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Politics of the Machines 2025: Synthetic Sentience

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Abstract

This pilot study investigated whether mindfulness focused virtual reality simulations provided from within the aloeVR software program improved vagal tone and self-reported emotional regulation among middle schoolers with neurodevelopmentally based learning differences (e.g., autism spectrum disorder, attention deficit hyperactivity disorder, specific learning disability, other health impairments and their comorbidities). Extant literature shows that heart rate variability (HRV) is correlated with improved stress coping and emotional control in self-thought and social interactions. We measured 12 middle school participants' HRV and self-reported socioemotional regulation at regular counseling check-ins during socioemotional learning, and after exposure to aloeVR simulations supporting check-ins. Results showed upward trends in HRV post-VR exposure, but no corresponding patterns in self-reported socioemotional regulation. Ideas for future research include pairing aloeVR with explicit socioemotional learning instruction to facilitate improved HRV and adaptive improvements in self-thought and social interaction.

Keywords: disability, virtual reality, socioemotional learning, special education, emotional regulation

Introduction

Socioemotional learning (SEL) is defined by the Collaborative for Academic, Social, and Emotional Learning (CASEL, 2024) as encompassing processes through which children and adults can learn and apply knowledge, attitudes and skills to manage their emotions and social interactions. There is a particular need for SEL in the digital age, owing to student tendencies across developmental periods to exhibit aggressive behaviors and emotional dysregulation in school (Blad, 2019; Twenge et al., 2019) in part owing to polarizing interactions that may emerge on the Internet (Glassman et al., 2023; Haidt, 2024).

Curtailing technology use in schools may not be a suitable answer to Haidt's (2024) concerns, since technology is unlikely to disappear in coming decades. A more adaptive solution may be to create innovative educational scenarios that tap technology's potential to augment student learning and improve behavior (Glassman, 2016). There is a small body of research that has addressed the use of cutting-edge technologies for SEL to serve students with wide ranging learning differences, and there has been a recent call for more (Xu et al., 2023).

Emotional regulation studies have been subsumed within self-regulation research. Self-regulation involves attending to and understanding environmental feedback regarding one's thoughts and actions in an effort to alter future thinking and actions (Blank, 2019). These change mechanisms underlie improved self-control, positive self-concept, and better social interactions (Bandura, 1994). The mechanism is a cybernetic feedback loop facilitating live error-corrections in social systems (Tilak et al., 2022; Carver & Schieier, 2012). Education researchers have suggested new skills in self-regulation and more effective strategy use may emerge from

**This paper is a preprint, and will be peer-reviewed post- the conference.*

experiential, real-time learning that curates an added value for self-regulated learning (Duckworth & Carlson, 2013).

In the current study we sought s to expand literature related to self-regulation and socioemotional learning in the Information Age by showcasing a new VR technology for biofeedback training and mindfulness. We also implemented a physiological measure of self-regulation. Our work focused on middle schoolers, who in their early years, are particularly receptive to SEL (National Center on Safe and Supportive Learning Environments, 2025).

Self-regulation, emotional regulation, and heart rate variability

Despite self-regulation showing possibility to have an embodied dimension related to stress management and heart functioning (Greenberg et al., 2015), it has been mostly measured through self-report questionnaires (Cleary et al., 2024) and qualitative interviews. The link between heart rate variability, vagal tone, and self-regulation has been shown in extant literature (Beauchaine, 2015). The vagus nerve (longest of all cranial nerves) is associated with stress and socioemotional responses that include changes in the pharynx, larynx and soft palate (Porges, 2007). Good vagal tone has been associated with higher heart rate variability (HRV), or well-defined rest during inhalation and exhalation (Makivic et al., 2013; Shields, 2009). On electrocardiogram (ECG), greater average distance between successive heartbeats suggests higher HRV.

A mathematical index directly proportional to HRV is the Root Mean Square of Successive Differences between heartbeats (RMSSD) (Shaffer & Ginsberg, 2017). An Apple Watch or phone with photosensors can measure HRV even over short time epochs (Apple Inc., 2024). While HRV metrics are usually taken over the course of a day, from wakefulness to rest, there is substantial support for the effectiveness of short-term measurements of at least two minutes (120 seconds) for both adults (Munoz et al., 2015), and adolescents (Baek et al., 2015; Chen et al., 2020; Nakamura et al., 2017).

Muhtadie et al. (2014) showed that vagal flexibility can predict accuracy in individuals' detections of social-emotional cues in still face images, and in their greater sensitivity to cues in dynamic social interactions). Borowski (2022) showed that adolescents in problem disclosure situations displayed superior vagal flexibility when they supported each other in their decision-making. Conversely, others have shown that poor vagal flexibility was associated with adolescents' internalizing psychopathology (McLaughlin et al., 2013). In the current pilot study, we explored whether there might be correlations between higher HRV and mental self-reported well-being when students with learning differences used virtual reality (VR) based mindfulness simulations.

