Developing a Self-Reg Lens with Preservice Teachers

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Abstract

In many parts of the world, teachers and students report increasing stress loads and witness or experience dysregulated behaviours within teaching and learning environments. In what ways are universities preparing future teachers to understand and navigate these challenging behaviours and manage their own stress load? This paper shares findings from a Canadian research project titled *Investigating Preservice Teachers' Stress Praxis*. This research occurred within a university setting where Shanker Self-Reg was embedded within three Bachelor of Education courses. This paper shares findings from surveys from this research that: Examine preservice teachers' perceived growth in understanding and application of Self-Reg theories and practices and ways they envision future application; describe five promising approaches/activities in engaging preservice teachers in thinking through a neuro-informed lens; and, provide three considerations for teacher educators responsible for designing courses within the Bachelor of Education degree.

Introduction

Preservice teacher educators are tasked with preparing future teachers for their work in a rapidly changing and increasingly stressful world. The literature is rich with examples of critical aspects of this preparation. Beyond knowing how to teach and assess content and skills associated with the elementary or secondary fields, preservice teacher preparation also seeks to develop candidates' capacities to: Identify and dismantle systemic inequities and decolonise teaching and learning conceptions (Hammond, 2015; Hill et al., 2020); teach through a lens of equity, diversity, inclusion and antiracism (Hammond, 2015; Hill et al., 2020; Leung et al., 2024); think critically (Lorencová et al., 2019) and conduct themselves ethically (Lindqvist et al., 2021); and, create and manage learning environments that centre "culture, methods, practice, relationships, and partnerships" (Kwok, 2021, p. 206) .

Alongside course work, preservice teachers also engage in practicum experiences where they are immersed in the complex work of a teacher. The literature describes the complex and energy expensive nature of this work (Edwards, 2022a, 2022b; Gold & Roth, 2013; Kyriacou, 2011; Prilleltensky et al., 2016), yet where do we see preparation for this in their post-secondary course work?

Reports of teacher burn out, challenging student behaviours, and ever-increasing demands on teachers highlight some of the challenges in the teaching profession (Gluschkoff et al., 2016; Kyriacou, 1987, 2001; Pressley, 2021; Skaalvik & Skaalvik, 2017). The literature also connects teacher wellbeing to student outcomes (Clunies-Ross et al., 2008; P. Jennings et al., 2021; Ramberg et al., 2020; Spilt et al., 2011). A well-regulated teacher is better positioned to coregulate their students (Jennings & Greenberg, 2009), than a teacher who is low in energy and carries a high stress load

(Shanker & Hopkins, 2020). In what ways are teacher educators supporting preservice teachers to develop awareness and understanding of the brain-body response to stress and apply processes that can support self-regulation and coregulation?

Advances in neuroscience provide insights into mechanisms and relationships within the brain that challenge educators to examine their practices (Hammond, 2015; Rosati & Lynch, 2022; Shanker & Hopkins, 2020; Whiting et al., 2021). Excessive stress loads create barriers to learning and communication and can lead to negative health outcomes (McEwen, 1998; Selye, 1976; Shonkoff et al., 2012; van der Kolk, 2014). These excessive stress loads are referenced by Shanker (personal communication, August 2023) in his webinar series on bullying. He describes three factors evident in society today: Excessive and increasing stress; maladaptive forms of self-regulation; and, a lack of restoration that returns the body to homeostasis. Are these factors catalysts for the many challenging behaviours and wellbeing issues observed within school communities today?

Recently, researchers have suggested that neuroscience does not feature in most teacher preparation programs and provide an argument for this to change (Ching et al., 2020; Coch, 2018; Dubinsky et al., 2022). Over the last decade, research shows how application of neuroscience in educational settings has affordances for students' (Rosati & Lynch, 2023; Salo & Kajamies, 2024; Swabey et al., 2019; Whiting et al., 2021) and teachers' wellbeing (Edwards, 2022a; Johnson & Naidoo, 2017; Salo & Kajamies, 2024). Participants in Hachem et. al.'s (2022) research identify significant benefits of professional learning on neuroscience for inservice teachers and the resulting improvement in relationships with students. How might we bring this learning into our preservice teacher education programs more deliberately and consistently to ensure it can benefit early career teachers and their students? In recognising the growing field of neuroscience and its implications for educators, this research suggests promising practices for how preservice teacher education programs can include this critical element of neuroscience.

To conclude this introduction, it is important to clarify four of the terms used in this paper. These terms are self-regulation, Self-Reg, coregulation, and praxis. While self-regulation is a popular term used in education, the term has many interpretations and definitions (Burman et al., 2015). The term Self-Reg is used to distinguish Shanker's Self-Reg (the understanding of stress and management of energy and tension using 5 steps of Self-Reg and the 5 domains of stress) from other definitions of self-regulation (Shanker & Hopkins, 2020). Similarly, coregulation suggests supporting another person to regulate, while Co-Reg specifically involves Shanker's 5 steps and 5 domains in this process.

The Merriam-Webster online (2025) provides various definitions for praxis such as an "action or practice such as the exercise or practice of an art, science, or skill or customary practice or conduct," as well as "the practical application of a theory". Salo and Kajamies (2024) extend this definition within the literature:

> "Praxis refers to morally committed professional actions (Kemmis & Smith, 2008, p. 4) (Kemmis and Smith 2008, p. 4). As praxis, professional learning should model and foster a good life (in the Aristotelian sense), both for those involved in it as well as for humankind. This means enhancing possibilities to live well in a world worth living in (Kemmis et al., 2014, pp. 25–26). (p. 444)

These definitions frame this research which sought to further understand how preservice teachers develop a stress praxis; morally committed professional actions through practical application of theory.

Context

The Program

This research was conducted in the School of Education at a small liberal arts University in eastern Canada. At the time of the research, there were approximately 120 preservice teachers completing their Bachelor of Education degree. Half of these students were completing the degree as a compressed 16-month degree, while the other half were in a 2-year program. It was this 2-year program cohort that were invited to partake in this research.

