

Development of an M-Learning application for early childhood education in emotional consciousness

Desarrollo de una aplicación M-Learning para educar en conciencia emocional a la primera infancia

Ingrid Selene Torres-Rojas* , Yuli Sidney Garcés-Bolaños , Daniel Antonio León Blanco

SUMMARY

Mobile Learning (M-Learning) is an educational innovation strategy with the potential to contribute to the development of emotional awareness competencies in early childhood. For this reason, an application prototype was built with gamification elements aimed at preschool students, in four vulnerable educational contexts in the city of Popayan (Colombia). The design methodology followed an iterative process in four phases - Analysis, Design, Testing, Delivery - and resulted in the validation of the visual design of the application by the end users, as well as a registration of the software. Additionally, the validation tests allowed us to conclude that the application in development facilitates the reflection, recognition, and management of their own emotions for infants.

Keywords: *Educational game, Mobil app, ICT, emotional development, early childhood education, mobile learning (Thesaurus IEEE y Unesco)*

RESUMEN

El Aprendizaje Móvil (M-Learning) es una estrategia de innovación educativa con el potencial de contribuir al desarrollo de competencias de conciencia emocional en la primera infancia. Por ello, se construyó un prototipo de aplicación con elementos de gamificación orientada a estudiantes de preescolar, en cuatro contextos educativos vulnerables de la ciudad de Popayán (Colombia). La metodología de diseño siguió un proceso iterativo en cuatro fases - Análisis, Diseño, Pruebas, Entrega - y arrojó como resultado la validación del diseño visual de la aplicación por

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parte de los usuarios finales, además de un registro del software. Adicionalmente, las pruebas de validación permitieron concluir que la aplicación en desarrollo les facilita a los infantes la reflexión, el reconocimiento y el manejo de las propias emociones.

Palabras clave: *Juego educativo, aplicaciones móviles, TIC, desarrollo afectivo, educación de la primera infancia, aprendizaje móvil (Tesaurus IEEE y Unesco)*

INTRODUCTION

In Latin America in 2019, 69 % of the population has a smartphone with a partial or constant internet connection, according to the report “The mobile economy 2020” by 2025 79 % of the population will have adopted this technology. Within this category of smartphones are tablets, touchscreen devices that allow through touch, usually the index finger, to open a world of interactivity and communication that can be used for learning (1).

The inclusion of these devices from an early age can enrich the learning of transversal and specific competencies. Although research on the influence of mobile devices on learning outcomes is incipient, reports show that these devices affect learning determinants such as motivation and attention, while improving the classroom climate, if they are used under the supervision of teachers and are integrated into classroom activities and dynamics (2). As indicated in (3), in a study on the perception of the impact that the use of tablets has on the learning of children in grades 5 and 6 of primary school in Spain, these devices favor the development of transversal competencies such as autonomy, initiative, collaborative work, and critical spirit, as well as the promotion of digital competencies and those specific to the subject or the content of applications or resources used.

For this reason, in this study, the design of an M-Learning application seeks to educate this inherent need of the human being “emotional education”; which presents a very little approach in educational institutions, especially because priority is given to the development of other areas (mathematics and language), instead of developing in continuous programs this type of

learning that is required from early education (4). The importance of working on the control of emotions allows for a healthier environment for children and a better learning process, especially because the designed strategy seeks to be implemented in children at high risk of vulnerability, since the students of the Educational Institutions where this strategy is intended to be implemented are displaced by violence, live in conditions of poverty (settlements) and present high school absenteeism, leading many of the children who start their studies to be unable to finish them. This is also another high-risk factor because by not attending classes, they miss the opportunity to intervene in their emotional world in time, resulting in emotional disorders in adolescence or adulthood (5). In studies with similar populations (aboriginal children), a double risk of vulnerability for social development (RR = 2.00; 95 % CI, 1.89-2.12) and 89 % risk of emotional vulnerability (RR = 1.89; 95 % CI, 1.77-2.02) were found (6).