VR simulations, self-regulation, and special education

A few studies have shown how full-body immersion into self-management and social interaction tasks can assist students with learning differences in improving their motor skills, impulsive tendencies, and effective self-governance via thinking, feeling, and social interactions. Weerdmeester et al. (2016) studied 73 children aged 6 to 13 years and found that an experimental group who played a full-body VR video game improved fine motor skills; teacher-reported symptoms of attention deficit hyperactivity disorder (ADHD) also improved relative to a control group. Ou et al. (2020) observed that students with ADHD displayed reduced oppositional defiant behavior, superior information processing and abstract reasoning after exposure to educational VR games.

Parsons (2015), working with 8-year-old students with autism spectrum disorder (ASD), observed that playing a collaborative VR game called "Block Challenge" improved reciprocity and collaboration. While neurotypical students and those with ASD effectively collaborated in this environment, those with ASD exerted more sustained effort. Schena et al. (2023) found that exposure to work and learning related experiences through participation in the IamHero VR tool led 5–12-year-old students with ADHD to not only improve their learning/motivation but also family interactions and school behavior. In Keshav et al.'s (2018) case study of a student with ASD, teachers reported improved self-awareness, eye-contact, and verbal expression after exposure to a SmartGlass technology that helped model and regulate social interactions in real-time. Tsai et al. (2021) used a VR tool that allowed students with ASD to view their interactions with others, and participate in these interactions from a first-person perspective; these investigators observed improvements in the efficacy students showed in interpreting role-playing social scenarios.

The Current Study

This quantitative pilot study explored whether VR-based mindfulness simulations in the aloeVR software application could assist students with learning differences [i.e., ADHD, ASD, Specific Learning Disabilities (SLD), and their comorbidities] in improving self-reported emotional regulation and HRV. We sought to answer the following research questions (RQs):

> **RQ1:** *To what extent will students' heart rate variability (RMSSD) change post-aloeVR assisted instruction versus traditional social pragmatic instruction?*
>
> **RQ2:** *To what extent will students' end-of-week self-reported socioemotional regulation scores differ post-aloeVR-assisted instruction versus traditional social pragmatic instruction?*

Method

Participants

Twelve middle schoolers with learning differences participated in the study (83.33% White, 16.66% Hispanic, age 12-14 years). Participants had been diagnosed with neurodevelopmentally-based learning differences that included ASD, ADHD, specific learning disabilities, and their comorbidities, such as anxiety disorder, adjustment disorder, non-verbal learning disorder, and other health impairments. Students were recruited from a small special education independent school in Southeastern Virginia. Students who participated were already receiving counseling sessions (check-ins) with the school counselor. The study was approved by Institutional Review Boards at both the independent school and an affiliated liberal arts university. All participants gave informed assent, and parents/caregivers of each participant gave written consent.

Curriculum

The aloeVR software is a mindfulness-based VR technology that provides students simulation experiences to teach them about breath and body work, self-management, and navigating social interactions. This tool can be used on a Meta Quest Headset. It allows students to select a biome that contains learning modules led by virtual animal instructors. Each simulation focuses on a specific emotion or skill (yoga, mindful breathing, art healing, managing anger), followed by a minigame sequence (playing drums, building with blocks, a basketball game, making soup, planting a tree, see Figure 1 for some examples).

Figure 1

Examples of aloeVR simulations.

Each simulation comes with a reflection rubric that asks students to draw, write and think about their own emotions and their interactions with others. The 12 possible simulations are:

1. Sea Lion, Intro to Mindfulness (Ocean Coast)
2. Humboldt Penguin, Breath (Ocean Coast)
3. Sea Turtle, Focus (Ocean Coast)
4. Jaguar, Anger and Acceptance (Rainforest)
5. Pink River Dolphin, Joy and Play (Rainforest)
6. Yellow-Tailed Wooly Monkey, Yoga (Rainforest)
7. Human-Being, Health Body and Balance (Machu Picchu)
8. Cuy (Guinea Pig), Stress and Fear (Machu Picchu)
9. Llama, Forgiveness and Gratitude (Machu Picchu)
10. Spectacled Bear, Sadness and Resilience(Rainbow Mountains)
11. Puma, Patience and Peace (Rainbow Mountains)
12. Condor, Self-Love (Rainbow Mountains)

In assigning four simulations, we implemented an individualized approach to gauge challenges that students faced at school, based on the counselor's judgment.

