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Abstract: This research examines the effects of the implementation of an educational programme of mindfulness training using Virtual Reality (VR) with students in adapted vocational training. The aim of this programme is to instruct and strengthen attention and self-regulation skills in relation to the learning process, with the objective of reducing anxiety and impulsivity in students, contributing to promoting sustainability in education, as well as reducing inequalities. The development and implementation of this project was carried out in IES Teguise in Lanzarote (Spain) with 11 students with intellectual disabilities who used the Virtual Reality Mindfulness application called TRIPP for three months. The use of Virtual Reality offers immersive experiences, while mindfulness enables concentration, which directly contributes to higher academic performance. After the implementation of the programme, it is observed that the use of this emerging technology provides students with a sense of calm and well-being, which translates into improvements in their academic grades, promoting equal and quality education in line with the Sustainable Development Goals (SDGs).

Keywords: mindfulness; virtual reality; vocational training; sustainability; equal opportunities

1. Introduction

In today's dynamic and changing context, in which transformations occur rapidly, the ability to regulate emotions becomes a crucial aspect for individuals. Understanding, managing, and strengthening one's own emotions are fundamental skills for personal development.

The evolutionary dynamics of our society is manifested through constant change, and in response to this evolution, different bodies, especially at European and global level, have outlined a set of Sustainable Development Goals (SDGs). These goals are designed to promote the well-being of society, providing essential guidelines for addressing contemporary challenges and guiding development towards a more sustainable future. In this dynamic context, scientific research plays a key role in providing fundamental insights and contributing to the understanding and achievement of the SDGs.

In order to achieve these aims, the present combination of mindfulness and Virtual Reality (VR) has emerged. This combination aims to address today's challenges, as well as to set development on the path towards a more sustainable future.

According to Schuman-Olivier et al., [1] the practice of mindfulness emerges as an innovative strategy, allowing, through meditation exercises, to cultivate these skills in people. According to Kabat-Zinn [2], these abilities not only promote greater emotional self-control, but also generate an increase in personal confidence. The benefits derived from this practice are manifested in various areas of life, including academic, social and personal [3]. Unfortunately, as mentioned in their study

Alzina et al., [4], education in the management of emotions is not usually part of the curriculum in the classroom, which represents a significant challenge that deserves to be addressed promptly and offering concrete solutions in order to provide a better response to this problem. The reality is that, depending on the context in which it is used, Mindfulness can have multiple definitions, given that they are not unitary concepts [5]. Some of the most frequent meanings indicate that Mindfulness is a method whose main objective is to increase awareness and promote more skilful responses to the cognitive processes involved in the manifestation of psychopathological disorders and other behavioural problems (Bishop et al., [6]; it is also clear that this method is linked to mindfulness, focused on the present and offering individuals the ability to accept, recognise and regulate their thoughts and emotions [7]. On the other hand, authors such as Amaro and Singh [5], show that Mindfulness offers the possibility of intervening from the inside out, focusing especially on the development of skills that facilitate the adaptation of individuals to internal and external events, promoting the self-regulation of their own thoughts, emotions and perceptions, to focus on the present moment, without being carried away by the past or by future concerns.

The application of Mindfulness as a therapeutic procedure to address disorders of various kinds, both psychophysiological and psychosomatic, was promoted by Kabat-Zinn [8]; promoted significantly through the development of a programme called Mindfulness-Based Stress Reduction (MBSR) whose purpose is to address stress within the scope of intervention of behavioural medicine and defined it as the awareness that emanates from intentionally directing attention to the here and now, without the need to make judgments.

This methodology is supported by studies such as that carried out by Grossman et al., [9], in the management of stress, anxiety and impulsivity, thus allowing individuals to cultivate a greater awareness of the present moment, as well as to develop strategies to know how to adequately manage the symptoms associated with stress and thus improve psychological well-being and for this purpose it is based on an eminently practical and experiential methodology [10].

Likewise, Creswell [11] states that thoughts, emotions and sensations follow patterns that do not allow direct and voluntary control, so instead of trying to modify those negative thoughts or sensations, he proposes to accept them and let them flow, accepting their presence without confronting them.

