Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 1, 1173-1181
2025
Publisher: Learning Gate
DOI: 10.55214/25768484.v9i1.4367

Neuroeducation strategies that promote participation in the classroom. A belief from the experience of university students in Perú

Christian Alberto Yaya Copaja[1*], Juan Raúl Egoavil Vera[2]
[1,2]Doctorate in Education, Graduate School, University San Ignacio de Loyola, Lima, Perú; christian.yaya@usil.pe (C.A.Y.C.) Juan.egoavil@usil.pe (J.R.E.V.)

Abstract: The purpose of this study was to describe university students' beliefs from their experience using neuroeducation strategies that promote participation during classes. This study was conducted in a qualitative paradigm and used a phenomenological method to understand the beliefs and experiences of students. Data were gathered through interviews based on a script, involving participants from a Digital Animation course at two Peruvian universities. Five neuroeducation strategies were implemented, focusing on understanding their impact on participation. The findings revealed that students show a favorable belief of these strategies; particularly valuing gamification, as it allows students to engage playfully in class activities, improving their performance. However, cooperative learning presented challenges, because of the low levels of participation and lack of commitment from some group members. The conclusion of this study is that neuroeducation strategies promote participation and performance when applied with balance and suitably to student needs. Teachers have a significant role as facilitators to promote participation in classes, by applying these strategies to create an engaging environment for learning. Practical implications emphasize the significance of integrating gamification into teaching strategies to promote participation and addressing group dynamics in cooperative learning to ensure fair contribution. These insights can be valuable for teachers and institutions in implementing effective neuroeducation strategies.

Keywords: *Neuroeducation strategies, Neuroeducation, Participation in classroom, University students.*

1. Introduction

Education, a fundamental pillar for human and social development, must adapt to social and technological changes. In this context, neuroeducation appears as a contemporary discipline that delves into understanding how the brain functions in learning, which can be valuable for improving the teacher's educational practice [1]. Neuroeducation is based on the findings of different scientific disciplines, addressing brain plasticity, the understanding of emotions, and their impact on learning [2]. The interdisciplinary nature of neuroeducation allows pedagogy, psychology, and neuroscience to converge to understand the learning processes across a wide range of factors of human nature [3].

In this context, the holistic understanding of learning provided by neuroeducation can become a powerful tool for developing effective didactic strategies. In this way, the incorporation of neuroeducation strategies can generate positive emotions, curiosity, and empathy towards the topics taught in students [4].

This positive attitude towards the topics covered in class fosters student participation in building their knowledge. It is a proven fact that students who take part are more willing and eager to learn [5].

The strategies addressed in this study focus on promoting participation from a neuroeducation perspective. In this context, the aim of this study is to describe how university students have perceived, from their experience, the neuroeducation strategies that promote participation in classes, with

History: Received: 9 December 2024; Revised: 13 January 2025; Accepted: 17 January 2025; Published: 21 January 2025
* Correspondence: christian.yaya@usil.pe

subcategories including gamification, the use of information and communications technology (ICT), the flipped classroom, cooperative learning, and project-based learning.

1.1. Strategies Based on Neuroeducation to Encourage Participation

The application of neuroeducation strategies based on understanding human brain processes positively affects the transmission and assimilation of knowledge [6]. These strategies promote participation, which is vital for the development of critical thinking, reflection, and higher-order thinking [7]. To encourage participation, the teacher should propose activities that spark curiosity and attention, creating engaging experiences that involve the student with the class content [4]. In this way, promoting student participation through interaction and other techniques is vital for learning [8] which is why this study focuses on finding the most effective strategies to promote participation.

Neuroeducation strategies encompass game-based learning, collaboration, project development, problem-solving, focusing on action and teaching [9]. Likewise, the application of ICT as a neuro-educational strategy allows for the creation of engaging activities mediated by technology, contributing to the motivation to learn [10]. In this context, the participatory neuroeducation strategies described below are based on play, technology, collaboration, autonomy, and project development.

1.2. Gamification

In a neuroeducation context, the use of playful elements enhances students' interest and participation in class activities [11]. The game involves students by fostering creativity, curiosity, social, physical, cognitive, and emotional skills, essentially in the learning process and engages them [12]. Similarly, gamification strengthens attention, participation, feedback, and the consolidation of learning [13].