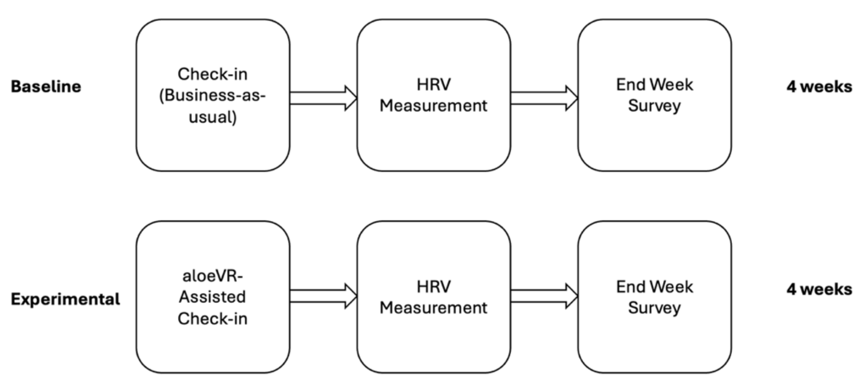
Data Collection

During the first four weeks, students were engaged in business-as-usual school activities including regular check-ins with the counselor. We measured HRV after the check-ins, and, at the end of each week, students completed an emotional regulation survey of their thoughts about their emotions and whether they sought social interaction with peers/trusted adults when they felt strong emotions.

During the second four-week period, we provided students an aloeVR simulation before each check-in, and used the same HRV and survey measurements. A flowchart of these study procedures is provided below (Figure 2). We avoided an ABAB design in which there might be alternating control and intervention sessions to prevent disappointment from intermittently removing the VR experience students had come to enjoy.

Figure 2

Procedure flowchart.



Measures

HRV Measure. We used an iPhone's photosensor and a paid version of the Welltory App to collect HRV data after the students' regular and VR-assisted check-ins. This app allows monitoring hearth health, diet patterns, exercise and sleep. We recorded HRV metrics by noting the app-generated RMSSD value.

Surveys. We administered an emotion regulation scale developed by Phillips and Power (2007) to all participants at the end of each week of the study. We used only the five items from the internal and the four items from the external adaptive emotional regulation subscales, for which there has been sufficient internal reliability previously reported with adolescents (Cronbach's Alpha score of 0.76 and 0.66 respectively). These items are provided in Table 1.

Table 1

Survey items.

Variable	Items
Internal Adaptive Emotional Regulation (Cronbach's Alpha= 0.76)	1. I review (re-think) my thoughts or beliefs.
	2. I review (re-think) my goals or plans
	3. I put the situation into perspective
	4. I concentrate on a pleasant activity
	5. I plan what I could do better next time

External Adaptive Emotional Regulation (Cronbach's Alpha= 0.66)	1. I talk to someone about how I feel
	2. I seek physical contact from friends/family
	3. I do something energetic
	4. I ask others for advice

***Note**: Likert scale ranges from 1 to 5 (Not at all to Always).*

Data Analysis

We inputted all data into a CSV file for analysis in RStudio. RMSSD values were log transformed to avoid excessive data skewing. Condition markers (0 for business-as-usual check-ins, and 1 for VR assisted sessions) indicated whether check-ins were assisted by VR. Each week's internal and external adaptive socioemotional regulation surveys were also inputted into this dataset.

We computed skewness and kurtosis for all variables to ensure that data were uniformly distributed. Linear mixed graphs were plotted to understand the effects of VR exposure on both HRV metrics, and emotional regulation survey responses over time.

Results

Skewness and kurtosis values for HRV and survey data fell within the ±2 and ±10 ranges, respectively, indicating a relatively uniform data distribution (Table 2).

Table 2

Skewness and kurtosis values for emotional regulation and HRV variables.