Working on the control of emotions allows for a healthier environment for children and therefore a better learning process. In a study they found through a multilevel analysis, how the cumulative stress of teachers and their assistants is associated with feelings of aggression, anger, anxiety, and lack of social competence in their students, therefore, transformation is required in the classroom with tools such as the one developed in this research that contributes to the transformation of the human being in the infant stage (7).

Therefore, the purpose of this application is to provide support to early childhood teachers in the education of emotional awareness through ICT tools provided by the Colombian National Government, through strategies such as “Computadores Para Educar - CPE, a program of greater social impact that generates equity through ICT, promoting the quality of education under a sustainable model”. This program encourages the use of ICT tools by delivering devices such as computers, tablets, and training to different teachers in public schools. Considering that only in the department of Cauca, as of December 31, 2019, 86 170 tablets and 80 304 computers have been delivered, thus guaranteeing a terminal for at least 4 students (8).

In addition, emotional education currently shows greater importance in training and it is stated that this process should be continuous and permanent, as it requires training at all stages of the life cycle: birth, early childhood education, primary basic education, basic secondary education, higher education and throughout adult life (9), thus generating a transformation in the classroom and learning, which can be understood as an approach to train life skills, leading to prevent social problems in the future of human beings (10). Thus, have analyzed several studies that show how training in EI (Emotional Intelligence) or this type of skills in children and adolescents obtains relevant benefits in the school context, such as better physical and mental health, greater well-being, lower risk of substance abuse, less aggressive behavior and better academic performance (11,12).

This project is carried out through mobile learning or M-Learning, which is defined as a learning methodology different from the traditional one that includes specific and simple tasks that allow promoting non-formal education to obtain skills and knowledge such as emotional intelligence (13). It is thus supported by the benefits of education on digital platforms that make use of the network, without the need for direct physical contact with the teacher, where self-taught learning stands out (14). Used for mobile devices with the Android operating system, it is supported by gamification elements that manage to capture the attention of children between 5 and 7 years old. Using Gamification (15) allows incorporating dynamics, mechanics, and game components in virtual learning environments, such as reward, competition, and solidarity; mechanics that invite the student to continue playing while achieving a final goal in an altruistic way.

METHOD

Methodological design

The design was based on the construction of the M-Learning strategy based on elements of gamification and development methodology. The construction of the research prototype was based on the ADPE (Analysis, Design, Testing, Delivery) methodology for the development

of mobile applications based on M-learning proposed by Garrido and Chiza (16), proposing the following phases: Phase I Scope, Phase II Testing and Phase IV Delivery.

The activities were designed and analyzed by an interdisciplinary team made up of a psychologist, an electronics and telecommunications engineer, a visual designer, and students from research groups who are part of three research groups in Higher Education Institutions (IES) (Bachelor's Degree in Early Childhood Education at Uniautónoma, Systems Engineering at Uniautónoma and Visual Design at Unimayor).

This process is associated with gamification, which transfers the mechanics of games to the educational environment, improves the user's experience, makes the user become committed, and motivated, and acquires a better spirit of improvement at the time of learning (15). In this case, we sought to educate emotional awareness, which is proposed as the first step to addressing the pentagonal model suggested by (17,18). The activities proposed in the work with the children are taken up again in a didactic and creative way using pedagogical strategies with the body (dance, situations, and expression of gestures), didactic activities (coloring, work with plasticine, slogans, alphabet soup, building words) and classroom games (sounds, puzzles, emoticons, forming pairs) that favor significant learning in the student (19).

Population

As part of these comprehensive care mechanisms, the project seeks to support emotional education processes, taking advantage of the fact that the institutions were beneficiaries of the "Computers to Educate" program, a Colombian government initiative implemented through the Ministry of Technology and Communications, MinTic, which encourages the use of ICT tools in educational institutions in vulnerable areas through the delivery of devices such as computers and tablets, as well as training for teachers in public schools. Only in the department of Cauca, as of December 31, 2019, 86,170 tablets and 80,304 computers have been delivered, thus guaranteeing a terminal for at least 4 students (8). However, in the absence of

educational software, there is an underutilization of the devices that do not correspond to the enthusiasm aroused in students by the use of the equipment during class sessions.

