronbach, those constructs yielded indices greater than 0.5, to be taken with enough internal consistency were taken.

To determine math skills, a battery of EVA MAT-8, which is an instrument that values the skills of basic mathematics based on tests calculus, geometry, processing of information and randomness and resolution of problems was applied. Based on the results, it was adjusted to a checklist or estimation scale, to identify the skills related to the ability to reason, achieved by students in the classroom, which was made up of 23 items that consider the dimensions of: knowledge and management of the basic mathematical elements; implementation of reasoning processes for solving problems; ability to interpret and express with clarity and precision the information; and disposition towards information rating the students on a five-point Likert scale: 1 - very poor; 2- deficient; 3- regular; 4- good; and 5- very good. This instrument was evaluated in a pilot group of 2 0 students from the pre-university center of the National University "José Faustino Sánchez Carrión" (CPU-UNJFSC), to determine its validity and reliability, being approved by expert judgments and with a Cronbach alpha of 0.965. The degree of skills was rated according to the scores: low, from 23 to 53 points; medium, from 54 to 87 points and high, from 88 to 115 points (Santamaría Villar & Valdés Muñoz, 2017).

The data were processed by descriptive statistics for comparative analysis and for inferential statistics; After the Kolgomorov-Smirnov test confirmed that the data do not follow a normal distribution with $p < 0.05$, the Spearman Rho nonparametric test with 95 % confidence was used to establish the relationships between the variables. These procedures were performed with the SPSS V23 statistical package.

The study was carried out under the approval of the Directorate of the Pre university Center (CPU) of the National University "José Faustino Sánchez Carrión" and the representatives or tutors of the students were duly informed about the objectives of the research, so that the permission for the participation of those represented was made, after signing the informed consent.

RESULTS

The applied emotional intelligence test showed Cronbach's alpha coefficient values in the constructs chosen between 0.579 and 0.873; indicating that the instrument was reliable. Thus, figure 1 shows that the majority, 50,44 % (n = 114) of the students presented a medium level, attending to the established scale. The results were mainly determined for a medium score in the competences of self awareness in a 76,11 % (n=172), selfregulation 61,06 % (n=138) and social awareness on 55,75 % (n=126) (figure 2).

When observing the scores achieved by students in each of the competencies of EI, it is denoted that most students reached a medium level, in self - awareness, self - regulation and social consciousness, while 50.88 % (n=115) and 41.15 % (n=93) of the students obtained a high level, in motivation and relationship management, respectively. On the other hand, in relation to mathematical skills,

figure 3 shows that 72.57 % (n = 164) of the students scored at medium level.

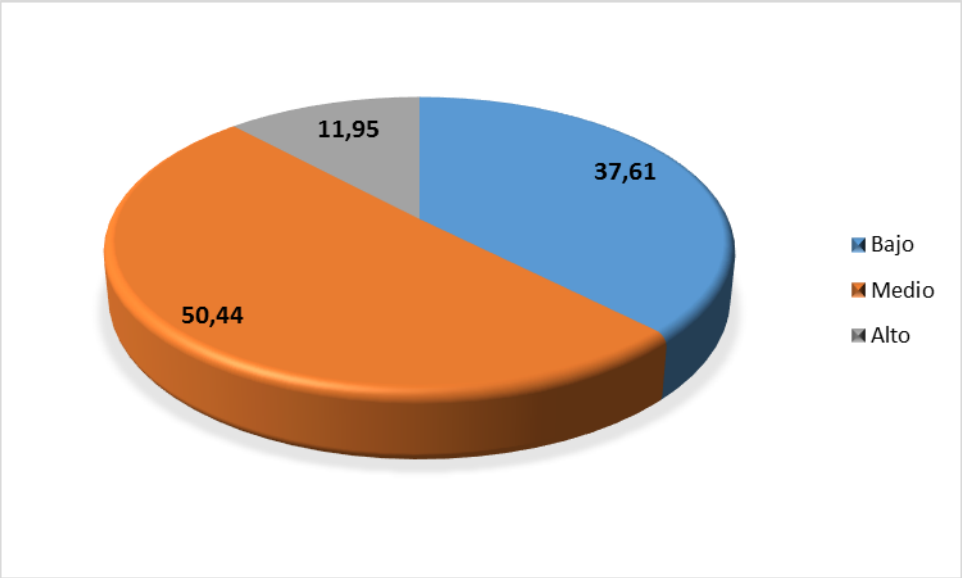

Fig. 1 - Percentage distribution of score Competencies of the IE, obtained by the students of the pre university center of UNJFSC, 2019