Therefore, controlling the problem is not the remedy, but rather the opposite, as Gutiérrez and Luciano [12] argue, given that the more attempts are made to eliminate events or thoughts that are not to our liking, the more force and persistence they gain. Several studies have shown that such attempts at control can increase the frequency, duration, and intensity of the negative stimulus that we are trying to avoid, causing it to gain greater strength, as evidenced by Dorais et al. [13].

Mindfulness is an effective tool for addressing students' lack of attention, as well as awakening curiosity in them, developing their autonomy, reducing impulsivity and improving attention levels, creating positive attitudes and emotions towards learning [14], therefore, it is clear that it can be understood as a technique that offers the opportunity to promote learning and a healthy life, contributing to the well-being of all individuals and allows for the successful development of SDG3.

In education, there have been attempts to apply these techniques in the classroom, and one of the most common ways of practising mindfulness is through mindful breathing, i.e., focusing mindfulness on one's own breathing to slow down the heart rate. This can result in increased blood flow to vital organs such as the brain, which will help to think more clearly about a task at hand [15].

Despite the diversity of definitions of VR there is a consensus on its nature as a tool that facilitates the simulation of reality, providing sensory immersion to the individual. In this context, the linking of VR with Mindfulness positions it as a highly effective tool [16]. We are exposed to numerous tempting distractions; therefore, Mindfulness practices may not be linked to the entire population, and such practices can be an arduous journey [17].

In recent years, the potential of VR to support and enhance mindfulness learning and practice, as well as to improve people's well-being, is beginning to be explored. Recently, a number of research studies linking VR and Mindfulness have been carried out, and the common element of these studies is to enhance their teaching and practice. Regarding the combination of mindfulness

and VR, immersive virtual environments have been constructed to simulate emergency situations that may occur in life, and the effect of a meditation programme on the physiological and psychological responses evoked by these situations has been observed [18]. Regarding the benefits that VR brings to Mindfulness, it is perceived that it creates a safe context for intervention, reduces costs, and facilitates intervention with people who have difficulties in accessing the sessions due to work, geographic health issues, or any other type of situation. Furthermore, Flujas-Contreras et al., [19] state that it promotes the improvement of the psychometric properties of the assessment, and it also offers the possibility of being able to assess in natural contexts and in real time.

VR has been shown to be effective and valid in numerous research studies of various kinds, for example in cognitive assessment, which was traditionally assessed using classical measurement instruments [20]. VR has also been shown to be effective in pain management by facilitating users' abstraction [21]. Similarly, its validity has been verified in mental health therapies such as phobias, post-traumatic stress disorder, eating disorders or psychosis, among others [22].

In recent years, research has begun to investigate the possibilities offered by VR, due to the fact that it favours and encourages learning and mindfulness, which has a positive impact on the well-being of the people who practice it [23]. This is why authors such as Delgado-Reyes and López [24], show that it is a tool that enables the assessment and intervention of groups with learning difficulties, as it is a non-intrusive method supported by ecologically valid environments, as it reduces distractions and allows them to maintain their attentional focus, thus promoting mindfulness. In addition, it encourages the inclusion of motivating and engaging environments, together with the possibility of creating three-dimensional environments with realistic images, allowing for complete immersion in the present.

VR also promotes flexibility and allows the therapist to build intervention contexts adapted to the needs of the user, enabling the manipulation of the environment and minimising inconveniences in the assessment and intervention, allowing students with learning difficulties to be treated in a way that is personalised to their needs.

Access to health and well-being are human rights and for this reason the UN agenda for Sustainable Development provides the opportunity to ensure access to the highest standards of health and healthcare as stated [25].

The alternative realities formed by Augmented Reality and Virtual Reality present very appropriate characteristics for the fulfilment of the Sustainable Development Goals (SDGs) decreed in the 2030 Agenda, with a negligible cost, therefore, they are emerging technologies.

Currently, the most significant advances obtained through the contributions of emerging technologies focus on innovative learning methodologies that incorporate digital content as detailed by Rodríguez [26] and serve teachers in various disciplines; and therefore, promote the (SDG4, ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all).