The research population was preschool children (transition grade) in a range of 5 to 7 years, who are part of public sector educational

institutions in the city of Popayán - Cauca (Table 1), who are in vulnerable situations, because they have high levels of poverty (being of strata 0 and 1), forced displacement by armed conflict, discrimination of inequality, unemployment, overcrowding, drug addiction, absence of one of the two parents, early pregnancy, domestic violence, among others.

Table 1
Project population

Educational Institution	Number of Courses	Students	Boys	Girls
Institución Educativa Niño Jesús de Praga	2	43	33	15
Institución Educativa Gabriela Mistral - Sede El Uvo	1	21	13	8
Institución Educativa Gabriela Mistral – Sede Bella Vista	1	23	13	9
Institución Educativa Gabriela Mistral – Sede Mixta Cauca	1	24	14	10
Institución Educativa Normal de Popayán	3	84	48	36
Institución Educativa La Pamba	1	22	13	9
Totales	9	222	135	87

Source: Own elaboration

RESULTS

Results of Phase 1. Scope

In this phase, requirements engineering is applied to elicit requirements to avoid critical points in the development of the application. For each requirement, the analysis, specification, and validation are done through techniques such as interviews, brainstorming, observation, social analysis, and prototyping. Techniques proposed in the SWBook 3.0 (Guide to the Software Engineering Body of Knowledge). Within the scope of the application, it is established for the education of emotional awareness in children of the selected population, the teaching of the emotion’s happiness, sadness, fear, joy, love, gratitude, and anger, designed as shown in Figure 1, through one of the strategies.

The application is developed through levels, each level is a module oriented to the learning of emotions mediated by game mechanics or playfulness (20), the child who starts the



Figure 1. Emotional Emoticons. Note: With the same functions and characteristics as the table notes.

application must feel at all times that he/she is playing. All the modules have the avatar shown in Figure 2, identified as the tutor of the application; this avatar teaches the child about emotions and guides him/her on the use of the application and the progress of the game as he/she goes through each level.



Figure 2. Avatar of the prototype. Source: Own elaboration.

Gamification is defined as a learning technique that aims to bring game mechanics to

the educational and professional environment, through the implicit structure of the game known as dynamics, the basic components that cause the development of the game, its rules, its engine, and operation (mechanics) and its components as resources available to design the activity (21). Its main objective is to enhance motivation, concentration, effort, and other common values developed among the players, through elements such as points, progress bars, avatars, and rankings that involve the user’s feelings of autonomy, commitment, competitiveness, and social relations (22). Some levels proposed for the delivery of the prototype are presented in Table 2.

Table 2
Levels of the learning methodology proposed for the delivery of the prototype

How to quote	Name	Description	Gamification Technique
0	Identification	In this level, the student starts the session with the help of the teacher and identifies himself with his name throughout the application.	Individual or group missions or challenges, customization.
1	The dance of emotional awareness	In this level, the student listens to a series of sounds and chooses the face of what makes him/her feel the sound, finally, he/she draws what he/she feels. A diagnostic impression is made about the student's knowledge of emotions.	Reward, Levels
2	Emotional emoticons	At this level, the application explains to the student the meaning of each emotion and finally asks the student to select how he/she feels and shares with peers the feeling. This application will be played whenever the child logs in regardless of their progress in the application. The selected information is stored in the database for further analysis.	Reward, solidarity, levels
3	Sounds and emotions	In this level, the student listens to the sounds of bottles with some element inside them and chooses the feeling it produces.	Reward, competition, levels
4	Touch and emotions	At this level, the student must have his eyes covered and touch different shapes with his hand, finally selecting how he feels after the process.	Reward, levels
5	Expressing emotions	In this level, the student makes groups of 4 students, closes his eyes, and remembers a moment suggested by the application, finally, a picture is taken to represent the feeling. The image is stored in a database for later analysis.	Reward, solidarity, levels
6	Painting Emotions	At this level, the student draws on a canvas of what the music that is playing at that moment provokes in him/her. The idea is to get him/her to represent the emotion associated with the type of music that is playing. The drawn image is finally stored in the database for later analysis.	Reward, Levels, Challenge
7	Forming Emotional Faces	In this level the student must build the face corresponding to the one selected on the screen according to his current feeling, he must drag to the main avatar the eyebrows, the eyes, the mouth, and the hands of the correct face.	Personification, challenge, levels, reward, levels, reward, competition
8	How do cartoons feel?	The student must associate the emotion felt by the cartoon shown through a video, the idea is to identify the emotions through the identified expressions.	Challenge, levels, reward
9	Finding emotional partners	At this level, the student must relate the emotional face represented by a real person with the avatar selected for that emotion, the idea is that he/she makes all the complete relations.	Challenge, levels, reward

