

Executive Summary: The Effects of HeartMath Emotion-Regulation on
Elementary Students

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Winner of an Ahmadiyya Muslim Jama'at Scholarship

Winner of the Student Writer Award Gold Medal, Research Essay Category (3rd-4th Year)

Executive Summary

Resilience and Heart Rate Variability

It is critical to cultivate resilient children at an early age, by equipping them to overcome various adversities they encounter throughout life. Resiliency is characterized as an individual's ability to prepare for, persevere through, and recover from stress, adversity, trauma, or difficult situations (McCraty & Atkinson, 2012), with the capacity for positive adaptation to that which may have otherwise been detrimental to one's well-being. Resiliency is a complex construct that can be fostered and maintained through self-management of energy stores through four domains: physical, mental, emotional, and spiritual (McCraty, 2015, p. 9). The emotional domain has the most significant impact on internal reserves as it subtly depletes our stored energy.

Emotions are complex concepts involving experiential, behavioral, and physiological elements that enrich human experiences daily and can determine how one attaches meaning to life experiences that are encountered (American Psychological Association, n.d.). Self-generated positive emotions are imperative for the development and maintenance of physical and psychosocial well-being, such as purpose in life, social support, decreased illness symptoms, and enriched social well-being (Fredrickson et al., 2001; 2008; Kok et al., 2010). Positive emotions generally helped evoke positive behaviors such as being more generous, more likely to help, and have empathy for others (Isen et al., 2011; 2009 as cited in Compton & Hoffman, 2019). Furthermore, the act of self-inducing positive emotions innately increases coherence in heart rhythms, which has various benefits on an individual's ability to facilitate emotional stability and

induce a calm state of being, which can serve as a protective mechanism against unhealthy emotional and behavioral patterns (McCraty & Zayas, 2014).

Heart coherence is a physiological measure of the harmonious synchronicity of the heart and brain connection that can be “measured by heart rate variability (HRV) wherein a person’s heart rhythm pattern becomes more ordered” (McCraty, 2015, p. 26). Heart Rate Variability (HRV) is the naturally occurring beat to beat fluctuation in heart rate (McCraty, 2015), and studies have found that HRV is one of the most effective ways to monitor the functioning of the autonomic nervous system. It has also been a useful and valuable tool in studying emotions physiologically and provides a more in-depth understanding of emotions in social and psychopathological processes (McCraty et al., 2003; Appelhans & Luecken, 2006). Low HRV is an indicator that there is an imbalance of the ANS and is a strong predictor of the development and increasing severity of a wide range of pathologies (Rovere et al., 1998). A reduction in HRV has also been a powerful indicator of various mental pathologies, such as anxiety and depression (Gallagher et al., 1999; McCraty, 2015). Multiple studies have revealed that optimal levels of HRV may contribute to the healthy functioning of self-regulatory capability and resilience (as cited in McCraty, 2015, p. 13).

Each heartbeat generates a magnetic field that extends approximately three feet away from the body and has been discovered to be the strongest electromagnetic field produced by the body (McCraty et al., 1998). The coherence of the magnetic field that is generated by the heart fluctuates as a result of a person's inner emotional state, such as thoughts, attitudes, and emotions (McCraty et al., 1998). Interestingly, the internal emotional state and coherence within one's electromagnetic field does not just directly affect the individual, but also has ability to extend out and significantly impact individuals who are in close proximity. Individuals nearby detect the signals in such a way that their heart rhythms and brainwaves synchronize with the heart pattern radiated by the other person (McCraty et al., 1998). Such studies reveal the importance of emotion-regulation amongst students, as students’ emotions may ripple out and impact others nearby, influencing the learning environment of the classroom or even of the school.

Social-Emotional Learning

Previously, the primary focus of the educational system has been to attain academic success. However, in recent years, the school curriculum has evolved towards a shift that encourages healthy social-emotional development in children. Semple and associates (2010) illustrated the effects of mindfulness-based cognitive therapy, explicitly focusing on social-emotional resilience, which revealed that a focus on mindfulness reduced attention problems, as well as anxiety and behavioral problems. Research has indicated that it is essential to address social and emotional concerns, as these may interfere with learning or hinder academic performance (Zins et al., 2007). Early school efforts may be beneficial in fostering educational success by developing socio-emotional skills that may, in turn, lead to increased academic success (Zins et al., 2007).