1.3. The use of ICT

When used within a neuroeducation strategy, ICT allows for the establishment of multisensory techniques that foster curiosity for learning, while also contributing to the creation of new educational methods [14]. ICT is a great means for communication and exchange, enabling expression and creation, which gives them a high potential to stimulate and motivate students [15].

1.4. The Flipped Classroom

As a neuroeducation strategy, the flipped classroom places the student at the center of learning, fostering their autonomy and participation. This technique is based on the student getting prior knowledge, provided by the teacher, which they then put into practice during class in guided work, with the aim of problem-solving [16]. In this way, the student's responsibility is increased, promoting their autonomy and active learning [17]. In this method, teachers take on the role of learning guides, fostering interaction between students and the instructor [12].

1.5. Project-Based Learning

This method, applied as a neuroeducation strategy, fosters creativity and interest through the development of projects that involve the student in real-life situations, allowing them to apply the acquired knowledge creatively [18]. This method requires the formation of groups to carry out projects where topics of high complexity from the course are addressed, to encourage the student to research and deepen their learning [19]. In this framework, it is essential that teachers impart the required professional knowledge but also know how to guide the student during the development of the project. [20].

1.6. Cooperative Learning

In a neuroeducation framework, this strategy stands out for promoting joint learning, fostering social bonds and participation among students. Thus, this strategy is based on students collaborating

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 1: 1173-1181, 2025
DOI: 10.55214/25768484.v9i1.4367

with each other to get and practice knowledge, with the aim of achieving shared learning goals [19]. Cooperative learning fosters the brain's needs related to altruism and social interaction, activating areas associated with reward and well-being [12]. Cooperative learning stimulates participation and interaction among students, fostering communication skills, empathy, sensitivity, adaptability, and conflict resolution through group activities that enable social cohesion [21].

2. Methodology

This study is framed within a qualitative approach, focusing on significant topics, and then moving on to data collection where facts that appear are interpreted from a social perspective, adopting a phenomenological design that delves into human experiences, becoming aware of their meanings, reaching the essence and truth [22-24].

In this descriptive and cross-sectional study, the purpose was to understand and comprehend the problematic situation from the beliefs and experiences of the university students through the interview technique, where questions were posed to obtain truthful opinions, based on the semi-structured interview script instrument that included 10 in-depth questions.

For data collection through the interview, a non-probabilistic sample was chosen, consisting of 12 voluntary informants, who are students from 2 private universities in Lima - Perú, with 6 representing university A and 6 representing university B. The 6 students from university A were coded as 1A, 2A, 3A, 4A, 5A, and 6A. Likewise, the 6 students from university B were appointed with the codes 1B, 2B, 3B, 4B, 5B, and 6B. At the time of the study, these students were enrolled in the communications program; and they were taking the course "digital animation" at university A, and "multimedia animation" at university B in a computer lab at their respective universities. Both courses are remarkably similar, as they teach animation theory through practice in a 3D interactive software, by developing learning practice sessions for said software, and creating an animated short film as the main project.

For both courses, the same neuro-educational strategies were applied with the aim of fostering participation in a learning environment that promotes positive emotions while simultaneously getting in-depth knowledge. The application of the gamification strategy was carried out through the design of practical software learning exercises, giving them a playful character through stories and characters, where students develop class exercises with a degree of creative freedom while applying the techniques taught. In the case of ICT, a tool was used that allows remote access projection, where the teacher can enter the students' computers and manipulate the 3D software, with the aim of answering questions posed during the class. This makes it easier for students to ask questions at once, while also allowing other students to see the resolution of the questions on the projection. About the flipped classroom, it was proposed that certain practical exercises in their first stage could be completed by the students at home through tutorials, and then for the final stage of the exercise, the students would continue their progress in class where the teacher's role was to guide them in resolving questions and difficulties. Regarding cooperative learning, it was proposed that the animated short film, the main project of the course, be carried out in groups, so that each student would have a role as a coordinator in each area such as modeling, texturing, lighting, and animation, contributing to the development of the project in an environment of communication with their peers and mutual assistance for the fulfillment of the progressive work deliveries. Finally, about project-based learning, it was carried out through the development of the main course project, which consists of an animated short film. The students' aim is to create a small story with a prominent level of creativity, with characters and scenarios created and animated in 3D, reflecting everything learned in class both at a technical level of software use and at a theoretical level, proving mastery of the fundamentals of animation. At the end of the course, an in-depth interview was conducted on a voluntary basis, ensuring that the participants in the research have a genuine interest in collaborating and can provide in-depth responses.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 1: 1173-1181, 2025
DOI: 10.55214/25768484.v9i1.4367