Source: Own elaboration.

With the objective of the subsequent analysis of results, the most important elements of the student's journey in the interaction with the application are stored, such as the score obtained, the emotion of each day, the photos of their faces in a particular situation, among others (which can be visualized by the teacher through the web platform). That is why each student must be previously characterized within the application associated with each teacher who will be the administrator of the platform where the information is displayed.

Results of Phase 2. Development

The proposed architecture for the System is shown in Figure 3 Client - Server, where the clients are the students accessing from mobile devices/tablets to the application or computers for the administration of the web platform, they

are in charge of making requests; the server is located in the cloud and is in charge of storing and processing the information (23). Communication over the Internet is done through REST APIs, since it is known as a logical and efficient standard for creating services (24).

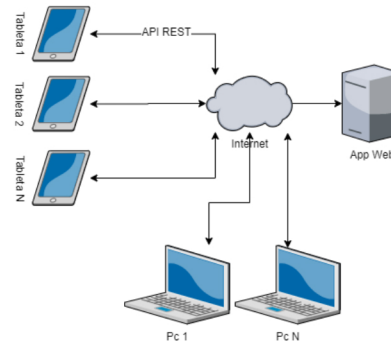


Figure 3. Client Server architecture of the learning methodology. Source: Own elaboration.

Regarding the technological considerations and for the development of the strategy (some specifications are explained in detail in Table 3), totally free tools are selected for the implementation of the web application, and the database space is purchased in the Hostinger application server. The starting point was NTS,

a leading technology company in consulting, development, and implementation of mobility information systems, since the Android operating system was present in 85 % of the world's smartphones, it was decided that the prototype would be developed only for this type of device (25).

Table 3
Specific technological considerations for the application

	Item	Description
Mobile Application	Native Language	Android
	Programming Language	JAVA
	Build Version	28
	Build Tool Version	29.0.2
	Minimum Supported Version	15
	Maximum Supported Version	28
	Development IDE	Android Studio 3.5.3
	Version	APK v13
Application Web	Programming Language	HTML5, CCS3, Javascript, PHP
	Development IDE	Visual Studio Code 1.43.2
Application server	Disk space	20Gb
	Bandwidth	Unlimited
	RAM memory	512 1CPU
	Database	Mysql 5.0.12
	Owner	Hostinger
	Address	https://conciencia.educarenemociones.com/index.php

The prototype development process was based on the SCRUM agile methodology (Figure 4), a complete process that adapts to the software life cycle, from design to implementation (26).

For each module defined within the group of requirements of phase 1, the respective sprint was carried out: planning, design, construction, testing, and review.



Figure 4. Sprint: Planning, design, construction, testing, and revision. Source: Taken from Learning Agile Scrum Methodology Using the Goupware Tool Trello.

The result obtained from the process was a fully functional module shown to the client for its passage to the testing phase and then, some images of the application are shown, which are

saved on the web page as shown in Figure 5, for pedagogical use, analysis and support of the children's teacher.

