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ORIGINAL ARTICLE

Mirror neurons in e-learning in high school students

Las neuronas espejo en el aprendizaje virtual en los estudiantes de básica superior

Neurônios espelho na aprendizagem virtual em alunos do ensino fundamental

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KEYWORDS

learning, virtual education, empathy, strategies, mirror neurons.

ABSTRACT. Mirror neurons are recognized for their relationship with empathy and that they contribute to virtual education. The objective of the article was to analyze the influence of mirror neurons on virtual learning in upper elementary students of the educational unit "José María Santana Salazar" of the Manta centon. The methodology used was quantitative-qualitative, descriptive, primary, and secondary sources of information were collected, through the deductive and analytical methods. The survey technique applied to an intentional sample of teachers, a student observation card, was used. An interview was applied with an expert in clinical psychology. The results indicated in 59% that mirror neurons promote learning through imitation and in 34% that it improves social relationships through empathy. It is concluded that teachers cannot take advantage of them because they have limited resources to apply them, making it very difficult to motivate and strengthen students' empathy in the virtual context.

PALABRAS CLAVE

aprendizaje, educación virtual, empatía,

RESUMEN. Las neuronas espejo son reconocidas por su relación con la empatía y que aportan a la educación virtual. El objetivo del artículo fue analizar la influencia de las neuronas espejo en el aprendizaje virtual en los estudiantes de básica superior de la unidad educativa "José María Santana Salazar" del centón Manta. La metodología utilizada fue cuanti-cualitativa, de tipo descriptivo, se recopiló fuentes primarias y secundarias de información, a través del método deductivo y analítico.

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estrategias, neuronas espejo.

Se utilizó la técnica de la encuesta aplicado a una muestra intencional de docentes, una ficha de observación a estudiante. Se aplicó una entrevista a un experto en psicología clínica. Los resultados señalaron en un 59% que las neuronas espejo promueven el aprendizaje mediante la imitación y en un 34% que mejora las relaciones sociales a través de la empatía. Se concluye que los docentes no puede aprovecharlas porque tienen recursos limitados para aplicarlas, siendo muy difícil motivar y fortalecer la empatía de los estudiantes en el contexto virtual.

PALAVRAS-CHAVE

aprendizagem, educação virtual, empatia, estratégias, neurônios-espelho.

RESUMO. Os neurônios-espelho são reconhecidos por sua relação com a empatia e contribuem para a educação virtual. O objetivo do artigo foi analisar a influência dos neurônios espelho na aprendizagem virtual de alunos do ensino fundamental da unidade educacional "José María Santana Salazar" do centon Manta. A metodologia utilizada foi quantitativo-qualitativa, descritiva, foram coletadas fontes primárias e secundárias de informação, por meio do método dedutivo e analítico. Foi utilizada a técnica de inquérito aplicada a uma amostra intencional de professores, um cartão de observação do aluno. Uma entrevista foi aplicada a um especialista em psicologia clínica. Os resultados indicaram em 59% que os neurônios-espelho promovem o aprendizado por imitação e em 34% que melhora as relações sociais por meio da empatia. Conclui-se que os professores não podem aproveitá-los porque possuem recursos limitados para aplicá-los, dificultando a motivação e o fortalecimento da empatia dos alunos no contexto virtual.

1. INTRODUCTION

Mirror neurons are those that are activated with one's displacement or that of others, imitation, empathy, and the function of attributing thoughts or intentions that are related to them (Morris, 2014). Especially, they influence the perception of stimuli, language, learning, social and motor skills; they are essential in the control and also in the interpretation of the gestures and movements used in communication (Araya & Espinoza, 2020). They allow to correlate own actions with others and give them meaning, with them it is possible to understand others, they are also related to the emotional aspect of individuals (Contreras, 2020).

The Ecuadorian reality in terms of teaching virtually reflects poor communication and guidance due to educators (Cóndor & Guapizaca, 2020). Teachers are unaware of neuroeducation instruments that facilitate the education and learning process, which will be reflected in insufficient academic performance that does not point to the educational quality that is desired to be achieved (Oyola, 2017). The lack of empathy creates dissatisfaction in students within the social environment, being a disadvantage for the development of coexistence (Garcés & Sellán, 2017), the lack of stimulus to teachers causes indifference and demotivation in the educational task (Rodríguez, 2019). The same has happened with the students, noticing a lack of empathy and dynamics, they show little collaboration, therefore cooperativity, motivation and the benefits of mirror neurons should be used.