Through Mindfulness-based interventions, people with functional diversity can learn these skills both indirectly and directly. The former involves the presence of parents and family members, other caregivers such as service providers or teachers, aiming for a long-lasting spillover or cascade effect on children or adolescents [27]. Second, directly, by teaching students mindfulness-based skills [28].

Emerging technologies are enabling tools for sustainable development, playing a key role in mitigating inequalities and supporting SDG10 [29]. The growing prominence of the use of technology lies in its ability to address the challenges associated with sustainable development, thereby contributing to the reduction of socio-economic inequalities and fostering social inclusion. The strategic adoption of technology is a key factor in overcoming obstacles inherent to sustainable development, while at the same time making it possible to meet the established objectives, thus generating a significant impact on the reduction of inequalities.

This research seeks, through the implementation of a programme based on Mindfulness applied through VR, to reduce and mitigate the levels of anxiety and impulsivity among students with functional diversity, developing attention and self-regulation skills to promote their health and

well-being. It also aims to ensure inclusive and egalitarian education by reducing inequalities and providing equal access, promoting equal opportunities.

2. Materials and Methods

2.1. Instrument

The application chosen for the implementation of the intervention is "Tripp", designed with the purpose of fostering a variety of positive emotional states, including concentration, mindfulness, serenity, calmness and happiness among users. This resource has a comprehensive collection of over 100 guided and immersive mindfulness meditations. It incorporates sounds using the binaural listening technique, breathing exercises aimed at establishing mental tranquillity and inducing relaxation. In addition, it allows for the adaptation and customisation of different types of meditation and exercises, while recording the user's progress over time. The meditations, presented in audio format, cover a range of themes, from approaches focused on concentration and calm to experiences designed for escape and distraction. It is relevant to note that this application is currently only available in English. Considering the psychological paradigms addressed, the therapeutic viability of this platform is suggested, particularly in the management of everyday stress and the promotion of positive emotional states [30].

For the implementation of the chosen programme, virtual reality viewers, Oculus Quest, a wireless system composed of a pair of glasses, microphone and headphones integrated into a single device, were used. This educational Mindfulness training programme using virtual reality lasts 3 months.

2.2. Participants

The sample of the present research is made up of 11 participants with functional diversity from I.E.S. Teguise, located in Lanzarote (Canary Islands), who are studying an adapted vocational training degree and who are described in Table 1. The sample has a mean age of 18.27 years and a standard deviation of 1.19087.

Table 1. Distribution of pupils in relation to gender and age.

Participants	Age	Gender
Participant 1	18	Male
Participant 2	17	Male
Participant 3	18	Male
Participant 4	20	Female
Participant 5	17	Male
Participant 6	20	Male
Participant 7	17	Female
Participant 8	19	Female
Participant 9	19	Female
Participant 10	19	Female
Participant 11	17	Male

[1] Tables may have a footer.

3. Results

The study details the intervention of 11 participants over 3 months through mindfulness training sessions using virtual reality (VR). Each participant showed progress with different levels of attention, concentration and proprioceptive control. Improvements in concentration, relaxation and motor coordination are perceived, as well as overcoming initial difficulties in understanding and executing the virtual dynamics. Some participants show a preference for certain scenarios, demonstrating the importance of individual adaptation in the application of VR for well-being.

The following is a classification of the participants according to their levels of attention, starting with those with the highest levels and ending with the lowest levels of attention and impulsivity:

Participants:1, 3, 7, 8 and 11: Show high or very high levels of attention from the start, with progressive improvements in concentration and adaptation to VR dynamics.

Participants 2 and 6: Experience initially low levels of attention, but with improvements as the sessions progress, overcoming emotional difficulties and adapting to the novelty.

Participants 4 and 5: Begin with difficulties in comprehension and coordination, but achieve improvements in concentration and tolerance of VR sessions.

Participants 9: Despite additional difficulties (hearing impairment), shows optimal levels of attention, adapting favourably to the programme.

Participants 10: Although he participates in fewer sessions, he shows medium-high levels of attention and a positive evolution.

In order to offer an overall view of the participants in the study, Table 2 shows the evolution, difficulties, as well as the level of concentration and the most relevant observations of each participant throughout the programme.

