Article **Journal of Critical Pedagogy**
June 2023, Vol.7 No.17 12-20

Dream Scape: Gamificando las funciones cognitivas

Dream Scape: Gamifying cognitive functions

GAMBOA-RODRIGUEZ, Patricia Guadalupe†*[1], RODRÍGUEZ-VARGAS, María de Jesús[2], GARDUZA-CASTILLO, Kelsy Elise[1] and JIMÉNEZ-ZARATE, Lizbeth[1]

[1]Tecnológico Nacional de México – ITS Coatzacoalcos. División de Ingeniería en Animación Digital y Efectos Visuales. Carretera Antigua Minatitlán Km. 16.5, Reserva Territorial, Veracruz, MÉXICO. Teléfono (921) 13-45891
[2]Universidad Tecnológica del Suroeste de Guanajuato, Tecnologías de la Información.

ID 1st Author: *Patricia Guadalupe, Gamboa Rodríguez* / **ORC ID:** 0000-0002-0865-3298

ID 1st Co-author: *María de Jesús, Rodríguez Vargas* / **ORC ID:** 0000-0002-3849-622X

ID 2nd Co-author: *Kelsy Elise, Garduza Castillo* / **ORC ID:** 0009-0002-9687-6092

ID 3rd Co-author: *Lizbeth, Jiménez Zarate* / **ORC ID:** 0009-0005-8117-0814

DOI: 10.35429/JCP.2023.17.7.12.20 Received March 20, 2023; Accepted June 30, 2023

Abstract

In Mexico, learning problems affect educational quality and hinder pedagogical planning. There is a lack of updating in learning methods and academic training, as well as insufficient commitment to the educational system. Additionally, public servants and administrators show inefficiency in education preparation. (De Ibarrola Nicolín, 2012) However, games have been proven to be an effective tool for improving student learning and motivation. Gamification, based on neuro didactics, aims to strengthen learning through brain functions such as motivation and attention. (Briones Cedeño & Benavides Bailón, 2021). A gamification tool called Dream Scape is presented, focusing on enhancing cognitive functions related to recognition and language. An experimental study was conducted with 66 third-grade students from two schools, using data collection tools and traditional evaluations. The results showed that gamification is motivating and stimulating, improving academic performance and student participation. In conclusion, gamified tools can enhance students' knowledge.

Gamification, Education, Learning

Resumen

En México, los problemas de aprendizaje afectan la calidad educativa y dificultan la planificación pedagógica. Existe una falta de actualización en los métodos de aprendizaje y formación académica, así como un compromiso insuficiente con el sistema educativo. Además, los servidores públicos y directivos muestran inconsistencia en la preparación en la educación de acuerdo con las competencias que día a día se demandan (De Ibarrola Nicolín, 2012). Sin embargo, los juegos se han demostrado como una herramienta efectiva para mejorar el aprendizaje y la motivación de los estudiantes. La gamificación, basada en la neuro didáctica, busca fortalecer el aprendizaje a través de funciones cerebrales como la motivación y la atención. (Briones Cedeño & Benavides Bailón, 2021) Se desarrolla una herramienta de gamificación llamada Dream Scape, que se enfoca en fortalecer las funciones cognitivas relacionadas con el reconocimiento y el lenguaje. En esta investigación se realizó un estudio experimental con 66 alumnos de tercer grado de dos escuelas, aplicando una herramienta de recolección de información y evaluación tradicionales. Los resultados mostraron que la gamificación es motivante y estimulante, mejorando el rendimiento académico y la participación de los estudiantes.

Gamificación, Educación, Aprendizaje

Citation: GAMBOA-RODRIGUEZ, Patricia Guadalupe, RODRÍGUEZ-VARGAS, María de Jesús, GARDUZA-CASTILLO, Kelsy Elise and JIMÉNEZ-ZARATE, Lizbeth. Dream Scape: Gamificando las funciones cognitivas. Journal of Critical Pedagogy. 2023. 7-17: 12-20

* Correspondence to Author (e-mail: pgamboar@itesco.edu.mx)
† Researcher contributing as first author.