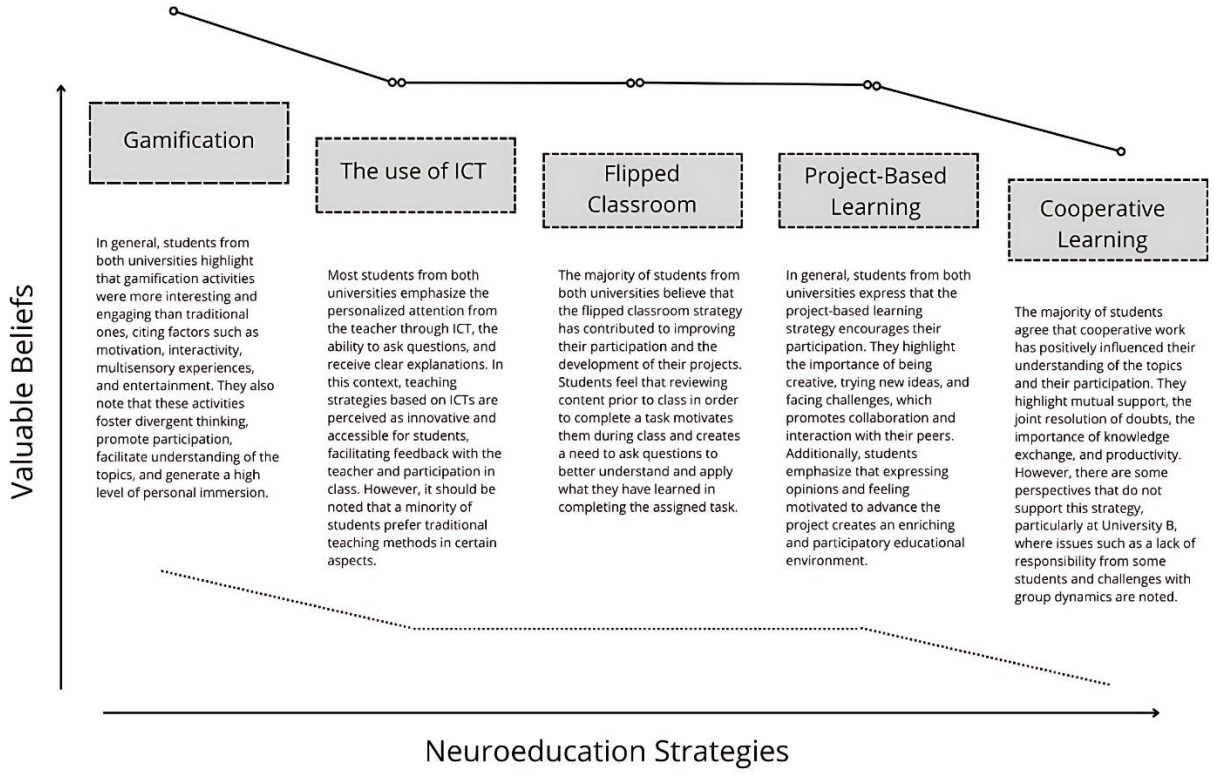

Figure 1.
Results of the study.

3. Results

3.1. Gamification

At University A, students highlight the benefits of gamification as a neuroeducation strategy that emphasizes healthy competition and creativity. Likewise, they argue that the experience of learning through playful elements such as characters and scenarios framed within a story increases their motivation and interest in learning. At University B, students highlight the gradual progression in learning difficulty and the increase in their motivation through the entertainment and immersion provided by playful exercises. They also mention the potential of this strategy to create a favorable environment for students to stay connected with their learning. However, some students do not share the same enthusiasm, like student 1B who feels that the professor's explanations should be more in-depth.

3.2. The Use of ICT

The students at university A agree that the use of ICT helps participation, understanding of class topics, teacher feedback, query resolution, personalized attention, and interactivity. The students point out that the use of ICT, such as remote access from the teacher's computer to the students' computers, helps teacher-student interaction, thereby promoting participation while allowing for more personalized learning. They also emphasize the potential for others to see the feedback and thus learn from each other, as the teacher-student interaction can be seen through the projector. In this regard, student 4A points out that: "the teacher provides more personalized attention and can resolve our doubts much more easily." The students at University B show that using ICT improves participation and understanding of class exercises. These students appreciate the speed of the professor's feedback,

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 1: 1173-1181, 2025
DOI: 10.55214/25768484.v9i1.4367

the guidance and advice, and the clarity of the explanations. However, some students prefer traditional methods, such as addressing questions with the professor face-to-face, rather than using technology.