Educational actors must be aware of the relationship between teaching and learning with the neuronal and biological bases of these processes (Barrios, 2016). About this, not taking advantage of its benefits in virtual learning prevents the achievement of better results in education. The problem of this research is the ignorance of the benefits of mirror neurons, which affects the virtual learning of the students of the upper elementary school of the Manta canton, Ecuador. According to García et al. (2014) teachers are delegated to promote collaboration, change traditional education, providing confidence to students to solve problems, promote cooperation and collaboration through empathy and trust Planning for virtual environments involves knowing and using technological resources diverse, schedule occupations for students, along with the preparation of guides for self-learning (Vargas, 2020). There is a lack of commitment on the part of the students, which does not facilitate the educational processes (Arroyo & Delgado, 2016).

Through the observation carried out at the educational center under study, it was evidenced that the students of the upper basic sublevel present difficulties when connecting to the virtual platforms, because they are currently

unmotivated and disinterested in the learning process. The poor knowledge of teachers in terms of neuroeducation tools and innovative methodologies limit their possibilities to improve virtual learning, the lack of empathy within the educational field generates dissatisfaction in teachers and students, affecting dynamism and commitment in the classrooms, it is necessary to reinforce the skills of educators through training and updating in strategies that incorporate the benefits of mirror neurons in virtual learning.

Deepening the benefits of mirror neurons in the virtual learning process of students and the positive contribution of neuroeducation is essential in the virtuality that is being experienced worldwide. It was intended to analyze the current reality to provide recommendations to implement and use strategies, create spaces to improve empathy in the educational process, social interaction, and the benefits of mirror neurons through the motivation of interaction between peers to work in a team and collaboratively.

Mirror neurons and learning

Neuroscience studies are giving more and more guidelines to the learning process, and in recent years have given importance to mirror neurons or mirror neurons. Pérez (2016) and Falconi et al. (2017) gree that it is important to consider certain elements so that they are effectively used, including knowing the functioning of the brain, attention, motivation, diversifying methodologies, promoting positive emotional states, recognizing learning problems in a personalized way, teaching self-control. and effective management of emotions. In educational training they facilitate cooperative learning, the acquisition of behavior patterns, and the transmission of culture (Araya & Espinoza, 2020); allow involuntary learning (Pulache, 2018), for this, educators must include innovative experiences, teamwork, and efficient communication through technological tools (Sandoval, 2020).

Teachers should use mirror neurons and their benefits in virtual learning by developing curricular planning that involves activities, techniques, and strategies that stimulate emotions (Chávez & Chávez, 2020), creating environments where students can function in a safe and comfortable, facing challenges that give them positive emotions so that they are motivated to learn.

Strengthening these conceptualizations, it is important to highlight that the benefits of mirror neurons have disturbed the attention of scholars such as Nella (2020), Crespo (2017), Oyola (2017), Zuta et al. (2017), Lozada and Quimiz (2018) who refer to the importance of these neurons for the emotions and behavior of individuals, which provides opportunities in learning processes, for this they recommend that teachers include strategies focused on development emotional level of the students, not only in the intellectual or cognitive aspect, being necessary to know each one individually, facilitating a relationship of respect and empathy, using technology, interactive activities and games that facilitate teaching, include practical activities, debates, resolution problems, role play, teaching resources, use practical examples about theory, teamwork that promotes social interaction, spread a positive attitude, to promote environments conducive to learning.

Mirror neurons and virtuality

Educational systems have been changing; being the virtual modality the solution to the current limitations, to this the mirror neurons give a significant contribution by the knowledge that they provide about the brain, the behavior, and the learning methods, allowing to know the students, to empathize with them, to be able to construct best programs and methodologies that favor learning (Contreras, 2020).