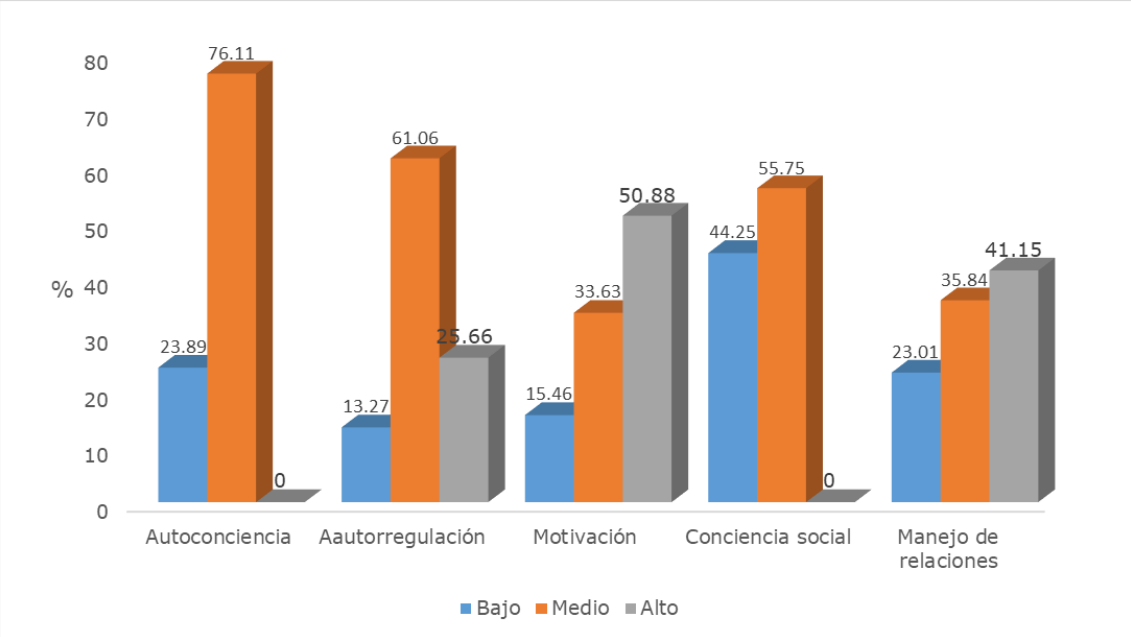

Fig. 2 - Percentage distribution of the score of each of the competencies of EI obtained by students from the pre university center of UNJFSC, 2019