3.3. The Flipped Classroom

The students at university A emphasize the importance of doing part of the work at home and then receiving guidance in class to resolve their doubts. Students 6A and 3A consider this method important for improving teacher-student feedback, as it allows them to enhance their learning through concepts and knowledge arising during the consultations to enrich their work. Likewise, the students at University B emphasize the benefits of fluid communication, flexibility, independence, and quick access to the professor's guidance, which allows them to optimally achieve their goals. In this way, they point out that reviewing the topics before class motivates them to attend classes and be able to ask questions about their doubts. In this regard, student 6B adds: "I consider that reviewing the class topics before class involves me."

3.4. Project-Based Learning

At University A, students emphasize the benefits of communication, organization, and commitment to the project. Likewise, the students point out that the group functions better with a well-structured project guide, which they consider essential to achieve the set goals. Creativity and participation are also highlighted as important qualities for the successful development of a project. In this regard, student 1A believes that the project should be based on constant communication to coordinate ideas and avoid low-quality, scattered work. However, the students from university B express the importance of interaction with peers and the professor's guidance. These students also value that the project has clear guidelines for its development, promoting the practical application of theory, and allowing for creative contribution and participation in the project's development. In this regard, the students consider creativity to be the most relevant part for the development of the project, and it helps to improve group interaction. About this, student 6B said: "Creativity is the most important part of the work, it is what motivates me the most to move forward because I know I have the freedom to use all my creativity without limits."

3.5. Cooperative Learning

The students at university A value a learning environment where similar and diverse ideas flow, highlighting the importance of each student's individual skills and the good guidance of the professor. Some students emphasize the need for mutual support among members to enhance their progress, while others express less positive experiences, such as the discomfort of being part of a group where some members do not contribute enough. Likewise, the students from university B highlight the value of each member's individual skills, the level of responsibility, the management of group organization, the ability to solve problems, and the benefit that collective knowledge brings. These students assert that group and pair work is ideal for achieving better organization and completing activities that are particularly complex to carry out individually. However, there are students who face challenges such as the lack of commitment from some group members; as student 6B that mentions: "it discourages me to know that my grade depends on some people who neither fulfill their duties nor work well."

4. Discussion of Results

4.1. Gamification

According to the data obtained from the study, the gamification strategy increased student participation and motivation at universities A and B. Students appreciate its interactive and multisensory approach, making tasks more attractive and stimulating, fostering more meaningful learning; which aligns with Lamrani and Abdelwahed [13] and Fuster [22] who mention that the effects of this innovative approach positively influence interaction and participation. This strategy motivates students to get involved in activities, promoting healthy competition and a dynamic educational experience. About this, Dugnol-Menéndez, et al. [25] proved that gamification increases

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 1: 1173-1181, 2025
DOI: 10.55214/25768484.v9i1.4367

students' satisfaction levels and their involvement in class activities. Likewise, this study found important levels of satisfaction with gamification activities which, due to their playful and personalized nature, help keep motivation even during external difficulties, such as emotional distress, among others. In this regard, Guillén [12] notes that gamification increases student participation in learning through emotion and curiosity, which allows the student to engage with enthusiasm in the subject matter learned. The results of this study, in general, support gamification as an innovative teaching method that enhances participation and learning; however, it is important to balance the implementation of gamification with the needs of the students.

4.2. The use of ICT, Flipped Classroom, Project-Based Learning, and Cooperative Learning

In education, *the use of ICT* has shown significant improvements in student participation and performance, highlighting their pedagogical value. At universities A and B, ICT has increased interactivity, feedback, and confidence in discussions, as noted by Cuetos, et al. [15] who also highlight their ability to motivate students and allow for closer monitoring of learning. This approach is supported by Meza and Moya Martínez [14] who emphasize how technology combined with neuroeducation promotes meaningful learning by adapting to current demands. Likewise, Reina and Silva [10] reinforce that ICT strengthens attention and concentration, essential elements for empowerment in learning. However, there are limitations. Lewohl [26] points out that some students prefer face-to-face interaction, which highlights the need to balance ICT with traditional approaches. Thus, technological integration should be complementary, respecting diverse preferences and learning styles, without replacing direct human interaction, but rather enriching pedagogical strategies.