2. METHOD

Under a qualitative-quantitative approach, the type of research was descriptive since it focused on searching for information and describing situations or events. The non-experimental research design observed phenomena in

their natural context, analyze them and establish the respective conclusions. The methods used were deductive and analytical using which the problem was examined, considering different sources of information, since this method according to Hernández et al. (2017) consists of the dismemberment of a whole, where the cause, nature, and effect can be observed and analyzed.

The technique used in this research is the survey, with the questionnaire instrument prepared based on previous studies by Orrego & Crespo (2017) and Contreras (2020), which was validated with Cronbach's Alpha coefficient, having reliability of 95%. It was addressed to the 29 teachers from the "José María Santana Salazar" educational center in the Manta canton, Manabí province, Ecuador. An observation sheet was applied to a focus group with 10 upper elementary school students during three class sessions on the zoom platform, observing behaviors, emotions, receptivity, motivation, empathy, and participation. The teacher was the subject of a study where the enthusiasm was observed if she took into account expressions, opinions, or identified moods. The interview directed to a professional in psychology from the Department of Student Counseling - DECE2 on the subject, allowed to incorporate the methodological and inclusive elements in virtual learning, highlighting mirror neurons as motivational factors, positive verbal and body language that is evidenced and influence in Classroom.

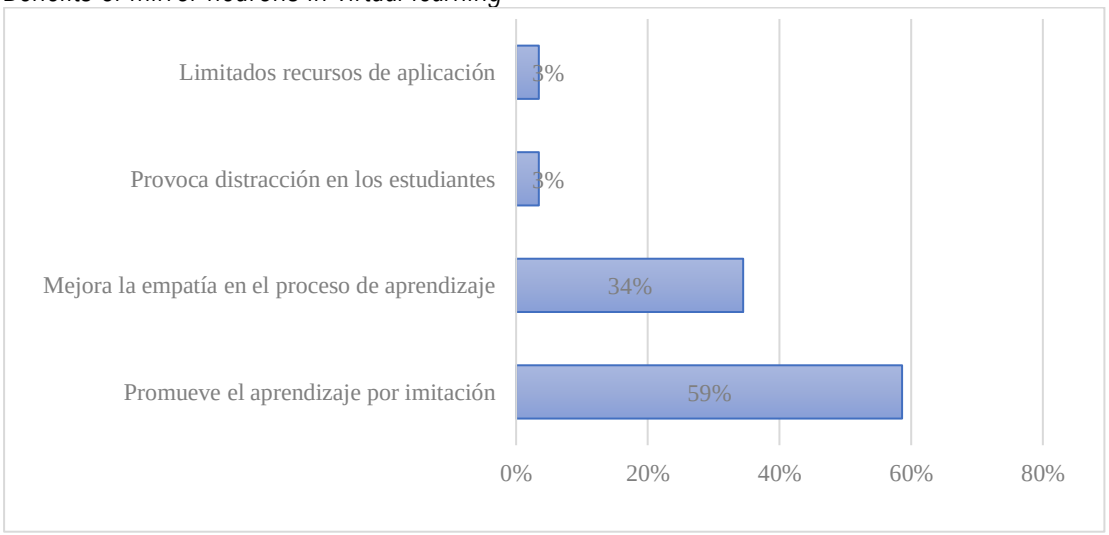
The data collection procedure was carried out through virtual environments, complying with the distancing protocols and biosafety regulations, the survey applied to the teachers was carried out by Google forms, for the interview and the observation file the zoom platform was used.

3. RESULTS

In the analysis of the benefits of mirror neurons in the virtual learning of upper elementary school students, the functioning and advantages of these neurons for students were first recognized, through the teacher survey 59% indicated that the higher advantage is that they promote virtual learning and another 34% improve empathy as indicated in figure 1. Perozo et al. (2020) argue that the benefits of mirror neurons are in the generation of knowledge through imitation, they are related to emotional and cognitive empathy, so in the current context they help the adaptation of new modalities if they are managed promptly in the teaching process will facilitate relationships between educational actors.

Figure 1.

Benefits of mirror neurons in virtual learning



[2] DECE: Departamento de Consejería Estudiantil, las funciones son prevención, detección, abordaje y seguimiento (Ministerio de Educación, 2020).