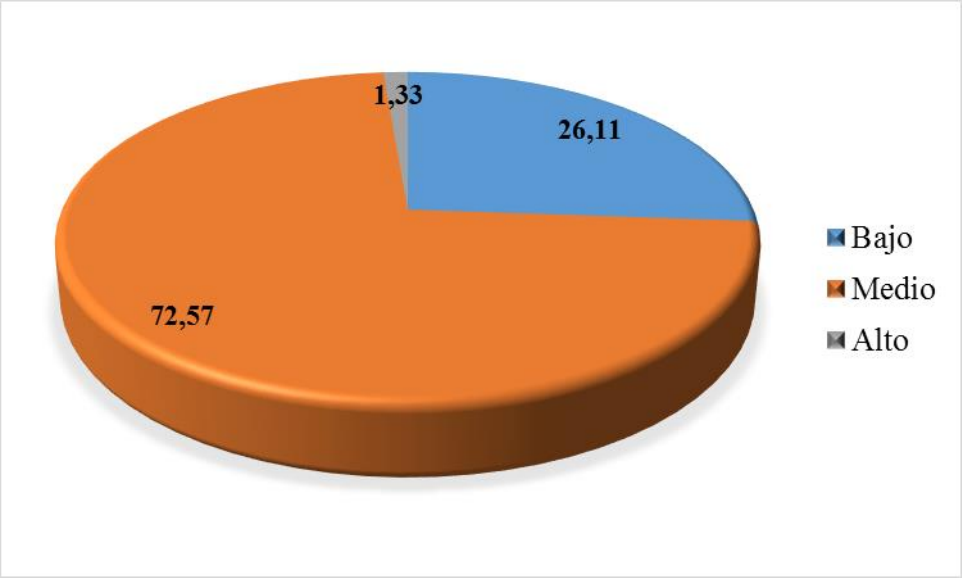

Fig. 3 - Percentage distribution of grade math skills obtained by students from the pre university center of UNJFSC, 2019

According to the statistical applied, it was observed with significance ($p < 0.05$) a weak association between variables IE and mathematical abilities ($Rs=0.225$ $p=0.001$). At valuing independently each of the powers of the IE and its effect on math skills, very weak associations, but with significances were found ($p<0.05$) in the competences of self awareness ($Rs=0.229$ $p=0.001$), motivation ($Rs=0.222$ $p=0.001$) and social awareness ($Rs=0.18$ $p=0.007$), and no relationship with self-regulatory skills ($Rs = 0.129$ $p = 0.06$) and relationship management ($Rs=0.105$ $p=0.115$).

DISCUSSION

In the educational field, several authors have determined the importance of emotional intelligence for success in any aspect of life, not only in work or learning, but also in social relationships (García Heredia *et al.*, 2017). This has led to the development of various theories on emotional intelligence and to deciphering the components that determine it. Among them, the Goleman and BarOn models, as cited in Sánchez Teruel & Robles Bello (2018) are the ones that have had the most diffusion at the educational level, known as the mixed models, since they join several aspects of personality and how they perceive the environment, thus building the main components or competencies of EI.

In this study a mixture in which some principles of the models were taken, building a model based on questions QE-I BarOn questionnaire, but were adjusted to the powers of Goleman (1995) cited by García Fernández & Giménez Mas (2010) were proposed. All this with the idea of having a shorter instrument, of easy application and interpretation, in which the items had already been validated by various authors.

In the assessing the general result of the test of IE, it was observed that the 50, 44 % of students, obtained a score average, indicating that

these adolescents had an average level of intelligence that influenced slight, but significantly , in math skills ; in this study it prevailed the medium level and only 1 % reached a high level of abilities. Other authors, carrying out similar evaluations, reported a significant association between EI and learning achievement in mathematics, specifically related to the management of emotions (Musonda, 2017; Prafitriyani *et al.*, 2019).

In observing the components of EI, in this group of students it was emphasized, for example, that none of them showed a high level in the component of self - awareness and social consciousness, reaching mostly an average level for these components. It could be said that, in adolescence, these components will not have developed so much, are still in the phase of knowing themselves, so they do not understand their feelings, and are not in capacity to understand and deal with them to follow forward; on the contrary, when faced with problems, they stagnate. Ros (2015) reported a similar result, when evaluating this component in students between 17 and 21 years old, when they observed that 100 % of their sample presented a low level of self-awareness. In this sense, if students still could not manage their emotions or feelings, they presented difficulties to understand the emotions of others, and achieve optimal performance in establishing relationships or social skills (Delgado Tapia & Sanchez Delgado, 2018), which defined the component of social consciousness.

In this study, these competences showed a slight but significant influence on mathematical abilities, which could explain, in part, the observed result in math skills valued. However, the literature indicates, controversial results, where there was not determined any significant relationship between those co mponents and the academic performance in general (Ros, 2015; Santamaría y Villar & Valdés).