Regarding *cooperative learning*, the study reaffirms the effectiveness of this strategy by enhancing student participation through teamwork, knowledge exchange, and mutual support. Guillén [12] highlights the social nature of cooperative learning as a promoter of values such as altruism and the pursuit of the common good. This aspect is particularly relevant in educational settings where collaboration fosters a sense of justice and equality. Yang [27] adds that social interaction is fundamental for the construction of knowledge. However, the research also finds problems related to the responsibility and support of some group members, which affects the dynamics of cooperative work. Díaz-Pompa, et al. [21] suggest strategies such as forming balanced teams and promoting solidarity, which underscores the need for proper management by teachers to ensure that all students are involved equitably. It is also important for the teacher to provide clear instructions for the development of group work, emphasizing the monitoring of individual contributions within the group work, which will be considered as part of the evaluation; this promotes greater commitment to contributing equitably to the work since their grade depends on it.

The conducted study confirms that *flipped classroom* promotes class participation and improves academic performance. According to Hong, et al. [28] the flipped classroom method is well received by students due to its focus on prior content review, which helps greater attention and understanding in class. Marcos and Moreno [29] highlight the impact of audiovisual resources as facilitators of autonomous learning, which resonates with young people's preferences for digital content. Likewise, in the second stage of the flipped classroom, when the student comes with the knowledge obtained to class, it is important to note that the study highlights the importance of clear and conclusive face-to-face feedback; where direct interaction with the teacher is valued, which reinforces the sense of participation in classes.

About *project-based learning*, it has also been confirmed that it is a valuable approach to promote participation. The study emphasizes the importance of communication, organization, and commitment in this type of learning, which aligns with the vision of Chen, et al. [20] who highlight the teacher's role as a guide and organizer of learning. This practical approach, as said by Green and du Plessis [18] allows students to have a greater belief in the relevance and usefulness of knowledge. Román [30] says that this approach helps students to develop social cognition by recognizing the needs of some members of the group, helping them and therefore creating a sense of professional social inclusion. In this regard

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 1: 1173-1181, 2025
DOI: 10.55214/25768484.v9i1.4367

the data collected suggests that Project-Based Learning allows students to apply what they have learned, deepening their understanding and developing skills relevant to their profession. Likewise, Sánchez, et al. [4] point out that creative freedom within Project-Based Learning sparks enthusiasm and curiosity in students, key factors in fostering participation.

4.3. Effectiveness And Applicability of Neuroeducation Strategies

Neuroeducation strategies have been effective in increasing participation and academic performance. In summary, gamification, according to Lamrani and Abdelwahed [13] fosters motivation and student engagement through interactive and multisensory activities. The flipped classroom, as shown by Hong, et al. [28] improves comprehension by allowing prior review of content. ICTs, according to Cuetos, et al. [15] promote interactivity and feedback. Cooperative learning, as highlighted by Guillén [12] promotes teamwork and equity, while Project-Based Learning, as mentioned by Chen, et al. [20] connects learning with practical and relevant skills.

Juárez, et al. [31] highlight that participation increases the levels of emotions which is a decisive factor for learning. In this regard, these strategies, if implemented properly, can significantly improve participation and academic performance. However, it is essential to consider individual preferences and group dynamics to maximize the impact of these strategies. The role of the teacher as a facilitator and regulator of these methodologies is crucial to balance technology with traditional interaction, fostering an inclusive and effective learning environment.

5. Conclusions

It is concluded that the gamification strategy is preferred by students because it fosters a fun and creative learning environment that invites them to immerse themselves in the world of games and experience exciting situations that simultaneously allow them to deepen their learning.

It is also concluded that project-based learning is valued by students for its creative approach and clear guidelines in its execution. The method of ICT-based resources is well received due to its technological and interactive nature, but a balance must be found in the use of ICT and traditional techniques. The flipped classroom is also valued by students due to the autonomous learning and the feedback received from the teacher for resolving doubts. Finally, in cooperative learning, mutual help and individual participation within the group are valued, but clear guidelines must be set up to encourage the participation of all students and ensure that everyone contributes equally.