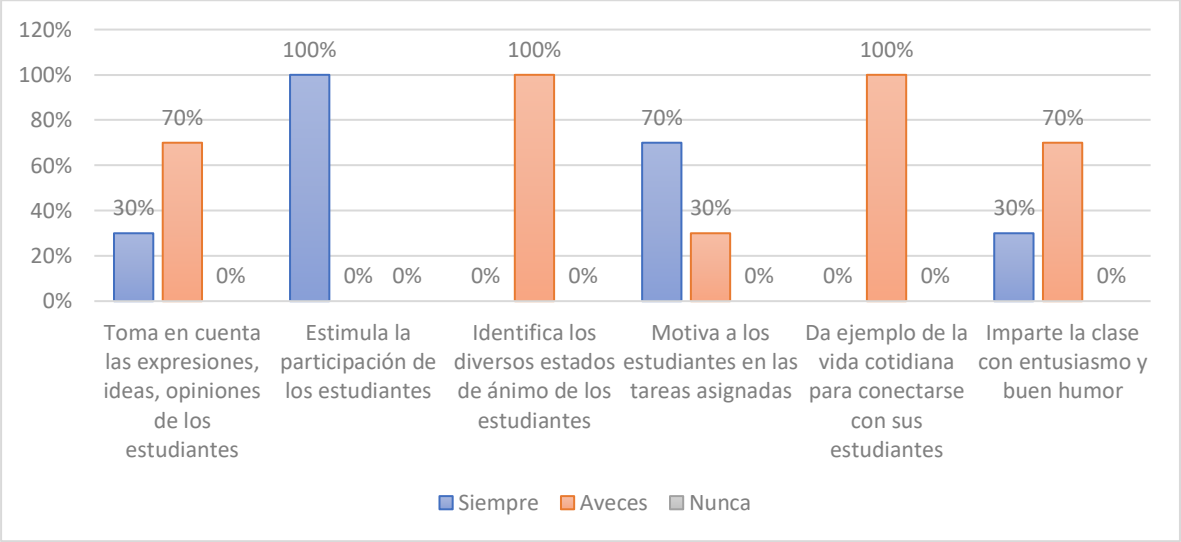
Source: Survey applied to teachers of the "José María Santana Salazar" Educational Unit of the Manta canton. Own elaboration.

In the interview with the expert Ormaza (2021), she also highlights that these neurons contribute to education by providing guidelines on the functioning of the brain and the relationship of emotions with thought. Ruíz and Kwan (2020) agree that the contribution lies in how the brain works for learning and behavior, encompassing emotional and cognitive processes.

In the teacher observation file, it was evidenced that the benefits of mirror neurons that are frequently incorporated into virtual classes are: stimulation of student participation and motivation in tasks, less frequently taking into account the expressions, ideas, opinions of the students, identifies the different states of mind, exemplifies and teaches the classes with enthusiasm, these results are reflected in figure 2. Regarding this, Tarqui (2019) indicates that motivation is important to achieve that students Students work hard and give better results, being the benefits of mirror neurons that allow empathizing and knowing what are the factors that stimulate students. Vásquez (2020) also points out that in the current context of virtual education teachers must teach their classes with enthusiasm and joy, seeking to transmit those positive emotions to students, reduce shame in them and improve academic performance.

Figure 2.