Introduction

The basis of student learning is in the first three years of basic school, being the most important throughout the student's life, starting from learning to read (Caballeros Ruíz, Sazo, & Gálvez Sobral, 2014).

In Mexico, learning disabilities are a reality that affects educational quality and hinders pedagogical planning. Despite this, there is a lack of updating in learning methods and academic training, as well as a lack of commitment to the education system. In addition, there is a notorious inefficiency in the educational preparation of public servants and managers (Muñoz Izquierdo, 2012).

It has been demonstrated that games can be an effective tool for teaching and learning, as students can take advantage of the knowledge of the characteristics of goals, rewards and levels to improve their academic performance. Furthermore, the use of games in education has been associated with increased student motivation and engagement, which can improve the quality of their learning (Ortíz Colón, Jordán, & Agredal, 2018).

Studies have also shown that the implementation of learning styles that identify how students perceive and process information can further improve learning outcomes. (Sailer, Ulrich Hense, Mayr, & Mandl, 2017).

This is known as Gamification which according to Rousseau's postulate defines it as the strengthening of cognition through brain functions such as: motivation, attention and memory in a framework of emotions, activated by neurotransmitters such as dopamine and serotonin, containing among its elements stimulus, discovery, narrative and ambience. (Castillo, 2021); of which has as its basis the neuro didactics that according to (Pherez, Vargas, & Jerez, 2018), establishes that it has the mission to give theoretical support to the design of didactic strategies based on the performance of the brain to strengthen learning, as well as its educational basis in the need to learn in an environment of freedom and spontaneity through play to develop personal and social skills.

Playful learning, has been figured mainly according to the teaching applied in video games, according to the different forms and levels used, the authors mention why not apply it to the themes and factors involved in the teaching-learning process. (Guerra Antequera & Revuelta Domínguez, 2022).

In the studies it is established that games are considered applicable tools that allow the improvement within the educational process focused on reading comprehension, the development of spatial skills, as well as the assimilation of numerical concepts. (Fernández Lara, 2022).

Gamification, has behaved as a means of generating different educational tools, although it is an entertainment environment which has been its main support through the creation of video games, it is also important to mention that in order to apply the gamified teaching must meet a number of parameters for its development and this apply it on an educational context that allows to be a guide for students.

There are different ways of defining gamification and with this we can identify that it is not only applied to educational tools, but also to the generation of video games, which is our main objective in this research, however we start with the author: (Teixes, 2015) where he defines it as "the use of mechanics based on games, aesthetics and playful thinking to build people's loyalty, motivate actions, promote learning and, above all, problem solving".

Under this definition we can consider that there are different research works focused on problem solving, in an educational way, but with an applied approach to the teaching-learning process. To this we can present different previous works related to gamification and the impact within the education system focusing on specific areas that served as a guide for this research such as: Analyse the use of gamification in children with Down Syndrome between 5-7 years old, where the problem is the constant change that occurs in the world of technology, this must continually advance with the educational reality that is currently living, a virtual reality that must be coupled to the individual need of students, particularly in children with Down syndrome, considering that they require more support in terms of their teaching-learning process; with daily activities.

ISSN 2523-2479

The software has proven to be widely accepted. These results allow us to deduce that the proposal could become a valuable aid to stimulate the cognitive part of students with Down syndrome (Balarezo Lata, Mendieta Parra, Pérez Pérez, & Hurtado Crespo, 2022).

Another study looks at developing Gamified Software Engineering Learning Systems (GSEELS) and assessing the effects of gamification, learning motivation, cognitive load and learning anxiety on academic performance. The research results support all nine hypotheses and also show the effects of cognitive load on learning anxiety, with strong learning motivation resulting from low learning anxiety. As a result, this study further demonstrates that a well-designed GSEELS would affect students' learning motivation and academic performance. Finally, the model of the relationship between gamified learning, learning motivation, cognitive load, learning anxiety, and academic performance is clarified, and four suggestions for software engineering education course instructors and future research are offered to assist instructors in implementing favourable gamified teaching strategies. (Prieto Andreu, Gómez Escalonilla Torrijos, & Said Hung, 2022).