One of the first courses in the Bachelor of Education program is *Principles and Practices 1 (P&P1)*. In P&P1, preservice teachers are introduced to many big ideas in education, for example: Equity and inclusion; assessment; methods of instruction; and, curriculum design. Relevant to this research, preservice teachers also learn about the brain-body response to stress, stressors within educational contexts, how these stressors can manifest in behaviours for teachers, students, parents, and colleagues, and neuro-informed ways to respond. The process of Shanker Self-Reg and other relevant theories are briefly explored as preservice teachers consider how educational practices, particularly around understanding and responding to behaviours, are changing due to advances in neuroscience.

Towards the end of the Bachelor of Education program, the 2-year program preservice teachers take the *Healthy Learning Environments (HLE)* course. In this course, students explore ways to create and maintain equitable, safe, and inclusive learning environments in much more detail. Content includes mental health literacy; consideration of social determinants of health; establishing, maintaining and developing various relationships; and, management and organisation of the classroom to support teacher and student wellbeing.

This research began as preservice teacher participants in the 2-year program neared the completion of their studies. Their final block of four courses included Healthy Learning Environments, and for some in the secondary cohort, a Classroom Management elective. Both of these courses included a Self-Reg focus and led into the final four-week teaching practicum marking the final part of their Bachelor of Education studies.

Lead Researcher and Course Instructor

My role in this research was two-fold. I was both the lead researcher as well as the course instructor for *Principles and Practices 1*, *Healthy Learning Environments* and the *Classroom Management* elective. As an Assistant Professor at this University, I brought a history of centring Self-Reg in research. My 2013 Masters research explored elementary school students' perceptions of self-regulating across Self-Reg's 5 domains (biological, emotion, cognitive, social, and prosocial) in various settings within various school learning environments; and, my PhD research (Edwards, 2022a) investigated how teachers develop self-regulation knowledge and skills to support their stress management. Another important prerequisite to this research was my engagement in Self-Reg courses with the MEHRIT Centre (TMC). These courses and my ongoing role as a facilitator and presenter for TMC positioned me well to bring a Self-Reg lens to all aspects of the

teaching, learning and research.

Ethics approval to conduct this research was granted through the university in December 2023. Specific procedures outlined in this ethics document ensured anonymity for participants completing the initial surveys, and delayed my access to the data until all course grades were submitted to the Registrar. The approval of a grant enabled me to employ a research assistant. This research assistant was a Master of Education graduate who completed a course with me introducing key Self-Reg principles. This supported the necessary Self-Reg lens for data analysis.

Participants

Participants for this research were recruited from the two-year Bachelor of Education Program. There were 57 students representing both the elementary and secondary cohorts. The majority of students were in the final courses of their Bachelor of Education learning. All but two participants had completed Principles and Practices 1, 15 months earlier, where Self-Reg was initially introduced.

Method

Mixed Methods

This research utilised a mixed methods approach to capture the experiences, understandings and perceptions of the Bachelor of Education preservice teachers through surveys, focus groups and interviews. This paper draws from the qualitative and quantitative data collected via the anonymous surveys at the beginning and end of the *Healthy Learning Environments* course.

Procedure for data collection and analysis

Fifty seven preservice teachers in the 2-year program were invited to participate in this research. The following table outlines relevant information for the survey data collection reported upon in this paper.

Table 1

Survey administration information

Date administered	Instrument	Participants
January 5, 2024	Survey 1 (18 questions)	28 (12 elementary, 16 secondary)
March 8, 2024	Survey 2 (37 questions)	40 (17 elementary, 23 secondary)

Survey 1 and 2 were administered during the first and last classes of the Healthy Learning Environments course. I maintained participant confidentiality by inviting a staff member within the School of Education to administer and securely store the surveys, only returning them to me when I had all grades for the courses submitted to the Registrar. Deductive and inductive thematic analysis (Braun & Clarke, 2008) was conducted collaboratively with the research assistant, the latter of which is included in the following results.

Results

Data analysis from both surveys provided many interesting insights to begin exploring the teaching and application of Self-Reg and neuroscience relevant to teacher education. In this section, I will share three findings. The first finding gives insight into preservice teachers' perceptions of their understanding and application of key Self-Reg theories across the Healthy Learning Environments course. The second finding suggests course learning that pre-service teachers hope to apply beyond the Healthy Learning Environments course for themselves and their students. The third finding provides five course activities that preservice teachers suggested were the most helpful to support their learning and application of Self-Reg.

Finding 1: Understanding and application of Self-Reg theories

Almost all participants indicated that their introduction to Self-Reg theories occurred 15 months prior to Survey 1 during the P+P1 course. In both surveys, participants were asked to consider their understanding separately from their application of various theories connected to Self-Reg. They were asked to rate their perceived understanding of a concept on a Likert scale from one to five, with:

- 1 indicating – no understanding of this concept
- 2- limited understanding
- 3- basic understanding
- 4- thorough understanding
- and, 5- extended understanding.

They were also asked to share their perceived application of the concept from one to five, with:

- 1- never applied
- 2– applied a few times
- 3– applied sometimes
- 4- applied many times
- and, 5- consistently apply

The following graphs show Survey 1 responses in the left column with understanding on the top and application on the bottom and Survey 2 responses in the right column following the same pattern to represent understanding and application. The figures are percentages reflecting the 28 participants from Survey 1 and then the 40 participants from Survey 2.

Understanding and application of the Thayer Matrix

In Figure 1, participants' understanding and application of the Thayer energy and tension matrix in January at the beginning of the HLE course is displayed on the left. On the right is participants' understanding and application of this matrix 10 weeks later, at the end of the HLE course.