Table 2. Participant's evolution.

Participants	Sessions	Initial level of concentration	Developments during the sessions	Difficulties encountered	Additional remarks
Participant 1	19 sessions	Medium - low	Progressive increase in concentration, improved coordination, and relaxation. Preference for the game "Calm".	Initial difficulty in understanding the dynamics of the games.	Improved postural control and relaxation
Participant 2	17 sessions	Initial low, rising to medium-high	Excited in the first sessions, needs time to concentrate. Increased proprioception over time	He is very nervous at the beginning	Increased proprioception observed over the course of sessions
Participant 3	13 sessions	Medium-High	Curious, observant, constant concentration	Difficulty at the beginning in taking breaths	Improved breathing performance towards the last few sessions
Participant 4	15 sessions	Low at the start, medium later	Initial difficulties in understanding the dynamics. Progressive improvement in attention.	Initial feeling of suffocation and suffocation	Greater predisposition and improved attention.
Participant 5	15 sessions	Very low	Constant movements, difficulty in controlling body.	Lack of control of body movements	Perform the breaths as directed

			Observer on stage.		
Participant 6	16 sessions	Medium at start	Agitated at onset, difficulty with controls. Breathing autonomy	Verbalises aloud what his senses perceive	Autonomy in breathing and observation in scenarios
Participant 7	19 sessions	Medium at the beginning, high at the end	Initial frustration. Learns the dynamics easily. Relaxed and concentrated and being aware of your body movements.	There are episodes of frustration at not being able to carry out all the guidelines followed.	Place your hands on your abdomen to control your breaths and become more aware of them.
Participant 8	18 sessions	High from the start	Paused and concentrated breathing. Precision in movements.	It does not present	High attention and precision.
Participant 9	14 sessions	Medium at the beginning, optimal at the end	He is calm and collected	He is hearing impaired and has difficulties in following explanations.	Favourable reception of the programme.
Participant 10	10 sessions	Medium-High	Lower number of sessions than his peers, but his performance in terms of attentional levels has been medium-high from the beginning.	He verbalised everything he saw and described it in detail.	He was attentive and curious
Participant 11	14 sessions	Medium-High	Concentrated, proactive, relaxed. Breathes easily.	It does not present	Optimal concentration and relaxation.

Overall, the implementation of VR seems to have positive impacts on participants' attention and well-being, highlighting the importance of individual adaptation and progression throughout the sessions.

In addition to collecting the information observed and provided by the different participants, structured interviews are conducted with both the students (Table 3) and the teachers involved in

the programme intervention (Table 4). The purpose of these interviews is to assess the impact of the programme on the participants and their perceptions of it.

Table 3. Questions asked to students with functional diversity.

Do you like virtual reality glasses?
When you use them, do you feel a sense of relaxation?
Have you noticed that your grades are better as a result of using the goggles?
Do you think the goggles can help you study?
Do you concentrate more when studying than if you had not worn the glasses?
What do you think you get out of using virtual reality goggles?
What would you improve about the goggles?
What would you improve about the goggles? Do you like virtual reality goggles?

Table 4. Questions asked to teachers of students with functional diversity.

How has the students' period of adaptation to the technology been since they first put on the glasses? Did they find it difficult? Did they not find it difficult?
Do you think that English has been a barrier to the use of this application?
What curricular problems do you think the application of this programme poses?
Have you noticed that its use has had an impact on grades, or is there a better underperformance?
And what difference have you noticed between the Focus game and Calm?
Do you think that implementing this technology has helped them to meditate?
Have you noticed changes in performance, motivation, learning, engagement when implementing this programme for your students?
Have you noticed that your students, compared to other activities, perform better, are more motivated?
Did you like the experience of using this virtual reality technology in the classroom?
Do you think it is complicated to use this technology with students with functional diversity?
Have you detected any side effects: dizziness, strange sensations, nausea?
What did you like most about the Tripp application?
Do you think that for example the type of movement performed with the glasses helps them to physically relax?
If you compare the results of the same task before and after implementing the programme, do the results improve?
Why do you think this programme can bring benefits?
Do you think Mindfulness should be integrated into the curriculum, or do you prefer specific workshops outside the curriculum?