Similarly we have different applications established in Android and App Store environments that do not have academic disclosure, but are in the entertainment environment and maintain a completely commercial profile, which likewise should be considered that in video game environment different forms of installation are established starting with mobile phones and considering the operating system to use, and likewise the platform or console to work. Having said this, we show some educational applications that are focused according to the population, market, and objective to be worked on.

Figure 1 Video game El Tren de Lola (Lola's Train)
Source Google Play Store

According to the AppStore there is a great diversity of applications focused on videogames, but few on education, the main one being Lola's Train, shown in Figure 1, which has the objective of learning five different languages through a narrative in which the player starts to advance. (Google Play Store).

Figure 2 Video game Leo with Grinn
Source: Google Play Store

Another of the applications found, according to the acceptance table shown in the Google Play Store, is Reading with Grin, showing its interface in Figure 2, since this application allows infants aged 4 to 6 years to form words and complete sentences for their comprehension, with this we have the application of the Gnosias and the main focus on executive functions, which is our main focus when establishing gamification for cognitive functions.

However, in the review of the Play Store there are no specific applications defined for executive functions for infants in third grade of primary school, and that support the academic content defined by the education system.

That is why this research considers the design, development and testing of a video game that fulfils as its main engine the strengthening of cognitive functions in its executive trait, through gamification.

ISSN 2523-2479

(Liberio Ambuisaca, 2019) establishes that gamification is a strategy that allows children to develop their cognitive skills from an early age, and applying it in the classroom, whether virtual or face-to-face, has a significant impact, from the feedback of educational processes, providing information to the teacher, stimulating the relationship with peers, maintaining active learning, as well as motivating students for specific topics.

While it is true that cognitive skills are strengthened by the development of achieving dexterity through physical motor use, in this project we will focus on strengthening the cognitive functions for students in third grade of primary school, with the main instance being reading comprehension, decision making, being able to have the ability to process and organise information, this being determined by decision making.

With the above, a gamification tool called Dream Scape is designed, whose objective is to strengthen the cognitive-executive functions, focusing on the gnosias that have the capacity of the brain to recognise previously learned information such as objects, people or places through our senses, as well as the function of language oriented to reading and comprehension. (UNIR Revista, 2022)

Methodology to develop

With the above in this applied research we present an experimental study with a cross-sectional design, on the subject of educational gamification as a strategy for teaching cognitive functions in learning environments.

Focusing on cognitive functions specifically in the executive functions being its definition as "a mental process of metacognitive type, since they are responsible for guiding and regulating the mental and behavioural activity of the human being" (Bausela Herreras, 2014) and in a classificatory manner to the Gnosias defined as "The skills that allow perceiving the environment by processing the different sensory signals". (Valencia, 2020)

From the above it is understood that gnosias are cognitive skills that allow a person to perceive and recognise information from the environment through the processing of sensory signals.

These skills involve the ability to interpret and understand previously acquired sensory information about objects, people or other stimuli. By combining the ability to perceive the environment by processing different sensory signals with the ability to recognise previously acquired information, gnosias allow us to effectively interpret and understand our environment and the stimuli around us.

To this end, the Dream Scape tool is designed as an interactive tool to help students between 8 and 10 years of age at basic level to retain and understand the topics seen in class in a more didactic way. To achieve this, illustrated 2D mini-games with interactive mechanics are used. The target audience is specifically aimed at students in the third grade of primary school. The videogame has mini-games specially designed for a child audience. These mini-games use gamification and address current educational topics. Meticulous care has been taken to ensure that the themes and game mechanics support the player's understanding of educational areas, focusing specifically on the subject of Spanish reading comprehension.

The development of the videogame is divided into different sections that make up its main elements.

In the artistic section, 2D illustrations were created, as shown in Figure 3 and Figure 4, for the main characters, the game scenarios, the assets used, the mini-games and the menus. The entire visual aspect was created completely from scratch, both the character art and the game mechanics.