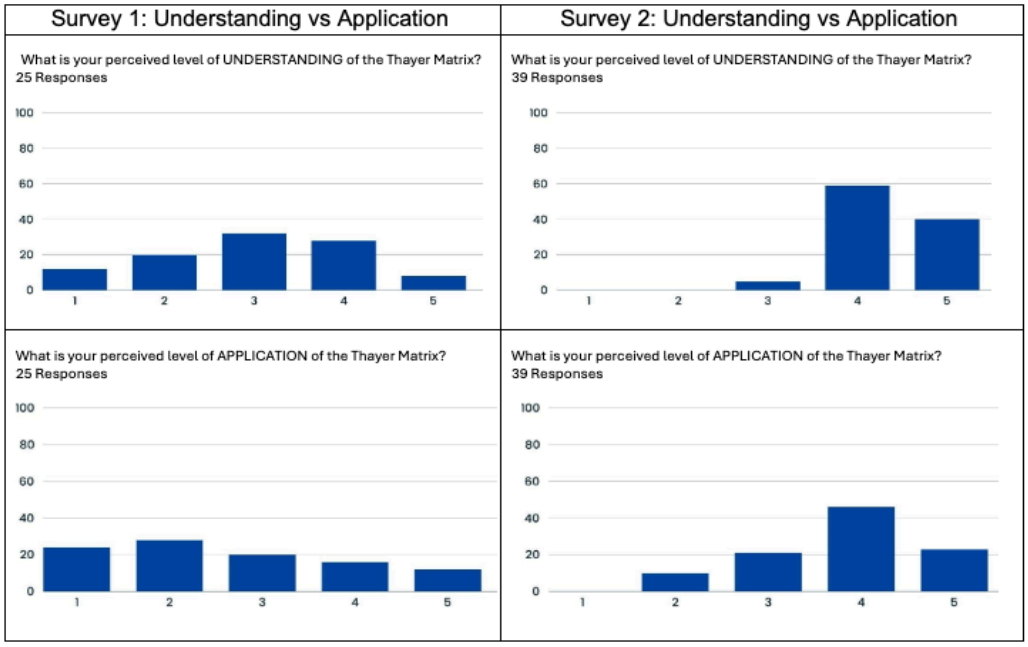

Figure 1. Understanding vs Application of the Thayer Matrix for Survey 1 and Survey 2

Comparing data from Survey 1 and 2, strong growth in understanding of the Thayer Matrix is apparent, with 94% of participants reporting a thorough or extended understanding of this concept, compared to 40% 10 weeks earlier. Survey 2 data also suggests that all participants perceived they were applying this theory to some degree in contrast to Survey 1 where around 20% shared no application.

Understanding and application of the Triune Brain metaphor

In Figure 2, participants' perceived understanding and application of the Triune Brain metaphor at the beginning of HLE (on the left) provides a comparison to participants' perceived understanding and application of the Triune Brain metaphor (on the right) at the end of HLE.

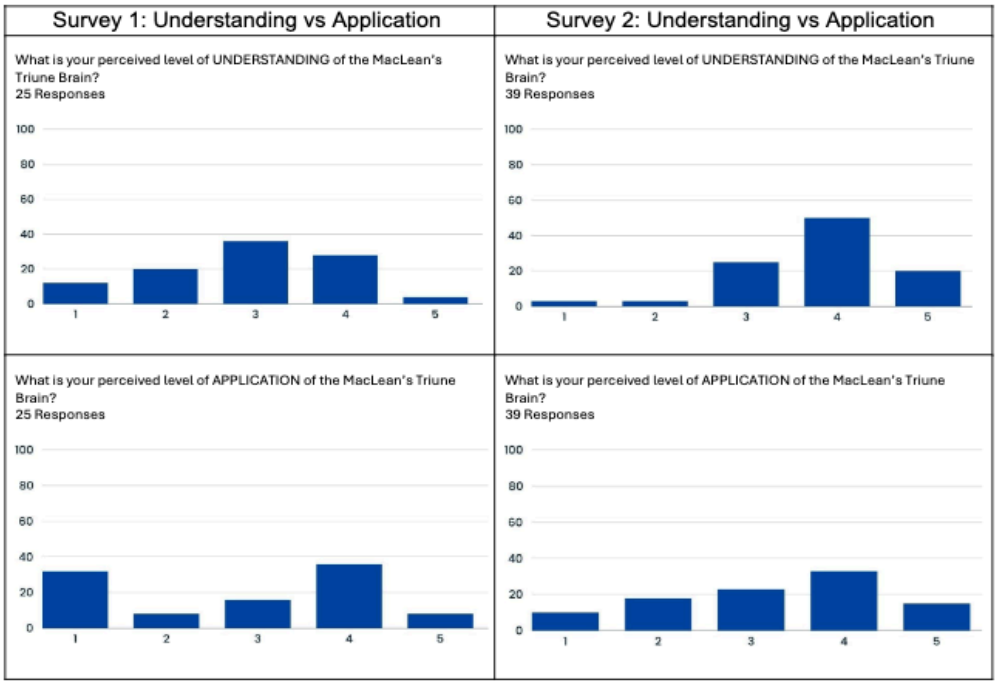

Figure 2: Understanding vs Application of the Triune Brain for Survey 1 and Survey 2

Once again, growth between Survey 1 and Survey 2 is evident when considering the participants' understanding and application of the Triune Brain. For this theory, 30% of participants reported no or limited understanding of the Triune Brain in Survey 1, whereas 4% reported this in Survey 2. This suggests that 96% of survey 2 participants perceived at least a basic understanding of the Triune Brain theory (most considered their understanding to be thorough). Application rates also increased between January and March. The January data shows 40% of participants declaring no or limited application, whereas in March, at the end of the course, this dropped to 28%.

Understanding and application of Shanker's 5 steps of Self-Reg

Figure 3 compares participants' perceived understanding and application of the 5 steps of Self-Reg over the 10-week course.