Results of teacher observation record

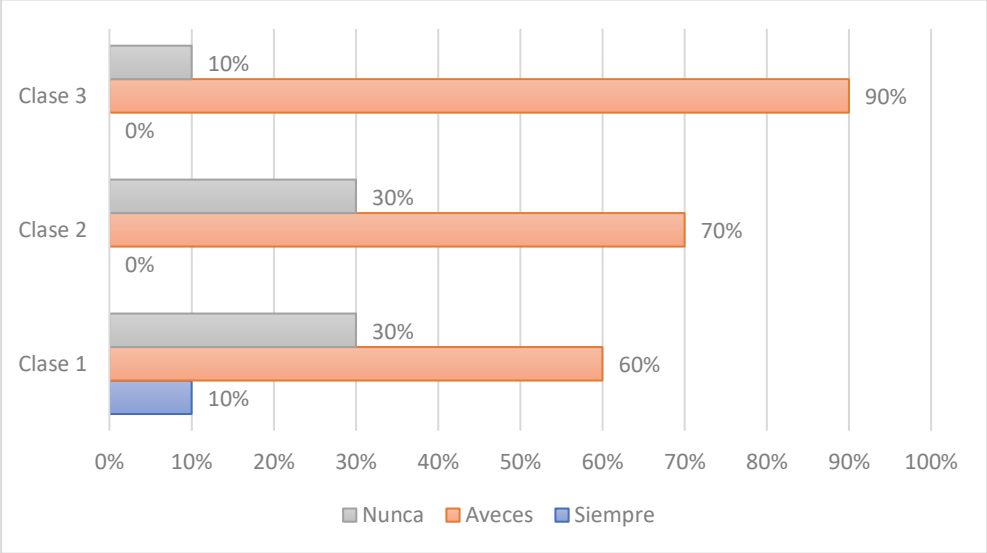


Source: Survey applied to teachers of the "José María Santana Salazar" Educational Unit of the Manta canton. Own elaboration.

An observation was made of a focus group of 10 students in three classes where indicators such as interest in expressions, receptivity through examples, motivation in classes, participation with peers, attention to the emotion of their classmates, among others, were evaluated; Obtaining among the main results that for the most part they are not motivated to carry out the tasks during the classes, they are also not receptive or pay attention to the emotions of their peers as shown in figure 3, where this action is only performed a few times.

Figure 3.

Indicator 5: Pay attention to the emotions of your peers



Source: Survey applied to teachers of the "José María Santana Salazar" Educational Unit of the Manta canton. Own elaboration.

About this, the Organization for Economic Cooperation and Development (2009) points out that mirror neurons facilitate empathy to pay attention to the emotions of individuals "seem to suggest the possibility of being able to instill empathy through carefully structured experiences, and in turn lead to a morally superior society and community " (p.279).

4. DISCUSSION

About the knowledge of mirror neurons and their benefits in the virtual learning process through the surveys applied to teachers, it was obtained that 66% know them; Among its benefits, they indicate improving empathy and facilitating virtual education, coinciding with Perozo et al. (2020) who point out that it is relevant for the teacher to know the benefits of mirror neurons to take advantage of them in the generation of knowledge through imitation, emotional and cognitive empathy. Regarding these statements, there is also a percentage of teachers who are unaware of the means and have limited resources to apply them, therefore the classes are not motivating or dynamic, which does not allow them to know the needs and interests of their students.

In the results of the interview, the expert Ormaza (2021) pointed out that mirror neurons contribute to education by giving guidelines on the functioning of the brain, the relationship that emotions have with thought, the relevance of the emotions transmitted by the teacher, among other to which Ruíz and Kwan (2020) agree that the contribution lies in how the brain works for learning and behavior, encompassing emotional and cognitive processes. Scientific studies confirm that mirror neurons contribute to the educational plane by helping teachers to plan their classes and adapt them to their students, creating pedagogical strategies for the classroom, through empathy that allows them to observe the interests of the student to improve their motivation.

Among the strategies that incorporate the benefits of mirror neurons in virtual learning, 48% of teachers indicated that communicative spaces should be maintained, and 45% that dialogue between participants is essential. Agreeing with Morris (2014) who recommend strategies for the virtual classroom to strengthen emotional

competencies through constant virtual contact, fostering interaction among their students, fostering collaboration, designing an appropriate load and evaluation.

It was also found that 52% indicated that the motivational and dynamic classes used by teachers in the virtual learning process have been somewhat effective. These results show that there are problems in the classrooms even though the teachers indicated that they promote motivating actions that, due to virtual limitations, have not obtained the desired results. Borges (2006) argues that it is important in online or virtual training, to promote motivation through dynamics and methodologies, for this must maintain closeness, flexibility, constant interaction, and collaboration.

55% of teachers indicated that it is difficult to attend to the emotional aspects of students in virtual learning, in addition, 45% indicated that they are somewhat trained for the application of virtual platforms. These results highlight the difficulties of adaptation to virtual education, which has not allowed an effective transmission of knowledge, generating demotivation in the parties. Urbaneja and Quintero (2020) indicate that the situation faced by students and teachers today is difficult, causing stress and exhaustion, in addition, there are deficient digital skills in teachers to teach classes in virtual classrooms since they are used to the face-to-face mode.