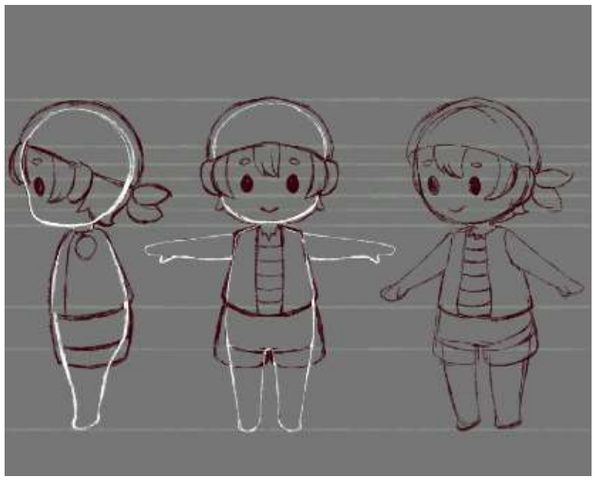


Figure 3 Illustrated carácter
Source: Own Elaboration

ISSN 2523-2479

Figure 4 Main character of the game
Source: Own Elaboration

In the programming section, research was carried out on different coding systems in order to generate the mechanics of the mini-games. A 2D project was used as a basis and was structured in an optimal way to facilitate its design and future updates. In addition, free-use code was sought and readapted, and the Unity graphics engine was chosen, as shown in Figure 5 and Figure 6, due to its practicality in adapting the game and generating the executable. Finally, work continues on the technical development to correct and improve the structure, thus achieving a stable and optimised programme for distribution on various devices.

Figure 5 Input interface of the Dream Scape Videogame
Source: Own Elaboration

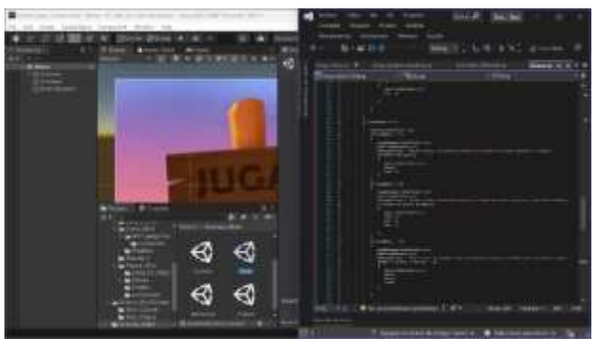


Figure 6 Programming interface of the Dream Scape Videogame
Source: Own Elaboration

Finally, in the narrative and level design section, the creation and adaptation of all the mini-games was carried out, taking into account the educational gamified elements.

This involved from the conception of sketches and structuring to the functionality and purpose of each game. In addition, the overall story of the game was designed, including the main characters, supporting characters, antagonists and other relevant characters. This whole process was carried out in an original way, with the aim of allowing our target audience to enjoy the game while learning, as shown in Figure 7 and 8.

Figure 7 Dream Scape Reading Comprehension Representation

Figure 8 Representation of Max, performing dexterity in catching obstacles

With the tool designed, the testing stage begins to corroborate the stimulus made in reading comprehension and ability that is governed by the causal predictive hypothesis:

It is necessary to consider that cognitive functions: in visual gnosias and language will improve with the implementation of gamification using Dream Scape, compared to the use of traditional assessments.

ISSN 2523-2479

For this it is necessary to test the improvement in the cognitive functions: Gnosias and language, through the Dream Scape tool, applying gamification for students in the third grade of basic level.

In its verification process, the design of data collection is carried out, supported by the Google Forms tool, and with the linking of two educational institutions being the School Article 123 Tomasa de Valdés Viuda de alemán and the Primary School Ernesto Toral Lombard with a total sample of 43 and 66 students of third grade of basic education. It is important to mention that prior to the support of the instrument, a basic test was carried out with the same exercise items that would be applied in the game, with the objective of observing their performance and development and subsequently doing the same with the application of the Video Game. As shown in Figure 9 and 10 respectively.