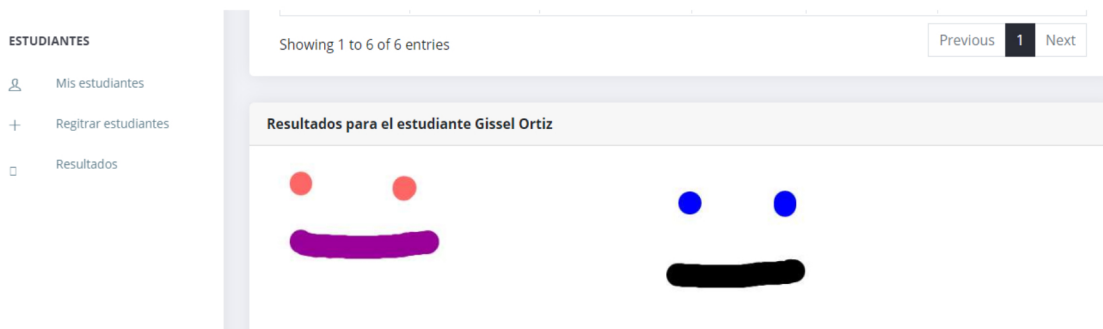


Figure 5. Report of a student's drawing from the web platform. Source: own elaboration.

Results of Phase 3. Tests

In this phase, students of the transition grade of the Institución Educativa Niño Jesús de Praga aged between 4 and 6 years old were tested. The application was installed on several tablets of the program Computers to educate ProFuturo project with the following characteristics:

- RAM memory: 2GB
- CPU: Snapdragon 425
- Android version: 7.0
- Resolution: 1280x800

DEVELOPMENT OF AN M-LEARNING APPLICATION

In the Educational Institution, the internet connection for downloading the installation file on the tablets was precarious; however, the operation of the application was successful, since the requests generated to the server do not occupy large bandwidth. The group of 4 thesis students from the research group Development of Socio-affective Skills DHASA, registered as teachers (administrators) in the web application, developed the test. Each one worked with groups of 6 children (Figure 6).



Figure 6. Prototype testing activities. Source: Photograph taken by the work team.

The test consisted of applying informed consent to the parents of the children who participated in the process, then the development of the first 5 activities of the EmotionApp application was carried out, while the participants used the devices, the testers asked about the development of the activity, inquired about the understanding of the activities, the appearance of the interface and its ease or difficulty of use. Each kept a field diary in which they recorded the children’s statements.

The participants’ comments or observations were grouped into three categories: functional, ergonomic, and visual/interactive. Among the

functional recommendations, the need to prevent a student from leaving the application by mistake and to store the login (to avoid inconveniences when logging in again) stood out. In terms of ergonomics, there was a need to place the tablet on a base or support for better handling by the students and to control the volume of some songs and sound resources of the application, on this point, for some activities it was necessary to use headphones, which made some participants uncomfortable, as they dropped them or were not used to them.

Regarding the visual and interactive elements, the character seemed “nice”, “funny”, “fun” and “friendly”, since his first appearance in the app, they called him “little friend”. Also, it could be noted that there was confusion in some of the character’s emotions, the children mentioned that the face of fear and sadness “looked very similar”, while the other emotions (joy, anger, love, and gratitude) were identified without major problems. For some children the character’s voice was pleasant, others said it seemed very “childish”. The students identified the buttons and related them to their functionality since most of them said they knew them from other applications or games installed on their parents’ or relatives’ cell phones.

Results of Phase 4. Delivery

In this phase and after validating the application in the testing phase, the software registration request is made to the National Directorate of Copyright, Special Administrative Unit of the Ministry of the Interior through the online registration (<http://www.registroenlinea.gov.co/index.htm>), delivering the installation file of the EmotionApp strategy, user manual, and documentation of the same, obtaining software support registration Number 13-78-443 in March 2020, as shown in Figure 7 (27).

RADICACIÓN	FECHA SOLICITUD	REGISTRO	TÍTULO OBRA	TIPO OBRA	ESTADO
1-2020-20803	03/03/2020	13-78-443	EMOTIONAPP	REGISTRO DE SOPORTE LOGICO - SOFTWARE	REGISTRADO

Figure 7. Software registration initial phase.

DISCUSSION

The Ministry of Education in Colombia has been forceful in determining the necessary mechanisms to promote the development of boys and girls in early childhood, through quality educational services, education being a right of the people where the State, society, and the family, who are co-responsible for its guarantee (28). However, the socioeconomic environment in which some of the children who participated in this project are excluded, delaying their educational processes (especially in times of pandemic where they study from home). This situation is explained by the limited accessibility resources they have to access the Internet or technologies.