Among the emotions that have been evidenced in virtual classes, 50% indicated anger and 37% stress occasionally. About this, Fernández (2020) states that feelings such as sadness, uncertainty, stress, fear, anxiety are manifested in the crisis caused by the pandemic, which affects the emotional state of students. The expert consulted indicated that to attend to these emotions and obtain the benefits of mirror neurons, the current teacher must be creative, empathetic, know and understand the reality of the student, coinciding with Segarra et al. (2016) which indicates that teachers must have the ability to see beyond grades and faces, must know how to read to their students, understand them and understand their needs in certain situations.

According to the observation that was made to the teachers, it was found in them that they possess attitudes that manage to take advantage of the benefits of mirror neurons, among which it takes into account the expressions of the students, stimulates their participation, identifies moods, motivates, teaches his class with enthusiasm, setting an example to connect with them. This agrees with Galvis (2014) and Camacho et al. (2015) who point out that the teacher's activity must influence and enhance learning since the activation of mirror neurons depends on their attitudes in class, stresses that it is relevant to establish links so that students learn by taking advantage of these, the positive relationships as well as games and dynamics to achieve the collective attention process. Regarding what has been verified, the observed teachers are optimistic, avoid negative attitudes, are motivating and innovative, always looking for effective teaching methods and paying attention to the needs of students, thus taking advantage of the benefits of these in their classes, evidencing the empathy that achieves a better environment and coexistence.

Among the recommendations to enhance mirror neurons as an ideal condition in virtual learning, the survey determined that 60% support dialogues are always used, 60% motivational videos, 65% collaborative work, 80% empathic relationship, among others, to which Rodríguez (2019) suggests transmitting positive emotions and avoiding negative ones, promoting imitation, combining observation and action; carry out interactions, invent imitation games of acts that involve reading and physical activities, educate by example, create bonds in a climate of affection and respect, avoid violent acts, pay attention to emotions such as fear and frustration so as not to transmit them.

As for the students, the lack of empathy with their environment was also evidenced, this can be improved with the benefits of mirror neurons, for which it is recommended to propose strategies so that they are more empathetic between themselves and their peers, through activities of the group, where they praise each other, rate each other, support collaborative work and improve their social skills; This is in agreement with the OCDE

(Organización para la Cooperación y el Desarrollo Económico, 2009) which indicates that empathy can be instilled through group and social experiences carefully structured according to working groups.

According to the results obtained, the benefits of mirror neurons contribute to virtual learning through empathy and imitation, for this reason, it is necessary for the teacher to constantly update himself to be able to produce a greater activation of these, using various tools that adapt to the different learning environments, this is compared with studies by Tarqui (2019), Fernández (2020), and Segarra et al. (2016) where multiple advantages were found in mirror neurons for education, and they emphasize that if teachers do not take advantage of the benefits of being empathetic, dynamic, communicative, knowing their students, recognizing their needs, their differences, they will not find the timely tools to reach them and be able to teach them efficiently and meaningfully.

It is suggested to propose new studies on neuroscience, empathy, emotions, and their incidence in learning, in such a way that they contribute to the investigation by clarifying the exposed data.

5. CONCLUSIONS

The influence of the benefits of mirror neurons in the virtual learning of the students of the upper elementary school in the Educational Unit "José María Santana Salazar" of the Manta canton was analyzed, determining that the knowledge in this subject in the teachers is low. A large percentage cannot take advantage of its benefits because they have limited resources to apply them and the most relevant thing is that it has been very difficult for teachers to motivate their students in the virtual context, despite applying various methodologies they have felt emotions such as stress and exhaustion constantly in their students, for which they need to train and innovate in strategies that allow them to connect with students and understand their needs, which are functions of these neurons.

It was recognized that mirror neurons are those tools that facilitate learning through imitation and empathy, their benefits are wide in the educational area since they facilitate relationships between the teacher and their students, allow anticipating thoughts, intentions, feelings; Based on this, to respond to key aspects, to create strategies that consider the cognitive needs as well as those of the students.