In their testimonies, they emphasised that carrying out mindfulness practices without the support of virtual reality is a challenging task, noting that the use of technology provides them with a sense of serenity. As a suggestion for improvement, participants expressed the wish for games to be specifically designed and adapted to be accessible in sign language and Spanish.

On the other hand, the teachers highlighted the extraordinary adaptation of the students to the programme, stressing that no adverse side effects have been observed. However, they noted that the English language barrier in the application was an obstacle. The teachers also reported that the use of virtual reality and mindfulness was reflected in a noticeable reduction in impulsivity among the students, which translated into improved academic performance. The implementation of this programme with students with diverse functional abilities was relatively straightforward, as they were able to adapt it according to the individual needs of each student.

Both teachers and students expressed a strong preference for the "Trip" application. The reported benefits were diverse, with students exhibiting greater calmness and serenity. The implementation of similar projects in all schools is considered essential. However, it is recognised

that there is resistance from some teachers who, being digitally illiterate, are reluctant to integrate these tools in the classroom. These teachers tend to focus only on the traditional curriculum and do not perceive how the application of programmes such as this one could improve students' grades by making them more receptive to learning.

4. Discussion and Conclusions

In general terms, the conclusions reached in this research emphasize the positive impact of the implementation of programs that merge mindfulness and virtual reality, underlining the relevance of these approaches for the comprehensive improvement of the educational process and the emotional well-being of the participants.

The educational reality of students with special educational needs is usually associated with different difficulties, among which the deficiencies in HHSS stand out, as explained by Van der Sande et al., [31], they also expose the deficiencies in other areas with a poor ability to resolve conflicts, lack of ability to manage failures, difficulties in initiating and participating in a conversation, listening, showing sympathy and maintaining a friendly relationship in a work team [32].

The numerous academic failures are the reason why students with learning difficulties do not believe that all the effort they make will serve to improve their performance or that they will be successful in their school tasks [33]. Recent studies based on mindfulness have shown a significant reduction in impulsivity in students with learning difficulties [34], the possibility of improvement in the regulation of attention, thoughts and emotions through breathing techniques in the face of behavioral problems [35] as well as the decrease in levels of hyperactivity and inattention in students with Attention Deficit Hyperactivity Disorder [36].

In the educational field, different programs have been launched aimed at students and teachers. Some of the interventions designed for the first group conclude that in Primary Education students the number of behavioral problems in the classroom has decreased, improving social relationships and relaxation [37] and, as for teachers, Body et al. [38] evaluated the effects of a Full Emotional Intelligence program, finding an improvement in the level of the participants during their training as Primary and Secondary Education teachers.

Keller et al. [39] present Mindfulness as a well-established metacognitive strategy that allows the development of attention, helps reduce anxiety and cognitive interference, as well as improves positive affect. Likewise, Currie et al. [40] studied a mindfulness-based program among people with intellectual disabilities, finding that participants had experienced several benefits, including improved self-esteem, confidence, and compassion for self and others. In another qualitative study Griffith et al. [41] found that participants showed greater sociability and better quality of life after participating in the mindfulness intervention.

In the words of Wang [42] there are previous studies that investigate the effects of virtual reality with other teaching approaches verify the potential that emerging technologies provide to students by allowing them to access simulated, immersive, and interactive virtual environments to carry out authentic learning activities. [43].

Wang [42] highlights in her study the significant increase in motivation and attitude towards learning of students who learn through the use of virtual reality compared to those students who receive a more traditional education.

In terms of motivation and learning attitude, students learning with the VPS-VR approach had significantly higher motivation and better attitudes compared to the control group.

Studies such as that of Abad [44] on emerging technologies verify that these tools, together with an appropriate pedagogical approach, allow the content of a relevant topic to be explained, providing additional resources that favor student learning.

However, the study has limitations due to the insufficient sample it has, and the difficulties it presents when generalizing results in other environments; since these data are compromised by the specific nature of the field to which they belong, therefore, it is complex to extrapolate the findings to other contexts.