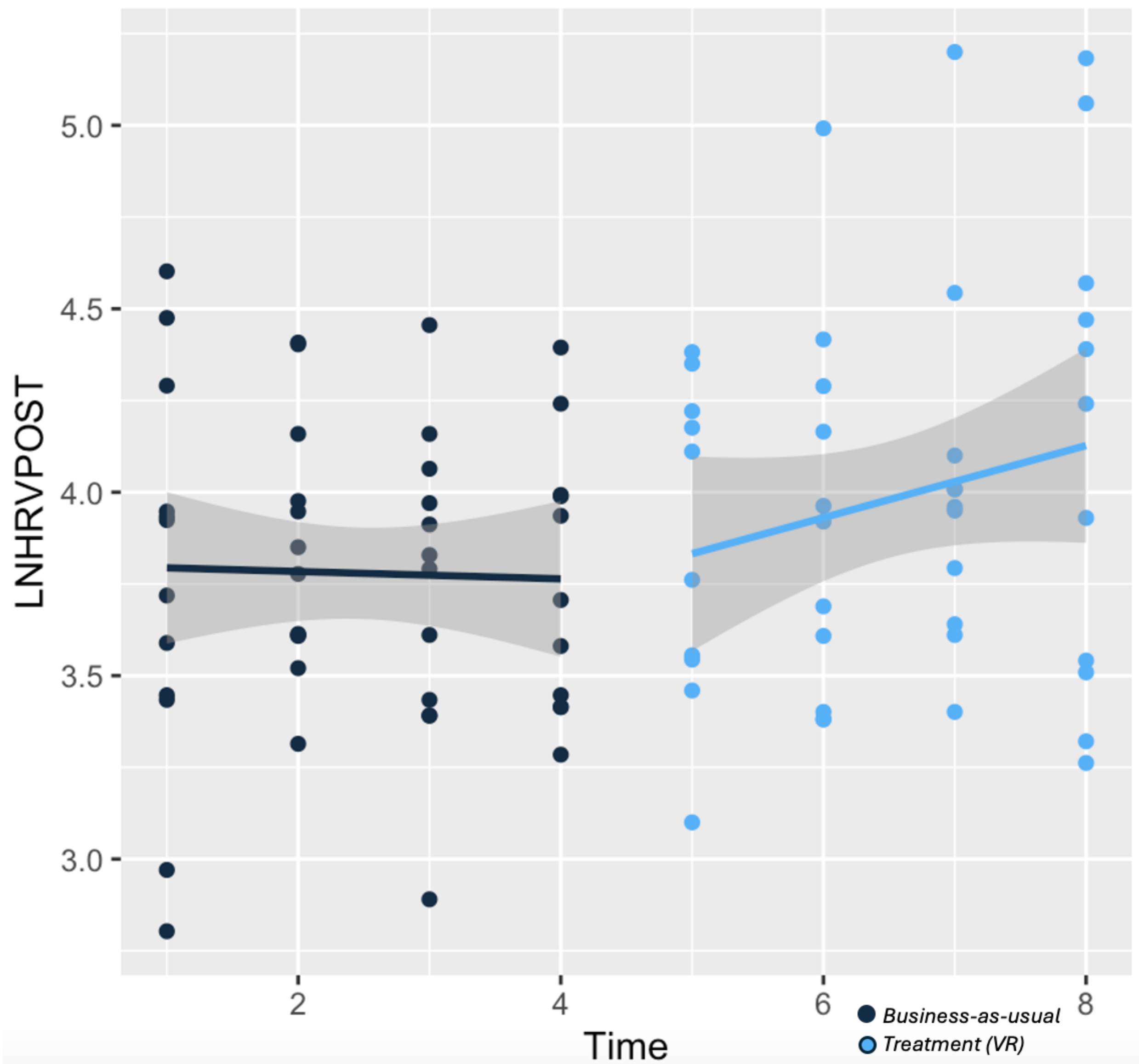
Variables	Skewness	Kurtosis
Log of RMSSD	0.46	3.26
Internal Emotional Regulation	-0.12	2.77
External Emotional Regulation	0.21	2.39

The effects of treatment and time on HRV and self-reported emotional regulation were computed using a series of three trend graphs.

The first graph (Figure 3) highlights the effect of the interaction between treatment and time on the natural log of the RMSSD values. On average students' HRV rose over time and after exposure to aloeVR assisted check-ins. HRV values tended to be higher, on average, post VR-assisted check-ins (3.99) than after business-as-usual check-ins (3.78). These results tackle RQ1.

Figure 3

Graph of the relationship between the HRV-based log of RMSSD values and treatment over time.



Figures 4 and 5 depict graphs focused on the effect of the interaction between treatment and time on self-reported internal and external socioemotional regulation, respectively. There was no upward trend in survey responses post-VR exposure.

Figure 4

Graph of the relationship between internal emotional regulation and treatment over time.