Figure 9 Elaboration of written evaluation prior to the application of Dream Scape
Source: Own Elaboration

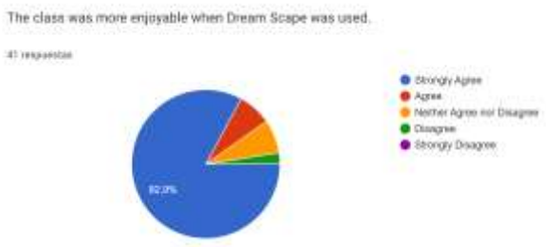
Figure 10 Application of Dream Scape after the manual instrument
Source: Own Elaboration

Results

Measurements were made through observation of students' motivation and initiative in their participation, despite their lack of knowledge of the use of the equipment and the Dream Scape application, during the test. Thus determining that gamification as a teaching technique is motivating and stimulating, not only in terms of academic performance, but also in terms of student participation and stimulation. With this, we can establish that through gamified tools the reinforcement of students' knowledge is attributed.

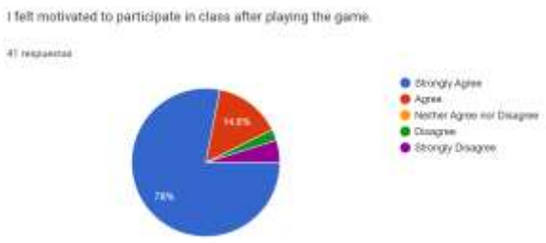
While in order to compare the hypothesis, the presentation of these results is carried out, obtaining as shown in Graph 1. Using a gamified tool does not allow the replacement of basic education teachers, but rather a feedback support of the subjects, as well as the reinforcement of the acquired knowledge, with a total of 82.9% of both institutions stating that the class using Dream Scape was considered fun.

ISSN 2523-2479



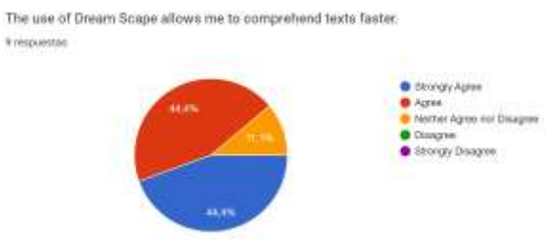
Graph 1 Application of Dream Scape following the manual instrument
Source: Own Elaboration

While another of the issues involved in the development of cognitive functions is precisely the motivation and stimulation shown to students to use this tool, they consider that 78% were not limited by it, according to Figure 2.



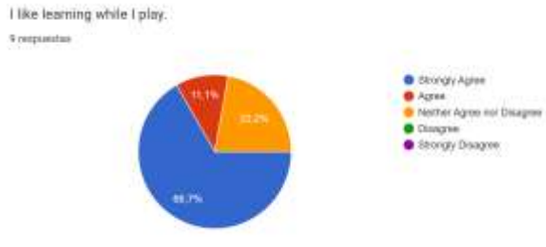
Graph 2 Application of Dream Scape after the manual instrument
Source: Own Elaboration

While, for the use of the tool in the formation of the cognitive functions of basic education students in the third grade, it is shown that 44.4% were able to understand texts quickly using Dream Scape, as shown in Figure 3.



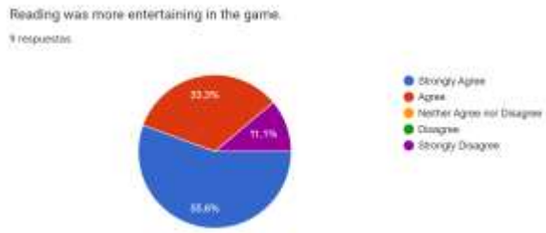
Graph 3 Understanding Gnosias using Dream Scape
Source: Own Elaboration

Using the tool allows the generations applied to technology to use more tools that involve the use of software or video games than other generations, so it is important to note that 66.7% of the students consider that they enjoy learning by playing more. As shown in graph 4.