Despite the aforementioned limitations, the study provides new possibilities for future research; In order to expand the research, it is proposed to implement this program with other groups with functional diversity and make a comparison between both contexts. Furthermore, it may be interesting to evaluate the program in different areas, such as the university population or the elderly, so that its effects and applicability in different contexts can be assessed.

This research presents an overview of the integration of virtual reality and mindfulness with students with functional diversity with the aim of taking appropriate measures towards the SDGs.

Likewise, the regulation of impulsivity is encouraged, which allows us to promote the health and well-being of students. If students are able to improve these skills, they will be able to benefit from this intervention and generalize this learning by applying it to their daily lives.

This study hopes that it will be possible to achieve the third, fourth and tenth goals of the SDGs through the fusion between virtual reality and mindfulness, thus promoting egalitarian and quality education, as well as promoting well-being and reducing inequalities to through technology.

References

1. Schuman-Olivier Z, Trombka M, Lovas DA, Brewer JA, Vago DR, Gawande R, et al. Mindfulness and behavior change. Harvard Review of Psychiatry. 2020 Nov;28(6):371–94. https://doi.org/10.1097/hrp.0000000000000277

2. Kabat-Zinn J. Mindfulness-based interventions in context: Past, present, and future. Clinical Psychology: Science and Practice. 2003;10(2):144–56. https://doi.org/10.1093/clipsy.bpg016

3. Hervás G, Cebolla A, Soler J. Intervenciones Psicológicas Basadas en mindfulness y sus beneficios: Estado Actual de la Cuestión. Clínica y Salud. 2016 Nov;27(3):115–24. https://doi.org/10.1016/j.clysa.2016.09.002

4. Bisquerra Alzina R, Hernández Paniello S. Psicología positiva, educación emocional y el programa aulas felices. Papeles del Psicólogo. 38:58–65. https://www.redalyc.org/articulo.oa?id=77849972006

5. Singh N, Singh Joy SD. Mindfulness-based interventions with children and adolescents: Research and practice. Abingdon, Oxfordshire: Routledge; 2022.

6. Bishop SR, Lau M, Shapiro S, Carlson L, Anderson ND, Carmody J, et al. Mindfulness: A proposed operational definition. Clinical Psychology: Science and Practice. 2004;11(3):230–41. https://doi.org/10.1093/clipsy.bph077

7. Vasquez-Dextre E. Mindfulness: General concepts, psychotherapy and clinical applications. Revista de Neuro-Psiquiatría. 2016;79(1):42–51. http://www.scielo.org.pe/scielo.php?pid=S0034-85972016000100006&script=sci_abstract

8. Kabat-Zinn J. Wherever you go, there you are: Mindfulness meditation in everyday life. United Kingdom: Hachette Go; 2023.

9. Grossman P, Niemann L, Schmidt S, Walach H. Mindfulness-based stress reduction and health benefits. Journal of Psychosomatic Research. 2004 Jul;57(1):35–43. https://doi.org/10.1016/s0022-3999(03)00573-7

10. Baer R, Smith GT, Hopkins J, Krietemeyer J, Toney L. Using self-report assessment methods to explore facets of mindfulness. Assessment. 2006 Mar;13(1):27–45. https://doi.org/10.1177/1073191105283504

11.   Creswell JD. Mindfulness interventions. Annual Review of Psychology. 2017 Jan 3;68(1):491–516. https://doi.org/10.1146/annurev-psych-042716-051139

12.   Luciano Soriano C, Rodriguez Valverde M, Gutiérrez Martinez O. Mindfulness interventions. Revista Latinoamericana de Psicología. 2005 Jan;37(2):333–58. https://bit.ly/3HPQ3R8

13.   Dorais S, Gutierrez D. The effectiveness of a centering meditation intervention on college stress and mindfulness: A randomized controlled trial. Frontiers in Psychology. 2021 Oct 21;12. https://doi.org/10.3389/fpsyg.2021.720824

14.   Moscoso M. Hacia una integración de mindfulness e inteligencia emocional en psicología y educación. Liberabit: Revista Peruana de Psicología. 2019 Jun 27;25(1):107–17. https://doi.org/10.24265/liberabit.2019.v25n1.09

15.   Mussey S. Mindfulness in the classroom: Mindful principles for social and emotional learning. London: Routledge; 2021.