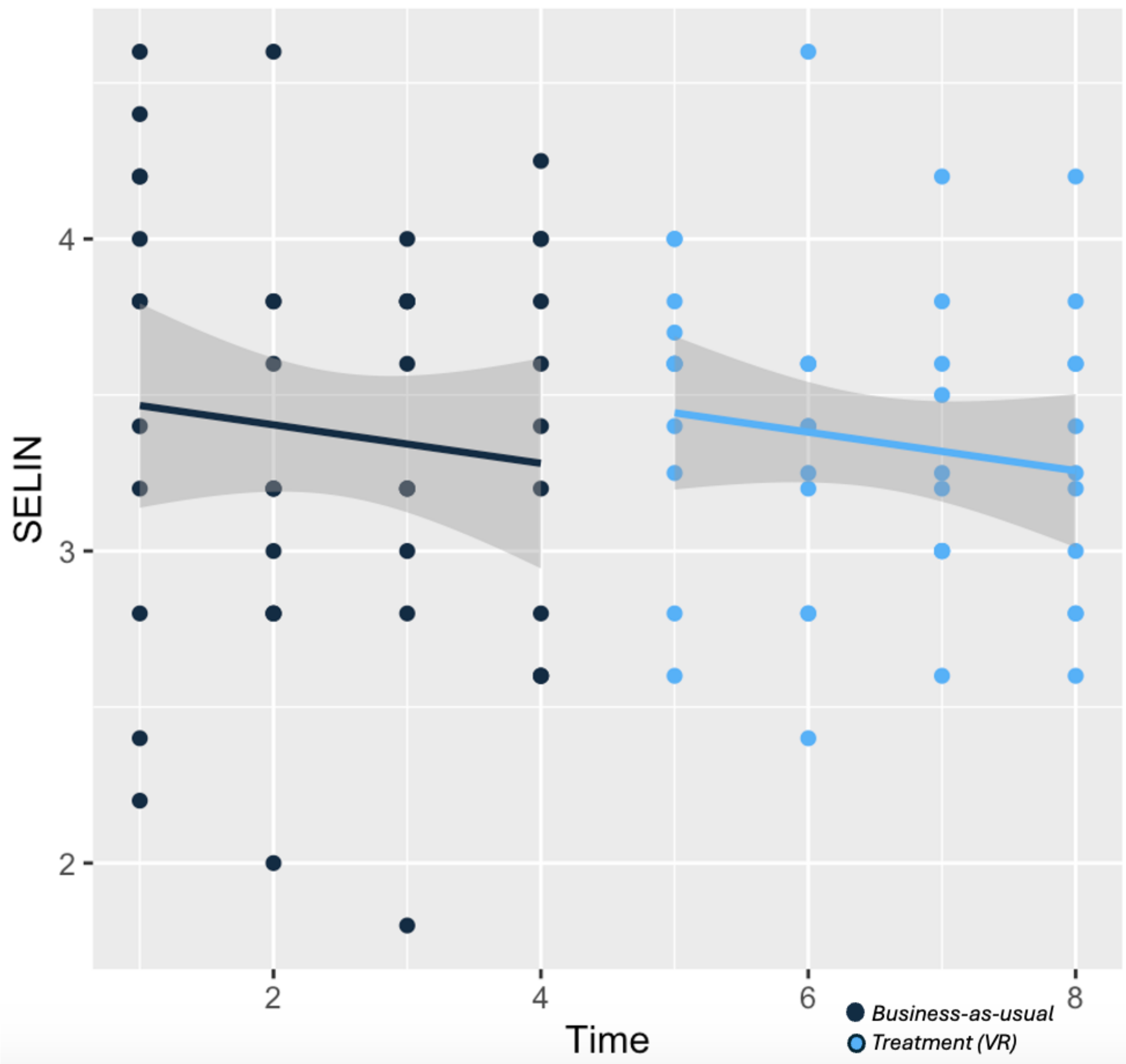
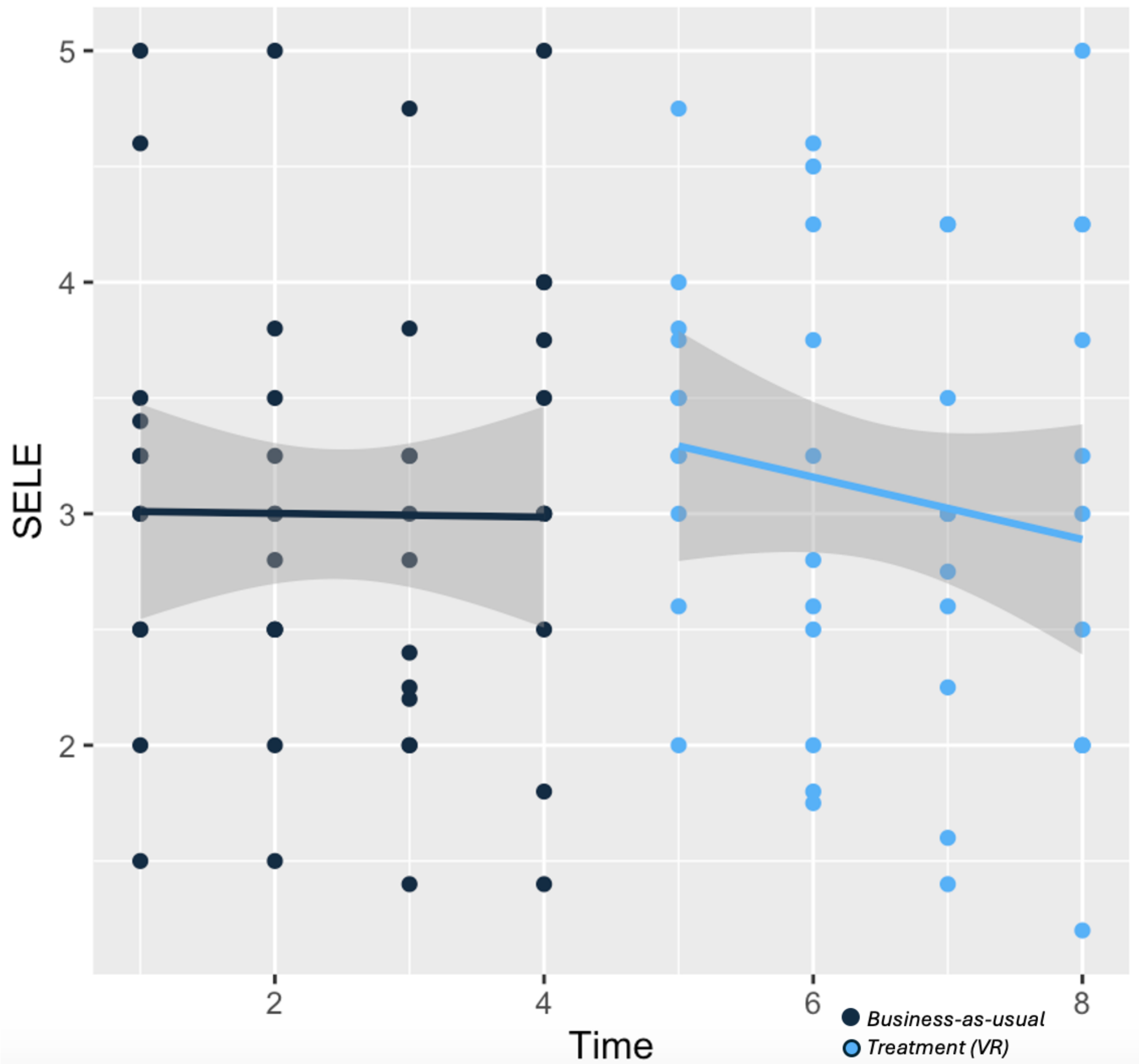