However, the validation of M-Learning allowed the education of emotional awareness in transitional children, since only they recognized the emotions of joy and sadness with little knowledge, having averages between 3 and 3.25 to end with the knowledge of the six emotions proposed in the project (surprise, fear, sadness, joy, love, anger). This leads to highlighting how ICTs have become an essential tool for learning in the classroom and also in the home, establishing new models of communication and generating spaces for training and information for the family (29). One of the stories expressed by a mother of a child says “the APK, it was very fun, very interesting, this little game, my son had fun taking pictures and making gestures and he was waiting for the other activities to continue working” (DC:10/ N: IENS79/R:05), as shown in Figure 8.

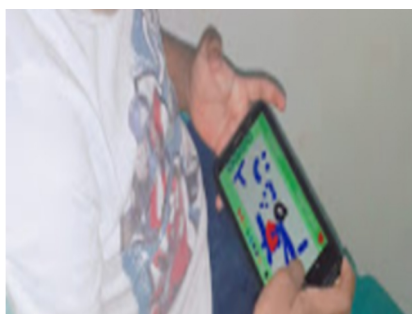


Figure 8. Students are in comfort with accessibility to technological devices. Source: Photo taken by a family member of the students.

Also with the use of this technological tool, some pedagogical strategies (emotional emoticons, bottle sounds, drawing emotions from songs, and looking for emotional pairs) were of great contribution to learning about emotional awareness, reflecting on the sounds presented in the application (Figure 10), the emotions felt with phrases such as “...this bottle sounds like Kellogg’s, the one in love, and this one sounds weird, it is the emotion of joy” (GF. CUA#6) and from their behavior by drawing the way they understand emotions in this process (Figure 9). This diversity of pedagogical strategies allows influencing the student, from the internalization of the contents and from the function of developing motor, cognitive, communicative, and aesthetic skills (30) and even more when ICTs are used (31).



Figure 9. Drawings made by a student from a technological device. Source. Report retrieved from the application’s web platform.



Figure 10. Activity screen 3 “Sounds and emotions.”

On the other hand, the process allowed strengthening communication bonds between parents and students, increasing their self-esteem and contrasting the theory that affirms

the importance of the family as a process that generates significant learning of emotions, “when mom and dad go out holding hands, it is a way of showing or manifesting the emotion of love” (DC2-N2-R4) (DC2-N2-R4). The family is the most appropriate context for the child from the very beginning to start living in society, requiring a climate of affection, trust, communication, and mutual respect to facilitate the construction of personal identity (32,33), although in some models of subsistence this responsibility is left to third parties (34).

CONCLUSIONS

The development of the M-Learning application for the education of emotional awareness in transition children is an iterative process of continuous improvement, and the first stage of application, which concluded with the software registration, showed that there is interest on their part for the content and appearance of the application. In terms of visuals and interaction, the activities are understandable and attract the attention of the participants. The emoticons and avatars are identified by the students so that students recognize the emotions associated with each representation.

The pedagogical experiences with applications do not describe much evidence on the construction of competencies in emotional awareness, and the fact that the children of the Institutions associate an emotion with a visual representation, and also express with words the name of it, is an indication of the construction of learning and the development of skills for the recognition of emotions, a fundamental element for them to be aware of them.