16.   Cózar Gutiérrez R, González-Calero Somoza JA, Villena Taranilla R, Merino Armero JM. Análisis de la motivación ante El Uso de la realidad virtual en la Enseñanza de la historia en futuros maestros. Edutec Revista Electrónica de Tecnología Educativa. 2019 Jun 28;(68):1–14. https://doi.org/10.21556/edutec.2019.68.1315

17.   Kitson, A., Prpa, M. and Riecke, B. (2018a) 'Immersive Interactive Technologies for positive change: A scoping review and design considerations', Frontiers in Psychology, 9. https://doi.org/10.3389/fpsyg.2018.01354.

18.   Crescentini C, Chittaro L, Capurso V, Sioni R, Fabbro F. Psychological and physiological responses to stressful situations in immersive virtual reality: Differences between users who practice mindfulness meditation and controls. Computers in Human Behavior. 2016 Jun;59:304–16. https://doi.org/10.1016/j.chb.2016.02.031

19.   Flujas Contreras JM, Ruiz Castañeda D, Botella C, Gómez I. Psychological and physiological responses to stressful situations in immersive virtual reality: Differences between users who practice mindfulness meditation and controls. Computers in Human Behavior. 2017 Dec;4(3):17–25. https://www.redalyc.org/pdf/4771/477152557003.pdf

20.   Negut A, Matu S-A, Sava FA, David D. Convergent validity of virtual reality neurocognitive assessment: a meta-analytic approach . 2015 Jan;31–55. https://www.researchgate.net/publication/310415667

21.   Kenney MP, Milling LS. The effectiveness of virtual reality distraction for reducing pain: A meta-analysis. Psychology of Consciousness: Theory, Research, and Practice. 2016;3(3):199–210. https://doi.org/10.1037/cns0000084

22.   Emmelkamp P, Meyerbröker K. Virtual reality therapy in mental health. Annual Review of Clinical Psychology. 2021 May 7;17(1):495–519. https://doi.org/10.1146/annurev-clinpsy-081219-115923

23.   Sousa Ferreira R, Campanari Xavier RA, Rodrigues Ancioto A. Virtual reality as a tool for basic and vocational education. Revista Científica General José María Córdova. 2021 Aug;19(33):223–41. https://doi.org/10.21830/19006586.728

24.   1. Delgado-Reyes AC, Sánchez López JV. Realidad virtual: evaluación e intervención en el trastorno por déficit de atención/hiperactividad (TDAH). Revista Electrónica de Psicología Iztacala. 2021 Mar;24(1):73–98. https://www.medigraphic.com/pdfs/epsicologia/epi-2021/epi211d.pdf

25.   Banguero Lozano HE. La Era del Desarrollo Sostenible: Nuestro Futuro Está en juego. Incorporemos el Desarrollo sostenible a la agenda Política Mundial. Revista Lumen Gentium. 2017 Sept 26;1(2):101–3. https://doi.org/10.52525/lg.v1n2a9

26.   Martínez Villalobos G, Ruiz Rodriguez D. Impacto del aula invertida con tecnologías emergentes en un curso del ciclo básico de ingeniería. Revista mexicana de investigación educativa. 2022 Aug 22;27(94):971–97. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-66662022000300971&lng=es&tlng=es

27.   Burgdorf V, Szabó M, Abbott M. The effect of mindfulness interventions for parents on parenting stress and Youth Psychological Outcomes: A systematic review and meta-analysis. Frontiers in Psychology. 2019 Jun 6;10. https://doi.org/10.3389/fpsyg.2019.01336

28.   Shogren K, Singh N. Intervening from the "Inside out": Exploring the role of self-determination and mindfulness-based interventions for people with intellectual and developmental disabilities. Advances in Neurodevelopmental Disorders. 2022 Apr 20;6(2):147–56. https://doi.org/10.1007/s41252-022-00252-y

29.   Alonso-García S, Romero-Rodríguez J. M, Marín-Marín J. A, , Sadio-Ramos FJ Tecnología educativa para la agenda 2030: Objetivos de Desarrollo Sostenible (ODS) ante la pandemia. Texto libre: Linguagem e Tecnología.2021;14(2) https://www.redalyc.org/articulo.oa?id=577168155001