Figure 5

Graph of the relationship between external emotional regulation and treatment over time.



On average, survey responses were nearly equivalent in the treatment condition for both variables (see Table 3). While externally mediated emotional regulation scores were slightly higher post-exposure, internally mediated scores showed negligible difference.

Table 3

Comparison of average self-reported emotional regulation scores.

Variable	Business as usual	aloeVR Assisted
Internally mediated emotional regulation	3.37	3.36
Externally mediated emotional regulation	2.99	3.1

The two graphs, and the accompanying descriptive statistics tackle RQ2.

Discussion

This pilot study investigated whether middle school students with neurodevelopmentally based learning differences positively responded to VR-based mindfulness tools in terms of their physical capacity for stress coping (as measured by HRV), and ways in which they navigated challenging situations in their social lives (as measured by their self-report). We first asked: *To what extent did students' heart rate variabilities (RMSSD) change post-aloeVR assisted instruction versus traditional social pragmatic instruction?* Our graphical results indicated that exposure to aloeVR produced an upward trend in HRV-based RMSSD metrics. This rise indicated restful respiration, and a more relaxed physiology. Our use of short-term HRV values computed from within 2-minute measurements post traditional counseling check-ins or VR exposure check-ins was an effort to apply a valid physiological measure for adolescents (Baek et al., 2015; Chen et al., 2020; Nakamura et al., 2017). Our results strengthen the argument that HRV metrics may be improved post biofeedback and breathing exercises for participants of this age group.

Our second research question, RQ2, asked: *To what extent did students' end-of-week self-reported socioemotional regulation scores differ post-aloeVR-assisted instruction versus traditional social pragmatic instruction?* Graphs and descriptive statistics showed that there were comparable positive perceptions of internal and external adaptive socioemotional regulation on VR days, but there was no consistent upward trend over time to indicate an increased frequency of self-reported strategy use in social situations students encountered in their everyday lives. These results resonate with extant literature showing that VR technology may support socio-emotional learning efforts in producing adaptive relaxation in social skill situations (Parsons, 2015; Schena et al., 2023; Keshav et al., 2018). However, when considering students with learning differences, additional efforts are needed to better understand how to combine explicit instruction and VR simulations to facilitate a transfer of any social skills learned virtually into real life situations. In sum, this study contributes to research on VR technology and self-regulation. It responds to recent calls to expand self-regulation measurement techniques (Greenberg et al., 2015) through incorporation of biomarkers to understand trends in students' physical well-being and how they relate to perceived social skill use.