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REFERENCES

1. León H. De la generación del pulgar a la generación del índice. *Teknokultura Rev Cultura Digital y Movimientos Sociales*. 2012;9(1):177-181.
2. Sánchez-Martínez C, Ricoy MC. Uso de las APPs con la tableta en la educación primaria y competencias asociadas. *Rev Estudios Invest Psicol Edu*. 2017;13(2017):001-005.
3. Mar M, Francesc E. El uso de las tabletas y su impacto en el aprendizaje. Una investigación nacional en centros de Educación Primaria. *Rev Educación*. 2018;379:170-191.
4. Wilkinson JE, Kao C. Aspects of socio-emotional learning in Taiwan’s preschools: an exploratory study of teachers’ perspectives. *Intern J Child Care and Education Policy*. 2019;13(1):1-17.
5. Finning K, Ford T, Moore DA, Ukoumunne OC. Emotional disorder, and absence from school: findings from the 2004 British Child and Adolescent Mental Health Survey. *Eur Child Adolescent Psychiat*. 2019;29(2):187-198.
6. Williamson A, Gibberd A, Hanly MJ, Banks E, Eades S, Clapham K, et al. Social and emotional developmental vulnerability at age five in Aboriginal and non-Aboriginal children in New South Wales: A population data linkage study. *J Equity in Health*. 2019;18(120):1-12.
7. Jeon L, Buettner CK, Grant AA, Lang SN. Early childhood teachers’ stress and children’s social, emotional, and behavioral functioning. *J Applied Develop Psychol*. 2018;1:1-12.
8. MEN. Computadores para educar, Entrega de Terminales en Sedes Educativas [Internet]. 2020. Available from: <https://colombiatic.mintic.gov.co/679/w3-propertyvalue-36665.html>
9. Bisquerra R. Educación emocional. Documento inédito elaborado para las I Jornadas del Máster en Resolución de Conflictos en el Aula. 2016. <https://www.coursehero.com/file/44156164/Bisquerra-R-2016-Educaci%C3%B3n-emocionalpdf/>
10. Torres-Rojas IS. Plan de orientación y acción tutorial, una estrategia en procesos socio-afectivos de la infancia. In: *Construcciones, aportes y elaboraciones en educación infantil*. Colombia: USC Universidad Santiago de Cali;

- 2020.p.179-197. <https://repository.usc.edu.co/bitstream/20.500.12421/4245/1/Libro.pdf>
11. Fernández-Berrocal P, Cabello R, Gutiérrez-Cobo MJ. Avances en la investigación sobre competencias emocionales en educación. *Rev Interuniv Formación del Profesorado*. 2017;31(1):15-25.
 12. Fernández-Berrocal P, Cabello R, Gutiérrez-Cobo M. sobre competencias emocionales en educación. *Rev Interuniv Formación del Profesorado*. 2017;88(31.1):15-26.
 13. Gracia E. Mobile learning y gamificación en la didáctica de las ciencias experimentales: Diseño de una experiencia innovadora y su aplicación en secundaria. Tesis para optar el título de Máster en Educación. Universidad de Zaragoza; 2012. <https://zaguan.unizar.es/record/31030?ln=es>
 14. Al-Emran M, Mezhyuev V, Kamaludin A. Towards a conceptual model for examining the impact of knowledge management factors on mobile learning acceptance. *Technology in Society*. 2020;61:1-13.
 15. Andrés-Roqueta C, Benedito I, Soria-Izquierdo E. Emocionatest: una herramienta digital (app nativa) para la evaluación de la comprensión emocional en niños y niñas de edad escolar. *Psicología y Educación: Presente y Futuro*. Alicante: ACIPE. 2016:2573-2581
 16. Garrido F, Chiza J. Methodical guide for Development on Mobile Applications focused on m-learning. In: *International Conference on Computational Science and Its Applications Computational Science and Its Applications -ICCSA2018. Lecture Notes in Computer Science*; 2018. https://www.academia.edu/33232668/Design_development_and_evaluation_of_a_mobile_learning_application_for_computing_education
 17. Bisquerra R, Pérez N. Las Competencias Emocionales. *Educación XXI*. 2007;10(1):61-82.
 18. Bisquerra Alzina R, Mateo Andrés J. Competencias emocionales para un cambio de paradigma en educación. Madrid - España: Horsori; Cuadernos de Educación. 2019. <https://www.rafaelbisquerra.com/libros/competencias-emocionales-para-un-cambio-de-paradigma-en-educacion/>
 19. Agullo M, Cabero M, Pellicer I, Sánchez R, Vásquez M. Educación emocional en la escuela. Tomo 2. Actividades para el Aula, dirigidas a niños de 6 a 7 años. México: Alfaomega; 2013. <https://www.rafaelbisquerra.com/libros/competencias-emocionales-para-un-cambio-de-paradigma-en-educacion/>
 20. Melo-Solarte D, Díaz P. El Aprendizaje Afectivo y la Gamificación en Escenarios de Educación Virtual. *Información Tecnológica*. 2018;29(3):297-248.
 21. Zapata Z. Estrategias metodológicas de la gamificación en el aprendizaje (Tesis para optar el título de Profesional en Educación primaria). Universidad de Guayaquil; 2019. <http://repositorio.ug.edu.ec/handle/redug/45399>
 22. Rienzo A, Cubillos C. Research of Gamification Techniques and their Application in Digital Games for Older Adults. In: *IEEE CHILEAN Conference on Electrical, Electronics Engineering, Information and Communication Technologies, CHILECON 2019*. https://www.researchgate.net/publication/339173898_Research_of_Gamification_Techniques_and_their_Application_in_Digital_Games_for_Older_Adults
 23. Oliveira G, de Abreu J, Maciel J, Kapp N. Implementação do Módulo Web Baseado na Arquitetura Cliente-Servidor para o Aplicativo Móvel Educacional e Open-Source Sem'lo. In: *In Anais XVI Congresso Latino-Americano de Software Livre e Tecnologias Abertas [Internet]*. Porto Alegre: SBC; 2019.p.135-138. Available from: <https://sol.sbc.org.br/index.php/latinaware/article/view/10347>
 24. Burgos LE. Análisis y evaluación de las arquitecturas REST y SOAP para el desarrollo de servicios web aplicados al ERP AdrisERP y su versión móvil en Android (Tesis para optar el título de ingeniería de sistemas). Repositorio Institucional - USS. Universidad Señor de Sipán; 2017. <https://repositorio.uss.edu.pe/handle/20.500.12802/4067>
 25. NTS. nts-solutions.com [Internet]. 2020. Available from: <https://www.nts-solutions.com/blog/dispositivos-android.html>
 26. Naik N, Jenkins P, Newell D. Learning Agile Scrum Methodology Using the Groupware Tool Trello Through Collaborative Working. *Advances in Intelligent Systems and Computing*. 2020;993:343-355.
 27. Garcés Y, Torres-Rojas I, Calle N. EMOTIONAPP (versión 13-78-443) [software]. Ministerio del Interior - Dirección Nacional de Derecho de Autor. Colombia. Androi con lenguaje AVA; 2020. <https://research.aston.ac.uk/en/publications/learning-agile-scrum-methodology-using-the-groupware-tool-trello->
 28. Mineducación. Bases curriculares para la Educación Inicial y Preescolar. Colombia: De Cero a Siempre - Imprenta Nacional;