On the other hand, other aspects that go in hand with emotion managing are stress control and anxiety levels, which were valued on the principle of self-regulation (which is included in the intrapersonal component of the BarOn inventory). . In this component, 25 % of students with a high score were observed, indicating that most of them present a certain degree of stress or anxiety. This just due to tiredness that may be suffering from the pressures of study among normal scholar activities and these parallel studies, which generate as many activities to do at home. However, there was no statistical significance in the association of this variable with mathematical abilities.

Regarding stress or anxiety, it has drew contradictory results, being reported relationship between age and levels of anxiety that is generated in adolescents in which, the older, more anxiety, which affects academic performance (Colomeischi & Colomeischi, 2015). In university students, Thomas *et al.* (2017) it was observed a decrease in performance to higher levels of anxiety, to the compare average obtained for a period of four years. On the other hand, Odicta (2016) reported a strong and positive association between the degree of stress and performance in mathematics, pointing out in his study that the teacher must promote learning in the classroom to control stress, which causes deco centration now to perform cognitive tests.

Regarding the motivation component, in the case of the students enrolled in the UNJFSC pre-university center, these are adolescents full of expectations for their future, in which initially the premise is

that they must be highly motivated, with the fact that they will enter college, so they put their trust in the center of study to strengthen their knowledge and thus ensure a successful outcome in the admission test. In this study, 50.44 % of the students obtained an average score and a slight but significant relationship with mathematical skills was observed.

Akben Selcuk (2017), although he reported that motivation favored learning in mathematics, he also pointed out that those students attributed their failures to personal problems, subsequently they did not improve their performance as those who considered their failures due to external problems, such as teacher or study materials. Noting that personality, as well as the origin of motivation, influence learning in different ways. In this sense, emotions facilitate thinking in the ability to reason (Musonda, 2017) and emotions affect motivation. A student bored or angry feels less motivated, and about 50 % of adolescents have mood swings associated with hormonal changes determined by age (Prafitriyani *et all*, 2019).

In relation to competition management relations, which assesses the related social skills aspects, geared towards adaptation to the environment, something that in adolescents is very important for the development of his personality, especially regarding how they feel in front of their peers, and how they want to be seen. In this study, 41% of the students achieved a high score, confirming in part that, as adolescents, they seek to be accepted by their peers; it is important for them to achieve an adequate level of relationships, even when this level of relationships did not significantly influence the mathematical skills achieved.

In this sense, Santamaria and Valdes (2017) reported positive association bet ween social skills and academic performance in general, but stressed that the achievements of learning cannot depend on a single variable, but it is the influence of a set of situations that may, or not, favor it. However, if the development of emotional skills can improve academic performance, this is the right time to offer students coping strategies aimed at the self - perception of external factors and how to control them, in order to achieve the achievement in any objective that they set.

Mathematics teachers have a complicated job, as in addition to teaching the foundation of math building, numbers, and operational skills, they have to empower students to think about problem solving; for this, they require to incorporate aspects of the language, including reading and writing. In addition, they must motivate students by teaching them to persevere even when problems have greater degrees of difficulty (Pulungan *et al.*, 2015). Hence the importance of that in the process of preparation of teachers includes not only the cognitive aspects, but can also handle the emotional aspects, so that by applying strategies for integrative teaching learning facilitates learning and the integral development of the individuals (Velez Bravo *et all*, 2017).

They are now demanding more and more to teens, to meet future goals to be planted to let aside recreational activities required for the age, and filled with formal activities. In a world with such a degree of activity, then it is paramount that these activities include interventions aimed at personal development, managing emotions, motivating the knowledge of themselves and those around them, to enhance skills and thus guarantee comprehensive training that

guarantees success in their professional lives.

BIBLIOGRAPHIC REFERENCES

Akben Selcuk, E. (2017). Personality, Motivation, and Math Achievement Among Turkish Students: Evidence from PISA Data. *Perceptual and Motor Skills*, *124*(2), 514-530. https://doi.org/10.1177/0031512516686505

Bravo Vélez, L. E., Amayuela Mora, G. & Colunga Santos, S. (2017). Tendencias históricas del proceso de educación emocional en los estudiantes del bachillerato en Ecuador. *Mendive. Revista de Educación*, *15*(3), 305-315.