Limitations

The first limitation of this study was its small sample size. While 91 data points were considered from 12 students, graphical results were nested within each participant due to high individual variability and diagnostic differences. Accordingly, we do not report statistical significance of results, but do showcase trends seen for 12 individuals in a nuanced comparison of post-VR exposure and post-traditional SEL instruction. Moreover, while we used HRV measurements, we relied on a 2-minute post check-in time epoch rather than mapping trends throughout the day. Since measurements were taken after the check-in or VR-assisted sessions that lasted 20-30 minutes, the changes produced by these experiences were salient in measurements but may or may not have persisted through the day. Mapping metrics throughout the day would better contextualize results.

While self-report results were somewhat stable, they seemed to suggest that students were either unable to understand surveys fully, or that it may have been challenging for them to apply newly learned skills in a simulated digital environment to their real lives. Perhaps explicit instruction to accompany VR activities would have helped this transfer. While it is hard to pinpoint which of these explanations may be accurate (as social cognition can be a black box, Tilak et al., 2022), two possible solutions for improving these results emerge. The first is to introduce a behavioral measure for teachers and parents to use in making observations of how participants manage outbreaks and disruptions at school and home post-VR exposure versus traditional SEL. The second is to assign aloeVR simulations in a planned order, by level and difficulty, supplementing them with explicit socioemotional learning curriculum (e.g., Second Step; Committee for Children, 2024) that focuses on cultivating strategies for positive self-thought and social interaction. Lastly, while HRV measurements tended to improve post four weeks of aloeVR exposure, it remains to be seen if this effect lasts long-term. Future iterations of the study will involve analysis of maintenance measurements from study participants.

Conclusion

In the Information Age, associations between mental health challenges and technology oversaturation seem to have contributed to a high incidence of emotional dysregulation for young students. It is important to curate ways of being with technology to augment cognition and behavior. Our study showed that VR simulations focused on biofeedback and mindfulness may produce adaptive results for middle schoolers with neurodevelopmental learning differences, in terms of their short-term vagal flexibility. Explicit instruction may be needed to produce improvements in how students actually use social skills and exercise positive self-thought in challenging everyday social situations.

References

Apple Inc. (2024). Monitor your heart rate with Apple Watch. Apple.

Baek, H. J., Cho, C. H., Cho, J., & Woo, J. M. (2015). Reliability of ultra-short-term analysis as a surrogate of standard 5-min analysis of heart rate variability. *Telemedicine and e-Health*, *21*(5), 404-414.

Bandura, A. (1994). Regulative function of perceived self-efficacy. In M. G. Rumsey, C. B. Walker, & J. H. Harris (Eds.), *Personnel selection and classification* (pp. 261–271). Lawrence Erlbaum Associates, Inc.

Beauchaine, T. P. (2015b). Respiratory sinus arrhythmia: A transdiagnostic biomarker of emotion dysregulation and psychopathology. *Current Opinion in Psychology, 3,* 43-47.

Blad, E. (2019). How schools can make advisories meaningful for students and teachers. *Education Week*, *38*(25), 6-6.

Blank, M. E. (2019). *The Physiology of Social-Emotional Learning: Integrating Biomarkers of Self-Regulation into the Assessment and Implementation of Programs* (Doctoral dissertation, University of Pennsylvania).

Borowski, S. K. (2022). *Considering the Role of Cardiac Vagal Tone in Adolescents' Behaviors Within Friendships* (Doctoral dissertation, University of Missouri-Columbia).

CASEL (2024). Fundamentals of SEL. CASEL.

Chen, Y. S., Clemente, F. M., Bezerra, P., & Lu, Y. X. (2020). Ultra-short-term and short-term heart rate variability recording during training camps and an international tournament in U-20 national futsal players. *International Journal of Environmental Research and Public Health*, *17*(3), 775.

Cleary, T., Zhang, R., Russo, M. R., & Slemp, J. (2025). A systematic review of the self-regulation strategy inventory (SRSI): Uses, applications and psychometric characteristics. *School psychology review*, *54*(3), 343-362.

Committee for Children (2024). Second Step. https://www.secondstep.org/

Duckworth, A. L., & Carlson, S. M. (2013). Self-regulation and school success. *Self-regulation and autonomy: Social and developmental dimensions of human conduct*, *40*(1), 208-230.

Glassman, M. (2016). *Educational psychology and the internet*. Cambridge University Press.

Glassman, M., Tilak, S., & Kang, M. J. (2023). Transcending post-truth: Open educational practices in the information age. *Distance Education*, *44*(4), 637-654.