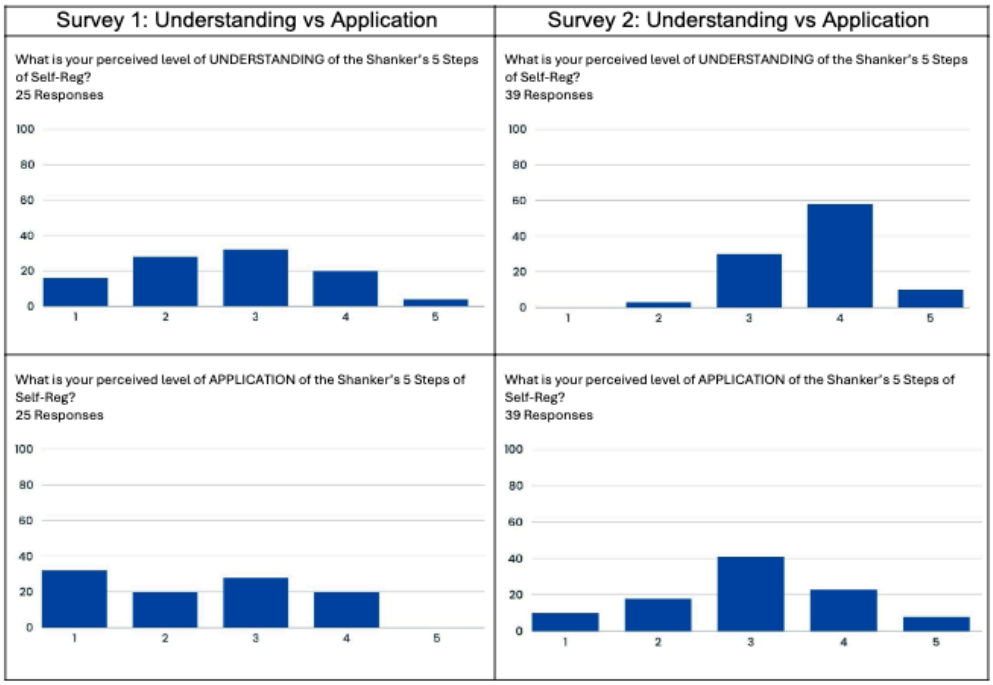

Figure 3: Understanding vs Application of the 5 Steps of Self-Reg for Survey 1 and Survey 2

All participants reported some understanding of Shanker's 5 steps of Self-Reg in Survey 2, with the just under 60% perceiving their understanding to be thorough. Some degree of application was reported by 90% of Survey 2 respondents.

Understanding and application of Self-Reg's 5 domains

Finally, Figure 4 shows participants' perceived understanding and application of the 5 domains across the 10 weeks of the course.

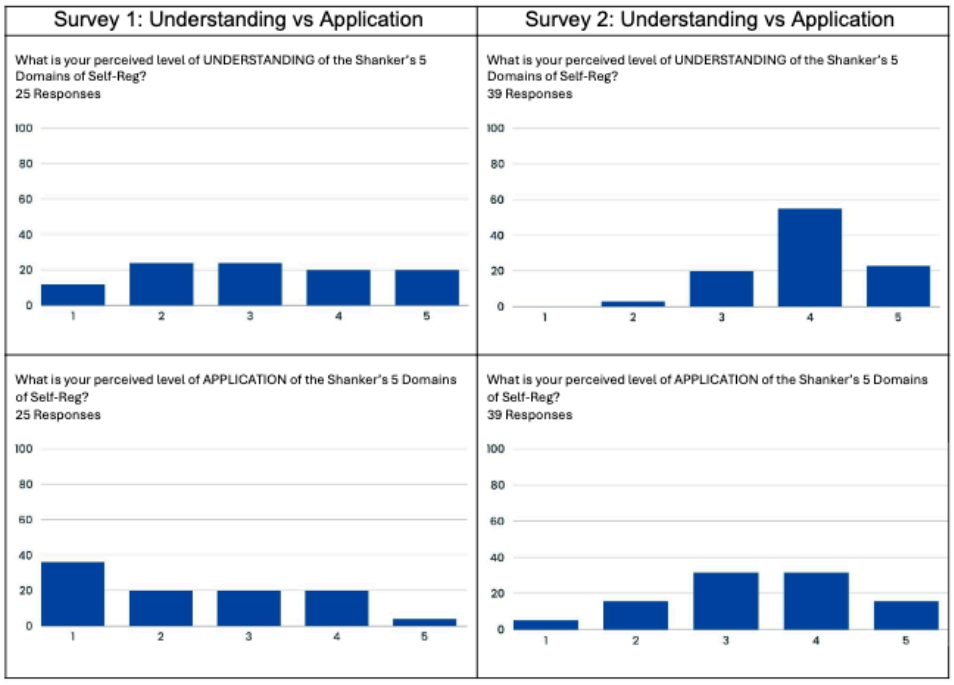

Figure 4: Understanding vs Application of the 5 Domains of Self-Reg for Survey 1 and Survey 2

Understanding and applying Self-Reg's 5 domains also saw growth across the surveys. Survey 2 showed that all participants perceived some level of understanding of this concept, with 80% ranking this in the top two categories. Over 70% of respondents indicated applying this sometimes, many times, or consistently.

In summary, consistent growth in perceived understanding and application was reported for this cohort of preservice teachers between Survey 1 at the beginning of the Healthy Learning Environments course and Survey 2 at the conclusion of the course. Only one theory (Triune Brain) had a participant report no understanding in Survey 2, all other theories were reported as understood. Understanding did not directly correlate with application, with application percentages being consistently lower that understanding.

Finding 2: Future application of learning

Survey 2 posed two questions about future application of learning from the Healthy Learning Environments course. When prompted by the yes/no question, "Are there elements of HLE learning you want to apply to support your own personal navigation of stress within the practicum context? 100% of participants answered "yes". When prompted with the same question with regards to supporting students in navigating their stress, all but one responded "yes" as well. The one participant responding "no" reported that they did not have enough time to develop relationships with the students in their high school Math class therefore would not apply this learning.