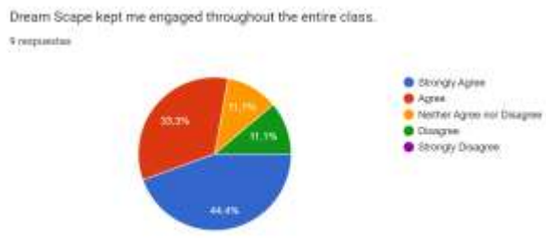
Graph 4 Acceptance of learning by playing
Source: Own Elaboration

Reading is one of the functions that as learners underpin their basic development so engaging with the Dream Scape characters maintains a positive training environment in the development of reading comprehension, according to figure 5.



Graph 5 Acceptance of learning by playing
Source: Own Elaboration

Another important aspect of this research is to be able to establish that cognitive functions are positively formative and that they keep students active in meaningful learning and acquisition in the development of cognitive functions, so figure 6 shows that involving tools of this type will allow for this to be accomplished in a positive way.



Graph 6 Entertainment and learning of cognitive functions
Source: Own Elaboration

ISSN 2523-2479

Acknowledgement

Special thanks to the two basic level institutions that participated with the 66 students that formed our sample in order to carry out the corresponding tests of the Dream Scape Video Game and show the importance of the development of the functions with them. Also to the Tecnológico Nacional de México Campus Coatzacoalcos with the support of the director Dr. Bulmaro Salazar Hernández who allowed us the loan of 30 Chromebook computers to implement the tool and perform the corresponding tests.

Conclusions

Gamification is not something new in our country, nor in the process of teaching and learning, however the design of video games focused on specific areas establishing the design of narrative, story, characters using programming such as Unity allows us not only to consider creating entertainment programs that are illustrative to our students, but to consider how the Dream Scape tool allows us to use the corresponding levels of development to be able to establish the reinforcement through the entertainment company as a feedback and promotion of the cognitive functions of students in third grade of basic education in Mexico, specifically in the city of Coatzacoalcos, Veracruz, where we can allow students of these grades to interact with technological tools that seek feedback, support and monitoring of the knowledge acquired in a classroom.

But, in addition, this tool will allow the strengthening of the Gnosias defined as the scope of the educational programmes, preventing the population of groups of 40 to 50 students from being affected, since it will allow constant feedback, at one level, with rewards and strengthening of the student's stimulus and motivation to learn.

The first level has been complemented by being able to use the tool in a test phase, and the next level is to be able to corroborate that its continuous use will allow students to maintain a higher level by being a support tool for teachers in their classrooms.

References

Balarezo Lata, E. D., Mendieta Parra, D. I., Pérez Pérez, J. M., & Hurtado Crespo, G. P. (2022). Gamificación en la estimulación cognitiva de niños entre 5-7 años. Ciencia Latina Revista Multidisciplinar, 6(1), 36-46. doi:10.37811. https://ciencialatina.org/index.php/cienciala/article/view/1761

Bausela Herreras, E. (2014). Funciones ejecutivas: nociones del desarrollo desde una perspectiva neuropsicológica. Acción Psicológica, 11(1), 21-34. Obtenido de https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1578-908X2014000100003

Briones Cedeño, G. C., & Benavides Bailón, J. (2021). Estrategias neorudidácticas en el proceso de enseñanza - aprendizaje de educación básica. Revista de Ciencias Humanidades y Sociales, 6(1), 72-81. doi:10.5281/zenodo.5512773, https://www.redalyc.org/journal/6731/673171218006/673171218006.pdf

Caballeros Ruíz, M. Z., Sazo, E., & Gálvez Sobral, J. A. (2014). El aprendizaje de la lectura y escritura en los primeros años de escolaridad: Experiencias existosas en guatemala. Interamerican Journal of Psichology, 48(2), 212-222. Obtenido de https://www.redalyc.org/pdf/284/28437146008.pdf