It was determined that teachers incorporate the benefits of mirror neurons in virtual learning through positive attitudes, dynamics, games, optimism, motivation, innovation, and creating bonds of trust with their students through strategies based on empathy and creativity, through the example, collaborative work, communicative spaces, dialogue, constant communication, the strengthening of emotional competences through interaction, for this it is necessary to identify the individual circumstances of each student, to be able to attend the needs as a priority emotional development of these and develop autonomy and self-esteem in them, through curricular planning with activities and conducive evaluation.

It is recommended to apply strategies of games, dynamics, group work, forums, debates, support dialogues, creative and motivating spaces that allow enhancing mirror neurons as an ideal condition in virtual learning, transmit through example positive emotions such as empathy, solidarity, gratitude, and love, in these crises, you must work on fear management and stress management; considering essential for this the training and updating of the teacher, who has a primary role and must be empathetic through their language, gestures, example, and expressions, to strengthen emotional and cognitive skills that contribute to the formation of empathetic and sensitive individuals regarding others.

It is necessary to carry out future lines of research in terms of strategies that promote or activate mirror neurons, in such a way that it can be recognized which are the most appropriate for the educational field, always promoting continuous improvement.

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Carlina Vélez: conceptualización, investigación, metodología, administración del proyecto, recursos, software, supervisión, validación, visualización, escritura - preparación del borrador original, escritura - revisar & amp; edición.

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REFERENCES

Araya, S., & Espinoza, L. (2020). Aportes desde las neurociencias para la comprensión de los procesos de aprendizaje en los contextos educativos. *Propósitos y Representaciones*, *8*(1). https://doi.org/10.20511/pyr2020.v8n1.312

Arroyo, M., & Delgado, L. (2016). Experiencia con la educación virtual en el aprendizaje de los estudiantes de la facultad de filisofia dela universidad técnica de Manabí. *Revista de filosofía, letras y ciencias de la educación*, *1*, 65-72.

Barrios, H. (2016). Neurosciences, Education and Sociocultural Context. *Educación y Educadores*, *19*(3), 395-415. https://doi.org/10.5294/edu.2016.19.3.5.

Borges, F. (2006). La frustración del estudiante en línea. Causas y acciones preventivas. *Digithum2*, *7*. https://doi.org/10.7238/d.v0i7.536

Camacho, I., Gómez, M., & Pintor, M. (2015). Competencias digitales en el estudiante adulto trabajador. *Revista Interamericana de Educación de Adultos*, *37*(2), 10-24.

Chávez, L., & Chávez, R. (2020). Neurodidáctica como alternativa innovadora para optimizar el aprendizaje. *Revista Varela*, *20*(56), 145-157.

Cóndor, V., & Guapizaca, E. (2020). *Una mirada al aprendizaje basado en problemas y a la creación de entornos virtuales de aprendizaje inclusivos*. Universidad del Azuay.

Contreras, N. (2020). La neuroeducación y la educación virtual. Ponencia en el I Congreso Internacional de Humanidades Digitales y Cibercultura-CIHDYC de la Facultad de Humanidades de la Universidad de Los Andes. *Revista de investigación, docencia y extensión de la Universidad de los Andes*, *2*, 103-120.

Falconi, A., Alajo, A., Cueva, M., MEndoza, R., Ramírez, S., & Palma, E. (2017). Las neurociencias: una visión de su aplicación en la educación. *Revista Órbita Pedagógica*, *4*(1).

Fernández, A. (2020). 2020: Estudiantes, emociones, salud mental y pandemia. *Revista Andina de Educación*,

4(1), 23-29. https://doi.org/https://doi.org/10.32719/26312816.2021.4.1.3

Galvis, R. I. (2014). Las neuronas espejo y el desarrollo de la empatía frente a la agresión y el conflicto en la escuela. *Praxis pedagógica*, *14*(15), 43-53. https://doi.org/10.26620/uniminuto.praxis.14.15.2014.43-53

Garcés, A., & Sellán, K. (2017). *Influencia del desarrollo de la empatía en la calidad de actitudes positivas, en los estudiantes del quinto grado de educación general básica de la Escuela Romeo Murillo Pazmiño, de la zona 7, distrito 07D02, Provincia El Oro, cantón Machala, parroquia Ma*. Universidad de Guayaquil.