Participants described their plans for application of a diversity of learning from the HLE course. Examples included: The Thayer energy and tension matrix; the 5 domains of stress; allostatic load; practical ways to apply learning; and, changes in language.

Thayer's Matrix

Beginning with the Thayer Matrix, one participant commented, "Thayer's Matrix helps me have a better understanding of where I am, and what I should do to help reduce stress." Another participant shared, "Using Thayer Energy-Tension Matrix with reflective journaling [helps] facilitate my cognitive appraisal of the 5 domains of stress."

The 5 Domains of Stress

The 5 domains of stress received numerous comments as participants shared their planned application. One stated, "Using 5 domains and Thayer Matrix [helps me] to identify and navigate my own stress." Another planned to, "[Look] at the 5 domains to see where [their] stress might actually be coming from." Yet another planned, "Consideration of the 5 domains of stress" to support them and their students in addition to considering the stressors within the environment as often as possible.

Allostatic Load

Allostatic load was also mentioned directly by some as evidenced by the following quotes: "Allostatic load to ensure I allow myself to decompress;" and "Understanding allostatic load is a reminder to take home for myself to recuperate. I'm no use if I burn myself out." Indirect messaging about managing allostatic load came through in comments such as, "Taking the time to regulate MYSELF (breathing, going for a walk)... but how do I make the time?" and "Understanding that when I'm freaking out, I need to calm down BEFORE I can start problem solving."

Practical Ways to Apply Learning

There were many comments sharing practical ways preservice teacher planned to apply this learning. These included music therapy, daily planning, physical activity, good routines, self-care, and mindfulness. When considering the learning for application, one participant enthusiastically responded, "All of it! All the theories, most importantly looking at children through soft eyes and activating empathy first and foremost."

Applying this learning to help their future students navigate stress was also a priority for preservice teacher participants. Again the 5 domains of stress, the 5 steps of Self-Reg, Thayer's Matrix, and Triune Brain were mentioned in comments. Participants considered application of the 5 domains as they shared how they might support students. One suggested possible adjustments to support the biological domain, "Physical classroom space (during homeroom have lights off so they can adjust/prep for the day)" while another planned on, "Giving a quiet space for students highly aroused." Another considered, "I certainly want to work to recognise and change the environment of my classroom to promote greater change to stressors for my students to enable their safety and comfort in learning while challenging them adequately to think critically."

Changes in Language

The first step of Self Reg, reframe behaviour, was evident in comments. Comments suggesting reframing and a shift in language included, "Understanding why a student might be distracted / "disobedient" may be (likely is) related to stressors and not just because and they want to cause trouble," "Stress behaviour, not just acting out," and "Understanding they are trying their best, reactions are a result of their stress, not to make

things difficult." Another participant was keen to apply this by, "Reframing my understanding of their stress and stress responses to be in a better mindset to help them." Steps 2 and 3 of Self-Reg, recognise and reduce stressors, could also be found in the data, "Doing my best to remove stressors and identify ones I wasn't aware of." Additional comments included reference to the Thayer Matrix and the Triune Brain. "Coregulation and regulation and being more in tune with theories such as Thayer Matrix, red/ blue brain, to support students," and, "Triune brain: Knowing how blue brain and red need to be balanced. Using this to check in with students. Self-Reg toolbox - example fresh air, knowing if students need a reset, to get outside and breathe and move" were examples of this. It was interesting to note participants show awareness of how their own stress may affect their students, with comments such as, "Being mindful of how my stress transfers to them," and "The best thing I can do is remain calm and understanding."

Finding 3: The top five learning opportunities that supported preservice teachers' development of their stress praxis

The Healthy Learning Environment course revisited Self-Reg and related theories to create a reflective lens for application across diverse educational situations. Using this lens, preservice teachers considered policies and legislation, school-based scenarios, key transitional times in education (example transitions being beginning school, middle school into high school, high school to other life pursuits, or perhaps just being a new student arriving in the middle of a school year), parent teacher interactions and their own personal wellbeing as educators. There were also guest speakers who shared how their work supports or promotes a Self-Reg lens. These presentations included a school counsellor, an advocate for the Alliance Against Seclusion and Restraint, and a school principal who actively integrates a Self-Reg philosophy into his leadership.

Survey 2 invited participants to reflect on these activities and presentations and comment on how helpful they were in supporting the development of their stress praxis as a teacher. Participants could answer:

- not helpful
- a little helpful
- helpful
- very helpful
- or, extremely helpful.

Figure 5 provides an overview of perceived helpfulness for 11 course activities represented on the survey.