Self-Efficacy

Student engagement is at the forefront of teacher concerns, and motivation to engage can be influenced by self-efficacy. Three domains that are most relevant to the educational context include social, academic, and emotional self-efficacy. Social self-efficacy is defined by Muris (2001) as the ability to overcome social adversities, while the capabilities to overcome academic challenges that lead to success are referred to as academic self-efficacy. Emotional self-efficacy is one's ability to effectively construct and exercise the desired emotions an individual is striving to obtain (Muris, 2001). Self-efficacy may be essential in a student's competency to be able to solve a math problem, complete reading a book, or any academic task. Linnenbrink and Pintrich (2003) suggest that self-efficacy is often interconnected with classroom engagement and learning, as the ability for students to perform a task is determined by one's ability to persist and achieve rather than avoid the challenging academic task. Students who possess high academic self-efficacy are more likely to ask for assistance from teachers and can facilitate behavior, cognitive, and motivational engagement in the classroom (Linnenbrink & Pintrich, 2003). It seems relevant to include social and emotional self-efficacy (not only academic self-efficacy) while examining children's experience in the classroom.

Emotion-Regulation in the Classroom

Emotion-regulation and socio-emotional skills have also been linked to enhancing overall academic motivation and success, as well as improvements in academic and test performance, given the alleviation of stress and test anxiety (Graziano et al., 2007; Bradley et al., 2007). Emotion-regulation can lead to enhanced interpersonal and social relationships, improving the positive classroom atmosphere, and thus creating an optimal space for learning (Bradley et al., 2007). Emotion-regulation is efficacious in providing immediate and long-term benefits that improve motivation, academic performance, enrich personal relationships, and enhance overall well-being, all while reducing stress and preventing various pathologies. Therefore, it is imperative to instill emotion-regulation into the school curriculum.

Present Study

The current research is in partnership with Red Deer Public Schools, and Alberta Health Services (AHS). The overall purpose of the current study is to provide evaluation support for community partners in their efforts to improve classroom learning and enhance social-emotional skills for students through the implementation of HeartMath practices in classrooms. Therefore, the present study evaluated the HeartMath Heart Lock-In practice to determine if the technique has a meaningful impact on elementary students' HRV, self-efficacy (academic, social, and emotional), emotion-regulation, and perceived school kindness compared to a relaxation (coloring) control group.

Methods

Participants and Procedure

The four-week HeartMath (HM) pilot project involved obtaining pre-post measurements from $N = 24$ grade five students (16 girls and 8 boys) ranging in age from 10 to 11 years, who completed all three data collection sessions. There was some data excluded as a result of subject attrition, as some students were not present all data collection days. Students were recruited through a local Community Liaison Worker (CWL) from the Red Deer Public School System.

Parental permission was granted through signed consent forms, and the grade five students provided verbal assent throughout the study. A repeated-measures (within-subjects) design was used to ensure all the students would receive the potential benefits of the HeartMath intervention.

The evaluation included three classroom visits; in the first two visits, the research team administered pre-post measures for the first four weeks for a relaxation control (five minutes of daily class time for the students to engage in coloring). Subsequently, pre-post measurements were taken for the following four weeks of practicing HeartMath, utilizing the Heart Lock-In method (led by the teachers and practiced collectively within the class for five minutes every school day). Length of time for practice and the time of day was chosen to accommodate the realistic nature of conducting activities with elementary school students.

The Heart Lock-In method is comprised of three stages. First, participants focus their attention on the area of the heart and direct their breath in and out of the heart center while slowing down and deepening their breathing rhythm (Heart Focused Breathing). After a few moments, participants activate and sustain a regenerative feeling of their choosing, such as care, gratitude, or compassion (Quick Coherence Technique). In the final stage, the students sustain and radiate that renewing feeling(s) to themselves, and also extend it out to others (Heart Lock-In). The participants consistently practiced the HeartMath Heart Lock-In method until our final post-test measurements following the experimental intervention, in which the students were verbally debriefed regarding the additional details of the study.