In conclusion, neuroeducation strategies, such as gamification, the flipped classroom, ICT, cooperative learning, and project-based learning, have shown their effectiveness in improving both student participation and academic performance. However, their success depends on a balanced implementation tailored to individual and group needs, which highlights the importance of the teacher as a facilitator. By combining these methodologies with traditional approaches, an inclusive and dynamic learning environment can be created, improving the educational process.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

References

[1] L. E. Aguirre-Vera and M. E. Moya-Martínez, "Neuroeducation: an innovative strategy in the teaching-learning process of students," *Dominio de las Ciencias*, vol. 8, no. 2, pp. 466-482, 2022.

[2] W. G. Campoverde Celi, B. C. Álvarez Macias, and L. L. Otero Tobar, "Neuroeducation, an essential discipline in university teaching development," *Opuntia Brava*, vol. 13, no. 2, pp. 1-13, 2021.
[3] A. H. Fernández, "Relation of the ict with neuroeducation, inclusion, pluriculturality and environmental education through a confirmatory factorial analysis study," *Texto Livre: Linguagem e Tecnologia*, vol. 13, no. 3, pp. 262-277, 2020. https://doi.org/10.35699/1983-3652.2020.25739
[4] J. G. Sánchez, C. N. Michuy, and S. G. Parreño, "Neurodidactic strategy: Consolidating understanding of learning in cognitive awakening," *Revista de Investigación, Formación y Desarrollo: Generando Productividad Institucional*, vol. 9, no. 3, pp. 77-84, 2021. https://doi.org/10.34070/rif.v9i3.303
[5] A. Sezer, Y. Inel, A. Ç. Seçkin, and U. Uluçinar, "The relationship between attention levels and class participation of first-year students in classroom teaching departments," *International Journal of Instruction*, vol. 10, no. 2, pp. 55-68, 2017. ttps://doi.org/10.12973/IJI.2017.1024A
[6] C. Rueda, "Neuroeducation: Teaching with the brain," *Journal of Neuroeducation*, no. 1, pp. 108-113, 2020.
[7] E. J. Parks-Stamm, M. Zafonte, and S. M. Palenque, "The effects of instructor participation and class size on student participation in an online class discussion forum," *British Journal of Educational Technology*, vol. 48, no. 6, pp. 1250-1259, 2017. https://doi.org/10.1111/BJET.12512
[8] A. Tadesse, S. Lehesvuori, H. Posti-Ahokas, and J. Moate, "The learner-centred interactive pedagogy classroom: Its implications for dialogic interaction in Eritrean secondary schools," *Thinking Skills and Creativity*, vol. 50, p. 101379, 2023. https://doi.org/10.1016/J.TSC.2023.101379
[9] N. Maras, T. Topolovčan, and M. Matijević, "Constructivist didactics and neurodidactics in discourse of the reform pedagogy. Theoretical premises, dilemmas and comparison," *Nova Prisutnost*, vol. 16, no. 3, pp. 561-576, 2018. https://doi.org/10.31192/NP.16.3.9
[10] A. R. Reina and Y. E. Silva, "Use of ICT and neuroeducation in higher education. Improvement of the teaching-learning process," *Human Review. International Humanities Review*, vol. 11, 2022. https://doi.org/10.37467/REVHUMAN.V11.3962
[11] I. Caponetto, J. Earp, and M. Ott, "Gamification and education: A literature review," presented at the 8th European Conference on Games Based Learning: ECGBL2014 - Carsten Busch. pp. 50 -57, 2014.
[12] J. C. Guillén, "Neuroeducation in the classroom: From theory to practice," 2017.
[13] R. Lamrani and E. H. Abdelwahed, "Game-based learning and gamification to improve skills in early years education," *Computer Science and Information Systems*, vol. 17, no. 1, pp. 339-356, 2020. https://doi.org/10.2298/csis190511043l
[14] M. L. R. Meza and M. E. Moya Martínez, "ICT and neuroeducation as a resource for innovation in the teaching and learning process," *Revista de Ciencias Humanísticas y Sociales (ReHuSo)*, vol. 5, no. 2, pp. 94-106, 2020.
[15] R. M. J. Cuetos, L. Grijalbo Fernández, E. Argüeso Vaca, V. Escamilla Gómez, and R. Ballesteros Gómez, "Potentials of ICT and its role in fostering creativity: Teachers' perceptions," *Revista Iberoamericana de Educación a Distancia*, vol. 23, no. 2, p. 287, 2020. https://doi.org/10.5944/ried.23.2.26247
[16] L. Cheng, A. D. Ritzhaupt, and P. Antonenko, "Effects of the flipped classroom instructional strategy on students' learning outcomes: A meta-analysis," *Educational Technology Research and Development*, vol. 67, pp. 793-824, 2019. https://doi.org/10.1007/S11423-018-9633-7
[17] J. A. Rathner and M. A. Schier, "The impact of flipped classroom andragogy on student assessment performance and perception of learning experience in two advanced physiology subjects," *Advances in Physiology Education*, vol. 44, no. 1, pp. 80-92, 2020. https://doi.org/10.1152/ADVAN.00125.2019
[18] S. L. Green and E. C. E. du Plessis, "Project-based learning to promote learner autonomy in training hospitality education at a technical and vocational education and training college," *International Journal of Learning, Teaching and Educational Research*, vol. 22, no. 7, pp. 136-155, 2023. https://doi.org/10.26803/IJLTER.22.7.8
[19] L. H. Caicedo, "Neuroeducation, an educational proposal in the classroom, Editions of the U," 2016.
[20] S.-Y. Chen, C.-F. Lai, Y.-H. Lai, and Y.-S. Su, "Effect of project-based learning on development of students' creative thinking," *The International Journal of Electrical Engineering & Education*, vol. 59, no. 3, pp. 232-250, 2022. https://doi.org/10.1177/0020720919846808
[21] F. Díaz-Pompa, N. V. Hernández-Carreón, I. Lores-Leyva, and O. L. Ortiz-Pérez, "Cooperative learning and social cohesion: Study in the 4th year classes of tourism degree of Cuba and Mexico," *Tuning Journal for Higher Education*, vol. 10, no. 2, pp. 189-222, 2023. https://doi.org/10.18543/TJHE.2417
[22] G. D. E. Fuster, "Qualitative research: Hermeneutic phenomenological method," *Propósitos y Representaciones*, vol. 7, no. 1, pp. 201-229, 2019. https://doi.org/10.20511/PYR2019.V7N1.267
[23] J. W. Creswell, *Research design. Qualitive, quantitive and mixed method approaches*, 4th ed. Thousand Oaks, CA: SAGE Publications, 2014.
[24] R. Hernandez, C. Fernandez, and L. Baptista, *Research methodology*, 6th ed. Mexico city: Mc Graw Hill Education, 2014.
[25] J. Dugnol-Menéndez, E. Jiménez-Arberas, M. L. Ruiz-Fernández, D. Fernández-Valera, A. Mok, and J. Merayo-Lloves, "A collaborative escape room as gamification strategy to increase learning motivation and develop curricular