Greenberg, M. T., Katz, D. A., & Klein, L. C. (2015). *The potential effects of SEL on biomarkers and health outcomes: A promissory note*. In J. A. Durlak, C. E. Domitrovich, R. P. Weissberg, T. P. Gullotta, & J. Comer (Eds.), *Handbook of social and emotional learning: Research and practice* (pp. 81-96). Guilford Press.

Keshav, N. U., Vahabzadeh, A., Abdus-Sabur, R., Huey, K., Salisbury, J. P., Liu, R., & Sahin, N. (2018). Longitudinal socio-emotional learning intervention for autism via smartglasses: Qualitative school teacher descriptions of practicality, usability, and efficacy in general and special education classroom settings. *Education Sciences*, *8*(3), 107.

Makivić, B., Nikić Djordjević, M., & Willis, M. S. (2013). Heart Rate Variability (HRV) as a tool for diagnostic and monitoring performance in sport and physical activities. *Journal of Exercise*

Physiology Online, *16*(3), 103-131.
McLaughlin, K. A., Alves, S., & Sheridan, M. A. (2014). Vagal regulation and internalizing psychopathology among adolescents exposed to childhood adversity. *Developmental psychobiology*, *56*(5), 1036-1051.
Munoz, M. L., Van Roon, A., Riese, H., Thio, C., Oostenbroek, E., Westrik, I., ... & Snieder, H. (2015). Validity of (ultra-) short recordings for heart rate variability measurements. *PloS one*, *10*(9), e0138921.
Nakamura, F. Y., Pereira, L. A., Abad, C. C. C., Cruz, I. F., Flatt, A. A., Esco, M. R., & Loturco, I. (2017). Adequacy of the ultra-short-term HRV to assess adaptive processes in youth female basketball players. *Journal of Human Kinetics*, *56*(1), 73-80.
Ou, Y. K., Wang, Y. L., Chang, H. C., Yen, S. Y., Zheng, Y. H., & Lee, B. O. (2020). Development of virtual reality rehabilitation games for children with attention-deficit hyperactivity disorder. *Journal of Ambient Intelligence and Humanized Computing*, *11*, 5713-5720.
Parsons, S. (2015). Learning to work together: Designing a multi-user virtual reality game for social collaboration and perspective-taking for children with autism. *International Journal of Child-Computer Interaction*, *6*, 28-38.
Phillips, K. F. V., & Power, M. J. (2007). A new self-report measure of emotion regulation in adolescents: The Regulation of Emotions Questionnaire. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice*, *14*(2), 145-156.
Porges, S. W. (1992). Vagal tone: a physiologic marker of stress vulnerability. *Pediatrics*, *90*(3), 498-504.
Samson, A. C., Hardan, A. Y., Podell, R. W., Phillips, J. M., & Gross, J. J. (2015). Emotion regulation in children and adolescents with autism spectrum disorder. *Autism Research*, *8*(1), 9-18.
Schena, A., Garotti, R., D'Alise, D., Giugliano, S., Polizzi, M., Trabucco, V., ... & Bravaccio, C. (2023). IAmHero: preliminary findings of an experimental study to evaluate the statistical significance of an intervention for ADHD conducted through the use of serious games in virtual reality. *International Journal of Environmental Research and Public Health*, *20*(4), 3414.
Shaffer, F., & Ginsberg, J. P. (2017). An overview of heart rate variability metrics and norms. *Frontiers in public health*, *5*, 258.
Shaw, P., Stringaris, A., Nigg, J., & Leibenluft, E. (2014). Emotion dysregulation in attention deficit hyperactivity disorder. *American Journal of Psychiatry*, *171*(3), 276-293.
Shields, R. W. (2009). Heart rate variability with deep breathing as a clinical test of cardiovagal function. *Cleve Clin J Med*, *76*(Suppl 2), S37-40.
Tilak, S., Glassman, M., Kuznetcova, I., & Pelfrey, G. L. (2022). Applications of cybernetics to psychological theory: Historical and conceptual explorations. *Theory & Psychology*, *32*(2), 298-325.
Tsai, W. T., Lee, I. J., & Chen, C. H. (2021). Inclusion of third-person perspective in CAVE-like immersive 3D virtual reality role-playing games for social reciprocity training of children with an autism spectrum disorder. *Universal Access in the Information Society*, *20*(2), 375-389.
Twenge, J. M., Spitzberg, B. H., & Campbell, W. K. (2019). Less in-person social interaction with peers among US adolescents in the 21st century and links to loneliness. *Journal of Social*

and Personal Relationships, *36*(6), 1892-1913.
Weerdmeester, J., Cima, M., Granic, I., Hashemian, Y., & Gotsis, M. (2016). A feasibility study on the effectiveness of a full-body videogame intervention for decreasing attention deficit hyperactivity disorder symptoms. *Games for health journal*, *5*(4), 258-269.