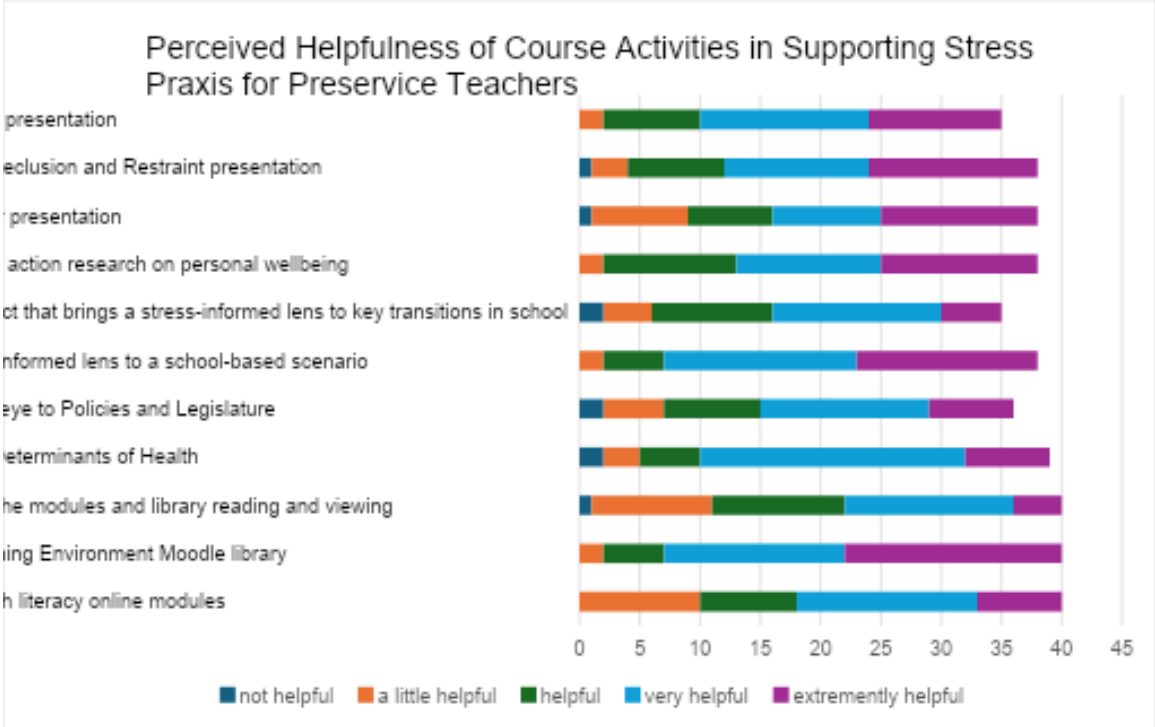

Figure 5: Perceived helpfulness of course activities in supporting stress praxis for preservice teachers

The following five learning opportunities highlighted in this paper were chosen due to the absence of "not helpful" responses, and the high number of very helpful and extremely helpful responses.

Learning opportunity 1: Self-Reg principal presentation

Figure 6 shows the perception of 35 respondents from Survey 2 as they considered how helpful the presentation from a Self-Reg principal was to their development of their own stress praxis.

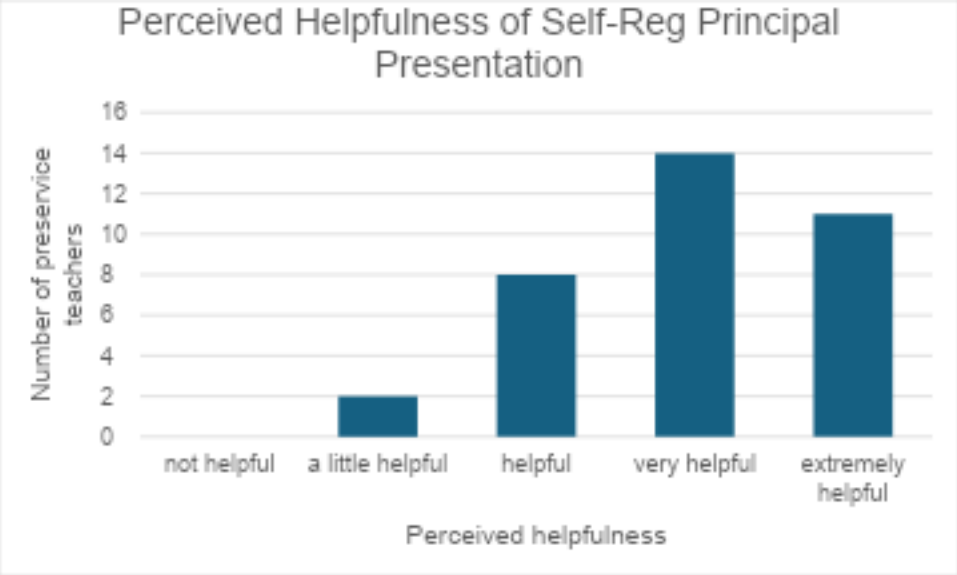

Figure 6: Helpfulness of Self-Reg Principal presentation for the development of stress praxis

Hearing from a practicing Principal, whose work is grounded in Self-Reg, supported the development of preservice teachers' stress praxis according to Survey 2 respondents. This was a one-hour session conducted through Zoom with an Ontario principal who is a facilitator and presenter of Self-Reg through the MEHRIT Centre. Participants commented on the practicality and the hope in this presentation. One participant responded, "This was so positive and motivating. The lens of Self-Reg is clearly present here and he did a great job. Anyone would benefit from this. AWESOME!" while another shared, "This was one of my favourite presentations and allowed me to see how Self-Reg may be applied in the school environment." There were "practical examples on how to apply theory," and Self-Reg noted as an "approach with understanding and empathy – work to help students develop Self-Reg skills and be more aware of their stressors." One participant noted it was, "important to see this valued so highly in a real school setting."

Learning opportunity 2: Conducting a mini action research project on personal wellbeing

There were 38 respondents suggesting how helpful the mini action research project was for the development of stress praxis. Figure 7 provides further details.

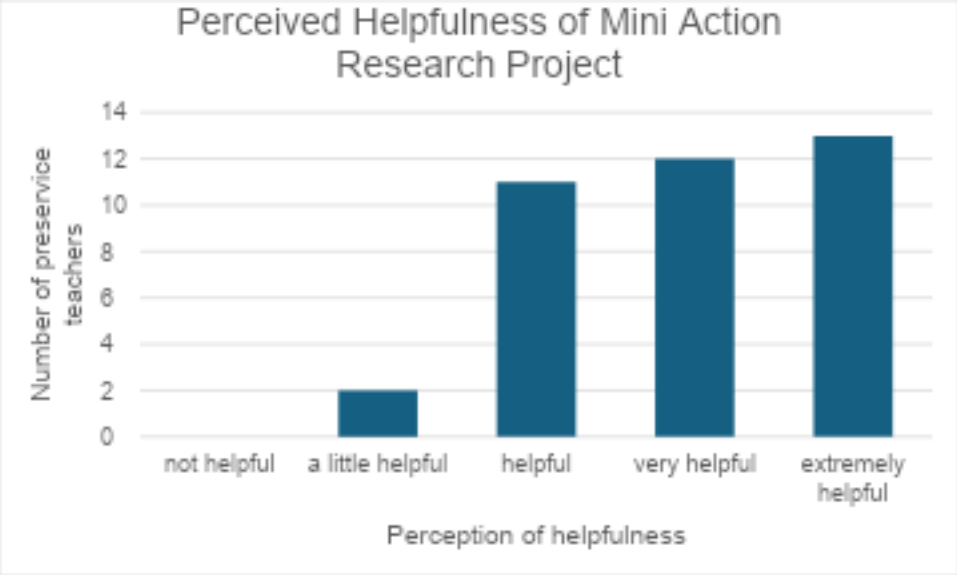

Figure 7: Helpfulness of Mini Action Research Project on Personal Wellbeing for the Development of Stress Praxis