skills of occupational therapy students," *BMC Medical Education*, vol. 21, pp. 1-13, 2021. https://doi.org/10.1186/S12909-021-02973-5

[26] J. M. Lewohl, "Exploring student perceptions and use of face-to-face classes, technology-enhanced active learning, and online resources," *International Journal of Educational Technology in Higher Education*, vol. 20, no. 1, p. 48, 2023. https://doi.org/10.1186/S41239-023-00416-3

[27] X. Yang, "A historical review of collaborative learning and cooperative learning," *TechTrends*, vol. 67, no. 4, pp. 718-728, 2023. ttps://doi.org/10.1007/S11528-022-00823-9

[28] Y. Hong *et al.*, "Semi-flipped classroom-based learning interventions in a traditional curriculum of oral medicine: Students' perceptions and teaching achievements," *BMC Medical Education*, vol. 23, no. 1, p. 44, 2023. https://doi.org/10.1186/S12909-023-04017-6

[29] R. M. Marcos and M. M. Moreno, "The influence of audiovisual resources for autonomous learning in the classroom," *Anuario Electrónico de Estudios en Comunicación Social: Disertaciones*, vol. 13, no. 1, pp. 97-117, 2020.

[30] F. Román, "The neuroscience behind problem-based learning (PBL)," *Journal of Neuroeducation*, vol. 1, no. 2, pp. 50-56, 2021. https://doi.org/10.1344/JONED.V1I2.33695

[31] V. D. Juárez, I. Bellido-García, and B. B. Gupta, "Analysis of stress, attention, interest, and engagement in onsite and online higher education: A neurotechnological study," *Comunicar*, vol. 31, no. 76, pp. 21-34, 2023. https://doi.org/10.3916/C76-2023-02

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 1: 1173-1181, 2025
DOI: 10.55214/25768484.v9i1.4367