García, E., García, A., & Reyes, J. (2014). Relación maestro alumno y sus implicaciones en el aprendizaje. *Ra Ximhai*, *10*(5), 279-290.

Hernández, R., Fernández, C., & Baptista, M. (2017). *Metodología de la investigación* (Sexta).

Lozada, D., & Quimiz, A. (2018). *La neuroeducación como herramienta para potenciar el aprendizaje cognitivo usando la plataforma web moodle en la unidad fiscal "Carlos Urgilés González"*. Universidad de Guayaquil.

Ministerio de Educación. (2020). *¿Qué son los DECE?* Educación para la Democracia y el Buen Vivir.

Morris, M. (2014). La neuroeducación en el aula: neuronas espejo y la empatía docente. *La Vida y la Historia*, *3*, 7-18. https://doi.org/10.33326/26176041.2014.3

Nella, M. (2020). *Competencias y herramientas digitales para el docente en el contexto del COVID-19*. UIDE.

Organización para la Cooperación y el Desarrollo Económico. (2009). *La comprensión del cerebro: El nacimiento de una ciencia del aprendizaje* (Universida).

Ormaza, J. (2021). *Psicóloga Clínica, Analista DECE*. Aragundi, P. (entrevistador).

Orrego, M., & Crespo, J. (2017). *La empatía docente-estudiante y estudiante-estudiante y su relación con el aprendizaje de Química Inorgánica de los estudiantes de cuarto semestre de la carrera de Biología, Química y Laboratorio periodo septiembre 2016 febrero 2017*. Universidad Nacional de Chimborazo.

Oyola, T. (2017). *La neuroeducación una mirada holística en el proceso de la enseñanza y el aprendizaje*. Universidad pedagógica experimental libertado. Rubio - Venezuela.

Pérez, A. (2016). *La función de las neuronas espejo en el aprendizaje*. nueces y neuronas.

Perozo, E., Medina, S., & Nava, A. (2020). Beneficios de la neurogerencia para el docente en las universidades colombo-venezolanas. *Tendencias en la Investigación Universitaria*, *10*, 465-479.

Pulache, R. (2018). *Influencia de las neuronas espejo en los infantes*. Universidad Nacional de Tumbes.

Rodríguez, C. (2019). *Las Neuronas Espejo y el aprendizaje*. Educa y Aprende.

Ruiz, M., & Kwan, C. (2020). Aportes de la Neurociencia a la Educación. *Revista científica en ciencias sociales*, *2*(1), 63-71.

Sandoval, C. (2020). La Educación en Tiempo del Covid-19 Herramientas TIC: El Nuevo Rol Docente en el Fortalecimiento del Proceso Enseñanza Aprendizaje de las Prácticas Educativa Innovadoras. *Revista Tecnológica-Educativa Docentes*, *9*(2), 24-31. https://doi.org/10.37843/rted.v9i2.138

Segarra, L., Muñoz, M., & Segarra, J. (2016). Empatía y educación: implicaciones del rendimiento en empatía de profesores en formación. Análisis comparativo Universidad de Castilla la Mancha y Universidad Autónoma de Chile. *Revista Electrónica Interuniversitaria de Formación del Profesorado*, *19*(3), 173-183.

Tarqui, V. (2019). *Motivación como Estrategia Pedagógica para mejorar el Aprendizaje del inglés en Estudiantes del Segundo grado "A" en la Institución Educativa Secundaria Agropecuario de Asillo - Azángaro, 2018*. Universidad Andina Nestor Cáceres Velasquez.

Urbaneja, N., & Quintero, G. (2020). Aceleración de competencias digitales del docente para impartir clases virtuales por los efectos del covid 19. *Actas del V Congreso Investigación, Desarrollo e Innovación*, 104-120.

Vargas, K. (2020). *Enseñanza aprendizaje virtual en tiempos de pandemia*. Universidad Estatal del sur de Manabí.

Vázquez, L. (2020). *Aprendizaje basado en emociones: de la vergüenza al entusiasmo*. Universidad Jesuita de

Guadalajara.
Zuta, M., Arévalo, J., & Palma, F. (2017). Identidad cultural y desempeño docente en instituciones educativas. *Revista de Ciencias Humanas y Sociales*, *84*, 292-322.