A well-regulated teacher is positively positioned to coregulate dysregulated students. This assignment asked preservice teachers to choose an area of their own wellbeing that they were curious about and conduct a mini action research project that used a theory covered in class that was relevant to their investigation. By focusing on their own well-being, preservice teachers might learn ways to support their own self-regulation.

There were many comments on how helpful it was to connect the theories we had been learning in class to practice. Some included, "Helpful to apply info we learned to our own research," "I like that I got to implement the theories to my own life and apply it," and, "This allowed me to reflect on something specific and gave me the chance to apply Self-Reg strategies." Participants also commented on the benefits that came from the assignment. One stated, "[This was] beneficial [for] understanding my own stressors and factors that affect my daily life, while another claimed, " I learned more about myself and what I need to stay focussed and happy." Some also made the link between their personal wellbeing and their students, with comments like, "My wellbeing = student wellbeing," and, "Navigating stress and finding out ways to address it are incredibly important for us as teachers and benefits our students." Within the data, two participants also noted, "I hated this assignment; however, it highlighted so many things about my personal well-being," while another cautioned, "It was too short to provide meaningful data so while I think it could be good to introduce the concept, I would be careful to apply too much meaning to the results." These comments suggest considerations for future iterations of this assignment.

Learning opportunity 3: Bringing a neuro-informed lens to a school-based scenario

Using a Self-Reg and neuro-informed lens to possible school-based scenarios supported participants in developing their stress praxis. Figure 8 indicates the levels of helpfulness shared.

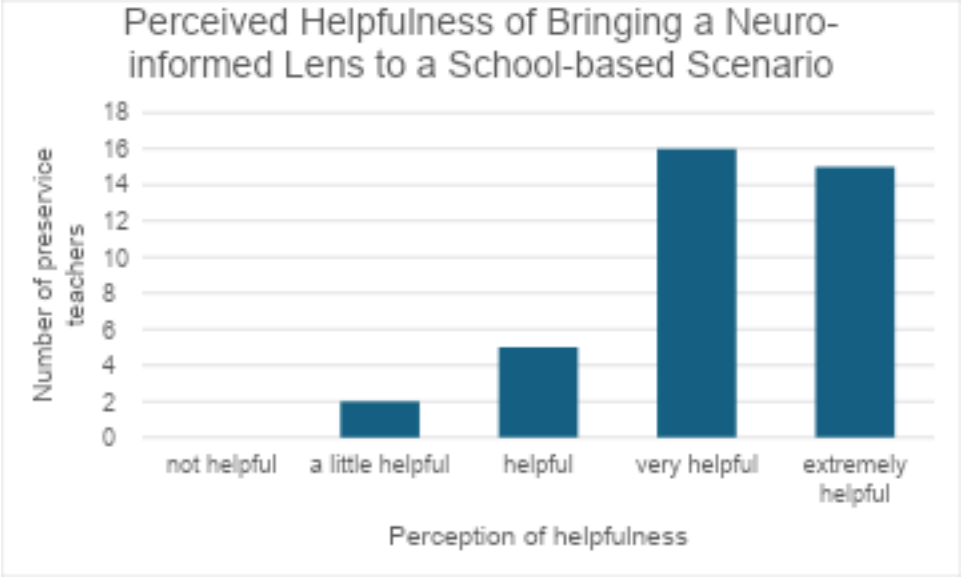

Figure 8: Helpfulness of Bringing a Neuro-Informed Lens to a School-Based Scenario for the Development of Stress Praxis

One of the group assignments required preservice teachers to read and respond to a school-based scenario using a Self-Reg approach. Together they needed to triage the scenario, consider various approaches to respond (and play with ideas that might further escalate the situation as well as ideas that might help reduce the escalation). Students then proposed what they would choose to do in the moment, directly after the event, and how they would provide further follow up. Finally, if they were able to wind back the clock, students could suggest proactive ways to mitigate the stressors in the scenario possibly preventing them from arising in the first place.

The feedback from participants was very positive with 82% of respondents finding this very helpful or extremely helpful in developing their stress praxis. “This was a fantastic exercise that really required us to think and consider much of what we had learned,” “So important to have real life scenarios and be aware of how to go about it,” and, “As a teacher I feel like this gave me the chance to reflect on how I would deal with certain scenarios,” were all examples of preservice teachers’ experiences with this activity. A number of comments suggested that the Bachelor of Education program could benefit from more scenarios as it provided practice and an opportunity for reflection.

Learning opportunity 4: The Healthy Learning Environment Moodle library

Rather than having fixed readings assigned in this course, preservice teachers were offered an online library with readings and viewing. In preparation for each class, participants were to choose one reading and one viewing from this library and come prepared to talk about these. Students rated this very highly as they reflected on how helpful this was to the development of their stress praxis. Within this library, there were many links to Self-Reg materials (blogs, podcasts, infographics), as well as provincial policies, like Nova Scotia’s new cell phone policy, and videos by researchers using neuroscience to better understand stress and stress responses.

Figure 9 provides how helpful this was according to 40 respondents.