Cadavid, N. (2008). Neuropsicología de la construcción de la función ejecutiva. Universidad de Salamanca, Tesis doctoral Departamento de psicología básica, psicobiología y metodología de las ciencias del comportamiento Facultad de psicología, España. Recuperado el 15 de Junio de 2023 Castillo, K. (29 de Marzo de 2021). https://docentesenlinealatinoamerica.com/. Obtenido de https://docentesenlinealatinoamerica.com/2021/03/29/principios-de-la-gamificacion-para-la-educacion/

De Ibarrola Nicolín, M. (2012). Los grandes problemas del sistema educativo mexicano. Perfiles Educativos, 34, 16-28. Obtenido de http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0185-26982012000500003&lng=es&tlng=es.

Fernández Lara , S. (28i de Noviembre de 2022). ¿Son los videojuegos herramientas adecuadas para aprender a aprender? Revista Colombiana de Educación, 239. doi: 10.17227. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0120-39162022000200239#:~:text=Los%20videojuegos%20se%20han%20mostrado,de%20resoluci%C3%B3n%20de%20problemas%2C%20la

Google Play Store. (s.f.). Google Play. Obtenido de https://play.google.com/store/apps/details?id=com.beiz.lolaabclite&hl=es&gl=US

Guerra Antequera, J., & Revuelta Domínguez, F. I. (28 de Noviembre de 2022). Investigación con videojuegos en educación. Una revisión sistemática de la literatura de 2015 a 2020. Revista Colombiana de Educación, 85(236). doi:10.17227 -12579. https://dialnet.unirioja.es/servlet/articulo?codigo=8436250

Liberio Ambuisaca, X. P. (19 de Diciembre de 2019). El uso de las técnicas de gamificación en el aula para desarrollar las habilidades cognitivas de los niños y niñas de 4 a 5 años de Educación Inicial. Conrado, 392-397. Obtenido de http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1990-86442019000500392

Muñoz Izquierdo, C. (2012). Tres problemas fundamentales del sistema educativo. Perfiles Educativos, 154-159. Obtenido de https://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0185-26982012000500014

Ortíz Colón, A. M., Jordán, J., & Agredal, M. (2018). Gamificación en Educación: Una Panorámica sobre el estado de la cuestión. USR Educação e Pesquisa. doi: 10.1590/S1678-4634201844173773, https://www.scielo.br/j/ep/a/5JC89F5LfbgvtH5DJQQ9HZS/

Pherez, G., Vargas, S., & Jerez, J. (2018). Neuroaprendizaje, una propuesta educativa: herramientas para mejorar la praxis del docente. Civilizar, 149-166. Obtenido de http://www.scielo.org.co/pdf/ccso/v18n34/1657-8953-ccso-18-34-00149.pdf

Prieto Andreu, J. M., Gómez Escalonilla Torrijos, J. D., & Said Hung, E. (2022). Gamificación, Motivación y rendimiento en educación: Una revisión sistemática. Revista electrónica: Educare, 26(1), 251-273. Obtenido de https://www.redalyc.org/journal/1941/194170643014/html/

Sailer, M., Ulrich Hense, J., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. Computer in Human Behavior, 69, 371-380. doi:10.1016/j.chb.2016.12.033 https://www.sciencedirect.com/science/article/pii/S074756321630855X

Teixes, F. (2015). Gamificación: Fundamentos y aplicaciones. Editorial. UOC.

UNIR Revista. (20 de Julio de 2022). unir.net. Obtenido de https://www.unir.net/salud/revista/gnosias-praxias/

Valencia Echeverry, J., García Murcia, D. C., Londoño Martínez, J. D., & Barrera Valencia, M. (2020). Habilidades gnósico-práxicas relacionadas con dificultades del aprendizaje de la lectura y la escritura en individuos de 9 a 12 años. CES Psicología, 113-128. Obtenido de http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S2011-30802020000200113#:~:text=Las%20gnosias%20son%20habilidades%20que,%2C%20Bigler%2C%20%26%20Tranel%2C%202012