Measures

The HRV measurements were recorded using the HeartMath emWave Pro Plus biofeedback software, which involved obtaining a five-minute HRV recording per child that is transmitted through a sensor that was gently placed on the student's earlobe. HRV readings are recorded using a time-domain measure known as the root mean squares of successive difference (RMSSD), and the metric was computed in milliseconds, which is used frequently as it is competent in measuring HRV (Berntson et al., 2016, p. 196).

The second component was a brief online survey. Although the same questionnaire was utilized for all three classroom visits, the questions were counterbalanced in various orders for

each classroom visit. Additional questions were incorporated on the final survey, which included open-ended questions to obtain student's experience with practicing HeartMath. The surveys contained a few demographic questions, and the survey questions were derived from the following validated self-report Likert-scales: Self-Efficacy Questionnaire for Children: includes academic, social, and emotional self-efficacy measures (SEQ-C; Muris, 2001), Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), and School Kindness Scale (SKS; Binfet et al., 2015).

Key Findings

1. Overall Student Responses Across All Testing Session

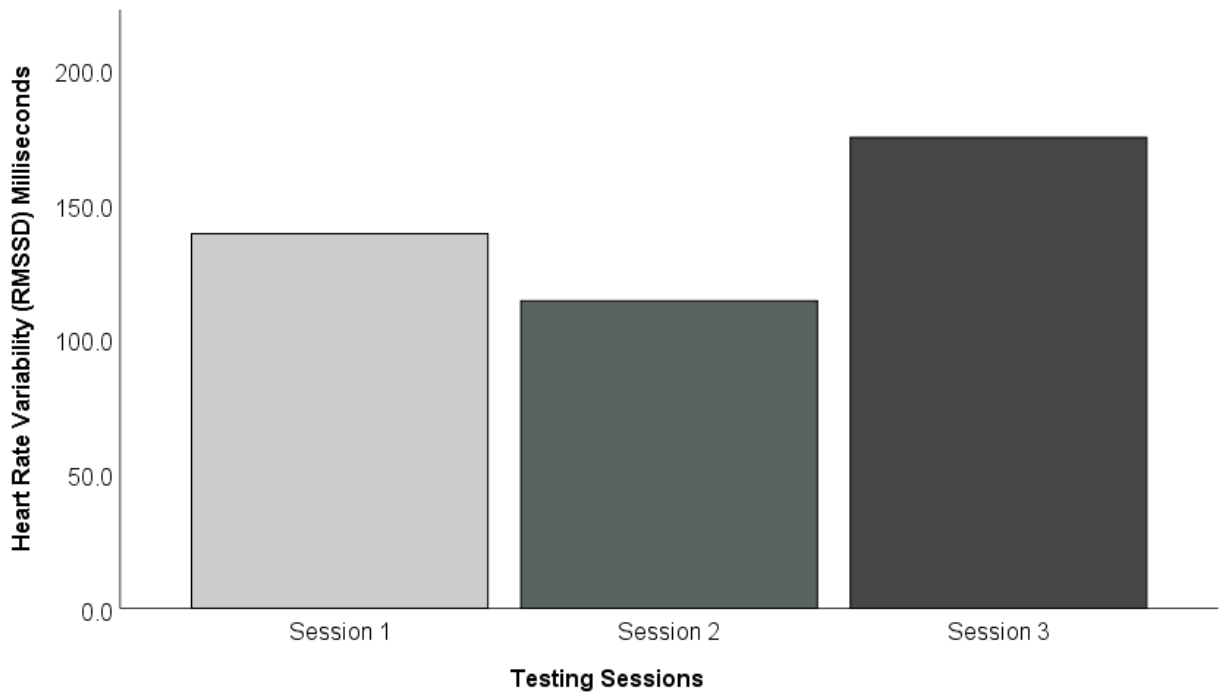
Scale	Session 1		Session 2		Session 3	
	M	SD	M	SD	M	SD
School Kindness	4.63	0.34	4.53	0.56	4.38	0.74
Academic Self-Efficacy	3.92	0.66	3.83	0.68	3.71	0.87
Social Self-Efficacy	3.73	0.71	3.80	0.59	3.77	0.79
Emotional Self-Efficacy	3.48	0.81	3.55	0.75	3.30	0.94
Emotion Regulation Questionnaire	4.94	1.10	4.86	1.07	4.84	1.06
Heart Rate Variability (RMSSD)	145.77	73.17	114.11	65.50	178.15	101.04