Colomeischi, A. A. & Colomeischi, T. (2015). The Students `Emotional Life and Their Attitude toward Mathematics Learning. *Procedia - Social and Behavioral Sciences*, *180*, 744-750. https://doi.org/10.1016/j.sbspro.2015.02.192

Delgado Tapia, D. L. & Sánchez Delgado, J. (2018). Plan de estrategias basadas en la inteligencia emocional para mejorar las habilidades sociales en los estudiantes del nivel superior: *Revista Ciencia Nor@ndina*, *1*(2), 72-79.

García Fernández, M. & Giménez Mas, S. I. (2010). La inteligencia emocional y sus principales modelos: Propuesta de un modelo integrador. *Espiral. Cuadernos del profesorado*, *3*(6), 4.

García Heredia, F. J., Martinez Ramírez, R., González Saucedo, A. C. & Pisté Beltrán, S. (2017). ¿Las Inteligencias Múltiples en la Educación Superior y la inteligencia de una persona se deben de medir por la capacidad lógico matemático y lingüístico? *Cultura Científica y Tecnológica*, *0*(59), Article 59. http://erevistas.uacj.mx/ojs/index.php/culcyt/article/view/1488

Musonda, A. (2017). Algebraic competences and emotional intelligence of first year Bachelor of Science in Mathematics and Science Education students at the Copperbelt University in Zambia. *Tuning Journal for Higher Education*, *5*(1), 171-195. https://doi.org/10.18543/tjhe-5(1)-2017pp171-195

Odicta, G. L. (2016). Intrapersonal and Stress Management Dimensions of Emotional Intelligence as Determinants of Mathematics Performance. *JPAIR Institutional Research*, *7*(1), 36-45. https://doi.org/10.7719/irj.v7i1.370

Prafitriyani, S., Magfirah, I., Amir, N. F., Irmawati, A. & Umanailo, M. C. B. (2019). Influence of emotional intelligence on mathematics learning outcomes of class VII middle school 9 Buru students. *International Journal of Scientific & Technology Research*, *8*(10), 1490-1494.

Pulungan, P. S., Lubis, N. H. & Fauzi, A. (2015). Development of Mathematics Learning Model Based on a Metakognitif Approach with Student Character Involving Student Emotional Intelligence. *International Journal of Science and Research*

(IJSR). https://doi.org/DOI:10.21275/ART20174532

Ros Martínez, N. (2015). Influencia de la inteligencia emocional en los estilos de aprendizaje predominantes de los alumnos de bachillerato de la modalidad de Arte. *Educatio Siglo XXI*, *33*(2 Julio), 53-78. https://doi.org/10.6018/j/232691

Sánchez Teruel, D. & Robles Bello, M. A. (2018). Instrumentos de evaluación en inteligencia emocional: Una revisión sistemática cuantitativa. *Perspectiva Educacional*, *57*(2), 27-50. https://doi.org/10.4151/07189729-vol.57-iss.2-art.712

Santamaría Villar, B. & Valdés Muñoz, M. V. (2017). Rendimiento del alumnado de educación secundaria obligatoria: Influencia de las habilidades sociales y la inteligencia emocional. *Revista INFAD de Psicología. International Journal of Developmental and Educational Psychology.*, *2*(1), 57-66. https://doi.org/10.17060/ijodaep.2017.n1.v2.918

Thomas, Ch. L., Cassady, J. C. & Heller, M. L. (2017). The influence of emotional intelligence, cognitive test anxiety, and coping strategies on undergraduate academic performance. *Learning and Individual Differences*, *55*, 40-48. https://doi.org/10.1016/j.lindif.2017.03.001

Ugarriza, N. (2001). La evaluación de la inteligencia emocional a través del inventario BarOn (I-CE) en una muestra de Lima Metropolitana. *Persona*, *4*, 129-160. https://doi.org/DOI:10.26439/persona2001.n004.817

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Authors declare not to have any conflict of interest.

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Authors participated in the writting process of this article and in the analysis of documents.