30.   Liang J. Research [Internet]. 2023 [cited 2024 Feb 6]. Available from: https://www.tripp.com/research/

31.   Van der Sande L, Hendrickx M, Boor-Klip H, Mainhard T. Learning disabilities and low social status: The role of peer academic reputation and peer reputation of teacher liking. Journal of Learning Disabilities. 2017 May 4;51(3):211–22. https://doi.org/10.1177/0022219417708172

32. Smith T, Polloway E, Taber - Doughty T. Teaching students with special needs in inclusive environments. Pearson; 2015.

33. Seyed S, Salmani M, Motahari Nezhad F, Noruzi R. Self-efficacy, achievement motivation, and academic progress of students with learning disabilities: A comparison with typical students. Middle East Journal of Rehabilitation and Health. 2017 Mar 26;4(2). https://doi.org/10.5812/mejrh.44558

34. Alqarni TM, Hammad MA. Effects of mindfulness training program on the impulsivity among students with learning disabilities. Journal of Educational and Social Research. 2021 Jul 8;11(4):184. https://doi.org/10.36941/jesr-2021-0088

35. McFall A, Jolivette K. Mindful breathing: A low-intensity behavior strategy for students with behavioral challenges. Preventing School Failure: Alternative Education for Children and Youth. 2022 Oct 13;68(1):1–7. https://doi.org/10.1080/1045988x.2022.2132196

36. Gabriely R, Tarrasch R, Velicki M, Ovadia-Blechman Z. The influence of mindfulness meditation on inattention and physiological markers of stress on students with learning disabilities and/or attention deficit hyperactivity disorder. Research in Developmental Disabilities. 2020 May;100:103630. https://doi.org/10.1016/j.ridd.2020.103630

37. García Rubio C, Luna Jarillo T, Castillo Gualda R. Impacto de una intervención breve basada en mindfulness en niños: Un estudio piloto. Revista Interuniversitaria de Formación del Profesorado. 2016;30(3):61-74. https://www.redalyc.org/articulo.oa?id=27449361007

38. Body L, Ramos N, Recondo O, Pelegrina M. Development of Emotional Intelligence through the mindfulness program program to regulate emotions (PINEP) in teachers. Revista Interuniversitaria de Formación del Profesorado. 30(3):47–59. https://www.redalyc.org/journal/274/27449361006/27449361006.pdf

39. Keller J, Ruthruff E, Keller P. Mindfulness and Speed Testing for children with learning disabilities: Oil and water? Reading & Writing Quarterly. 2019 Feb 14;35(2):154–78. https://doi.org/10.1080/10573569.2018.1524803

40. Currie T-L, McKenzie K, Noone S. The experiences of people with an intellectual disability of a mindfulness-based program. Mindfulness. 2019 Jan 24;10(7):1304–14. https://doi.org/10.1007/s12671-019-1095-4

41. Griffith G, Hastings R, Williams J, Jones R, Roberts J, Crane R, et al. Mixed experiences of a mindfulness-informed intervention: Voices from people with intellectual disabilities, their supporters, and Therapists. Mindfulness. 2019 Mar 28;10(9):1828–41. https://doi.org/10.1007/s12671-019-01148-0

42. Wang Z, Guo Y, Wang Y, Tu Y-F, Liu C. Technological Solutions for Sustainable Development: Effects of a visual prompt scaffolding-based Virtual Reality Approach on EFL Learners' reading comprehension, learning attitude, motivation, and anxiety. Sustainability. 2021 Dec 17;13(24):13977. https://doi.org/10.3390/su132413977

43. Parmaxi A. Virtual reality in language learning: A systematic review and implications for research and Practice. Interactive Learning Environments. 2020 May 22;31(1):172–84. https://doi.org/10.1080/10494820.2020.1765392

44. Abad-Segura E, González-Zamar M-D, Luque-de la Rosa A, Morales Cevallos MB. Sustainability of educational technologies: An approach to augmented reality research. Sustainability. 2020 May 16;12(10):4091. https://doi.org/10.3390/su12104091