As anticipated, there was a significant difference between HRV measurements following the HM intervention. A baseline correction on the HRV data was completed by subtracting the initial baseline measurement (first testing session) from the HRV measure of interest (sessions two and three) to take into account individual differences and to assess physiological HRV more accurately. HRV was computed in the time domain measure of RMSSD and is expressed in a metric of milliseconds. A repeated-measures *t*-test was conducted to compare the baseline

corrected relaxation training HRV to the baseline-corrected HeartMath intervention HRV. The t -test detected a significant difference between the sessions, $t(23) = -2.269$, $p = .033$, revealing that the HeartMath intervention group had considerably increased HRV values compared to the relaxation group (Refer to Figure 1).

Figure 1

Student's Heart Rate Variability Across All Data Sessions.



Student Experience with HeartMath

Students provided feedback regarding their experience with practicing HeartMath. Their responses indicated that 75% enjoyed or really enjoyed practicing the HeartMath technique of radiating positive feelings to themselves and others. Overall, 63% found it somewhat or very helpful. Approximately 29% of the students took the practice home to share with their parents, family, or friends. Over half (54%) of students indicated that they were likely or very likely to continue practicing at home. Furthermore, the results showed that 37.5% mentioned that they were likely or very likely to continue to practice HeartMath at school, and in overall, 37.5% also

intended to continue to practice frequently or very frequently. Approximately 64% expressed that practicing HeartMath was at least relatively to very helpful to them in managing their feelings and emotions.

Along with significant HRV findings, there was promising experiential qualitative feedback from students sharing their positive experiences with the HeartMath intervention. There were five main recurring and overarching themes that emerged across all questions that described how students were impacted and their experience with practicing HeartMath. These themes are conveyed in an acronym termed as HEART.

Handling Emotions to Regain Composure

This theme comprises the student's reflection in relation to their conscious ability to effectively self-regulate their emotions, allowing them to regain composure. Students reported that it "helps me control my feelings," and one student excitedly shared, "wow, I can control my feelings when I do HeartMath." While only 29% explicitly stated that it assisted them in the process of improving their emotion regulation, expressed by the following statement, "it helped me with controlling my emotions."

Eliciting Positive Feelings and Emotions

This theme reflects the shift towards more positive feelings and emotions after practicing HM. The results indicated that 79% of the students noticed they felt more "happy, calm, or content" after the practice. Moreover, there was a common feeling that 67% of students felt while practicing the Heart Lock-In method, which was the feeling of calm. Indeed, the practice of HM was beneficial as it allowed students to feel better, and a student articulated that the techniques allowed them "to get some rest and let your brain have a break." Furthermore, the practice was portrayed by the students as having beneficial effects, illustrated by a student that expressed, "it made me feel different because it made me feel very positive." Students also reported feeling "like I am a good kid," making them "feel really happy for the rest of the day."

Awareness of Improvements in Interpersonal Connection

This theme represents the interpersonal improvements and effective conflict management expressed by 29% of the students. Students had demonstrated that they were able to withhold problematic reactions in the middle of interpersonal conflict, and prevent an escalation of the conflict, by either walking away or regaining composure before attempting to resolve the dispute. For example, one student reported, “I was in an argument with another kid, I took a deep breath to calm down,” and continued to constructively resolve the conflict “when I get into an argument at recess I walk away and take a deep breath and get ready to talk about it calmly.” Another student indicated that they were experiencing “less arguments with friends,” as well as other students expressed that the intervention allowed them to “be a better friend.” The overall classroom atmosphere was also summed up nicely by one student “I feel that people are more calm when stressful things happen in class,” demonstrating that the students sensed and witnessed the positive transformation transpiring within their classroom environment.

Rising Performance and Personal Enhancement

This theme reflects the positive perceptions that the students embodied towards themselves. The theme also encompasses the recognition of student’s improvements in their performance that occurred on school-related tasks and emotional states. HeartMath made students feel more confident within themselves and their capabilities related to school. These perspectives were explicitly stated by relatively 37.5%. This viewpoint was represented in a student statement that identified their improvement in the HM techniques, “I got better at taking deep breaths.” In the school setting, students expressed that HM “helped me focus more at school,” with another student stated, “during my math sheets I could focus better.” One student reporting, “if I get off task and a little hyper I try to calm myself down by taking a deep breath.” Another student reported feeling ultimately renewed, “I feel like a new kid and a younger kid.” Increasing self-confidence was reported by a student, “it has made me feel more confident talking to people I have never met or do not see often.” One student illustrated that they utilized

the techniques while “a child is annoying me when I am trying to listen,” to divert their attention back on school learning. It allowed students to be “ready to do work.”