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2017. https://www.mineduacion.gov.co/1780/articles-341880_recurso_1.pdf
29. Sierra Lorente J, Bueno Giraldo I, Monroy Toro S. Análisis del uso de las tecnologías TIC por parte de los docentes de las Instituciones educativas de la ciudad de Riohacha. *Revista Omnia*. 2016;22(2):50-64.
30. Cortés A, García G. Estrategias pedagógicas que favorecen el aprendizaje de niñas y niños de 0 a 6 años de edad en Villavicencio-Colombia. *Rev Interam Investigación, Educación*. 2017;10(1):125-143.
31. Cudris-Moreno M, Cudris-Torres L, Bustos-Arcón V, Olivella-López G, Medina-Pulido PL, Moreno-Londoño HA. Educational technology and academic performance in students of public educational institutions during confinement by COVID-19. *Gac Med Car*. 2021;128:S336-349.
32. Molano-Castro L, Cudris-Torres L, Barrios-Núñez A, Alvis-Barranco L. Acompañamiento familiar y rendimiento académico en estudiantes colombianos en edad escolar. *Arch Ven Farmacol Ter*. 2020;39(3):251-256.
33. García A. Los valores y las nuevas tecnologías en la Educación familiar: programa de. Iniversidad de Murcia; 2015. https://www.researchgate.net/publication/338479017_Valores_Nuevas_tecnologias_y_Educacion_Familiar
34. Guzman K, Bastidas B, Mendoza M. Estudio del rol de los padres de familia en la vida emocional de los hijos. *Apuntes Universitarios*. 2019;9(2):61-72.