To Practice in Various Settings

Approximately 67% of the students conveyed that they utilized the HM technique in a variety of settings, situations, and scenarios. The various locations in which the students practiced were at school, home, and recreational sports facilities. Students particularly emphasized that they utilized the tools while completing school assignments and tasks and “during a hard test.” Another student reported, “at school I got frustrated and went out to a quiet room and did HeartMath.” Students also indicated that they practice at home in their bedrooms prior to sleeping, “in my bed when I was trying to sleep.” Few students reported that they had practiced the HM tools “at hockey,” and while “playing basketball.” Such feedback was informative, as it illustrated that while the strategies were practiced at school, students were also practicing it outside of the classroom within various contexts. A participant reported that they “used breathing everywhere, if I am frustrated in some way,” reinforcing that the simple techniques can be accessible at any place at any time. The qualitative feedback provided by the students supported the beneficial impacts of practicing HM techniques.

Future Implications

In the current study, scores on self-efficacy, emotion-regulation, and school kindness were relatively high at all three testing sessions, making it difficult to detect any significant shifts in these variables over time. This study was in a high SES school and within a population of students with no disabilities or known diagnoses. Future research is needed to assess the HM intervention in lower SES neighborhoods. Previous studies conducted with children, found HRV training to be effective amongst children who experience OCD, somatoform disorders, and ADHD (Pop-Jordanova, 2009; Lloyd et al., 2010). Suggesting that children with a wide range of psychopathologies can also reap the benefit from emotion-regulation interventions in the future.

The current study did not directly assess the associations amongst academic performance (grades) and the HM emotion-regulation technique. Future research is needed to examine the impacts of an emotion-regulation program on school performance (grades) amongst elementary school students. Future research may also want to include outside perspectives of the children's behavior, capabilities, and cognitive thought patterns from parents, teachers, or peers (including classroom atmosphere). It may also be beneficial to obtain additional information from the children or their parents regarding the children's level and frequency of physical activity due to the impact of exercise on HRV patterns. However, the current study did reveal that a simple short practice using the Heart Lock-In method, 5 minutes per day for four weeks, does create significant changes in HRV measurements and student experiences, which is promising evidence that should be replicated.

Conclusions

The current study sought to provide support for our community partners and educators in their efforts to improve classroom learning and enhance children's social-emotional skills. Importantly, the results from the present study support pre-existing literature specifically in the classroom context on the benefits of emotion-regulation and the effects it has on improving HRV. Impressively, the intervention increased HRV, and students also reported many perceived benefits from the short practice and in a short time frame, providing compelling evidence that a simple and short practice can be both practical and advantageous for children. Therefore, this study provides an essential contribution to the growing body of emotion-regulation and HRV literature by illustrating that a significant shift in HRV measures can be accomplished with a shorter practice. The results of the study also provide value to the emerging research of HRV amongst children. Notably, higher HRV is related to increases in resiliency to combat various stressors (McCraty, 2015). This may act as a line of defense buffering against the development or progression of various pathologies, including psychopathologies such as anxiety and depression (Rovere et al., 1998; Gallagher et al., 1999; McCraty, 2015).

The current study highlights that a brief practice in a short period of time can produce significant improvements in HRV. Such a simple and short practice can be easily implemented within classrooms. School educators may want to consider implementing an emotion-regulation

program such as the HeartMath Heart Lock-In practice within the school curriculum. If prevention strategies are implemented in a school setting at an early age, it provides students with an opportunity to build resiliency and enhance their capabilities to overcome challenging demands sooner. Despite some potential limitations, these results do provide feedback for our community partners and educational personnel regarding the importance of integrating emotion-regulation education into the school curriculum for students to reap a multitude of benefits. The students of today are the future of this world. Therefore, it is vital to foster a positive environment to prime children to reach their fullest potential. This will help to provide children with an opportunity to contribute to this world in a more meaningful and significant way.

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