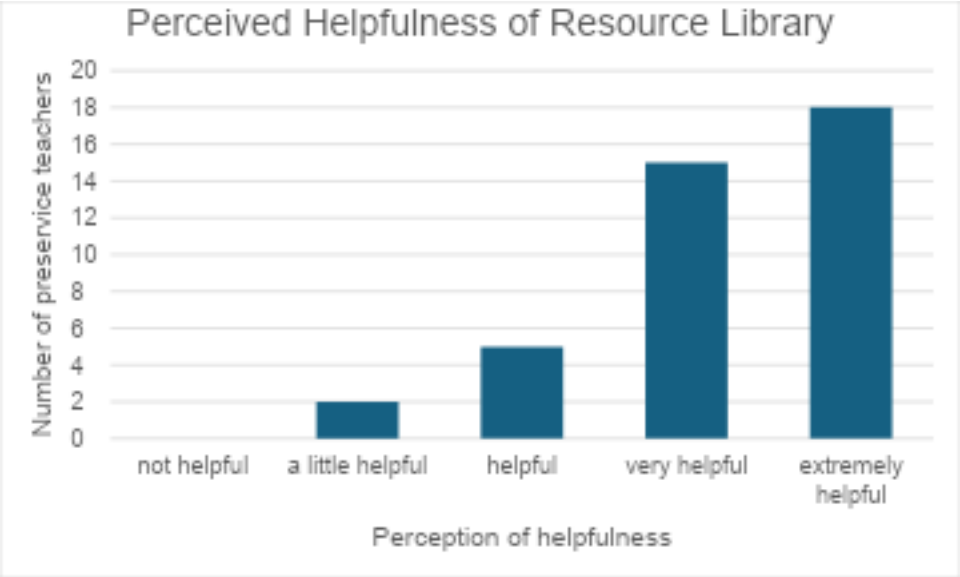

Figure 9: Helpfulness of Moodle Library for Developing Stress Praxis

Preservice teachers enjoyed many aspects of this library. They commented on the "great resources," and how they, "Loved this. I like that I got to choose my own interests." Other comments included, "The resources are wide and varied and will be something I refer back to (particularly LGBTQ2IA+ resources)" and "By getting to choose between very current and relevant topics we developed strategies to support our students through inevitable obstacles." Choice made things interesting for them as one pointed out, "Having the option of choice made completing the mandatory reading/viewings fun and exciting!"

Learning opportunity 5: University of British Columbia Online Mental Health Literacy Modules

Participants indicated how helpful these modules were to learn about or review mental health literacy (see Figure 10).

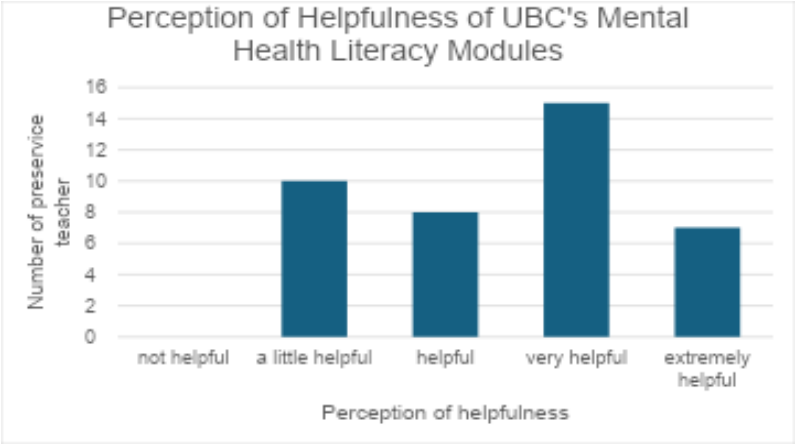

Figure 10: Helpfulness of UBC Mental Health Literacy Modules for Developing Stress Praxis

One participant commented, "I would have said I knew mental health literacy before, but these modules went well beyond what I thought. Plus, it really talked about stigma of mental health." Through conversations in class, we were able to connect the learning in the modules to Self-Reg. How might we reframe behaviour or recognise and reduce stressors for students experiencing various states of mental health? Another participant commented, "Mental health literacy enables me to be more aware and thus understanding of the experiences others may be going through."

In addition to these online modules, learning about the Social Determinants of Health received 30 rankings in the very and extremely helpful categories combined (as well as 2 in the not helpful category). Understanding the stressors families, children, teachers, and colleagues can experience because of their race, housing, income, education or other social determinants of health, also wove into the learning occurring in the University of British Columbia Mental Health Literacy modules.

Discussion and Recommendations

In the abstract and introduction sections of this paper, I questioned if and how teacher educators prepare preservice teachers to understand and navigate the ever-increasing stressors of the teaching profession. The literature suggests that although a significant increase in neuroscience is unfolding, new knowledge about the brain that might support educators in their work is not yet consistently included in teacher education. This learning can support teachers with their own stress management and position them well to effectively coregulate their students. This research demonstrates how Shanker Self-Reg can be a key piece of this learning for preservice teachers and offers promising practices to engage preservice teachers in mobilising learning through application. There are many ways for teacher educators to support preservice teachers in developing their stress praxis. This research provides a starting point and shows how learning and applying Self-Reg and related theories can be a catalyst for positive teacher and student outcomes.

A promising trend noted within the findings indicates that participants perceived an increase in understanding and application over the course of the learning. A pattern worth noting and suggested for future research within this data is that participants consistently reported their perceived understanding of various concepts and theories as higher than their perceived application of this knowledge. In other words, knowing something did not necessarily translate into practice or action. How can we continue to promote rich and authentic opportunities for application of learning in teacher education programs?

This discussion draws three recommendations from across the research, that suggest factors for teacher educators to consider as they look to the future. For rich learning and application to occur for preservice teachers these recommendations include revisiting the learning through cycles of theory and practice; providing authentic opportunities to apply (or witness application) of learning; and, ensuring preservice teachers have agency in their learning.

Recommendation 1: Revisiting the Learning Through Cycles of Theory and Practice

As I work with preservice teachers, I use the metaphor of lenses in a pair of glasses to describe how the way we see things can shift if we develop the lens we use (see Figure 11).

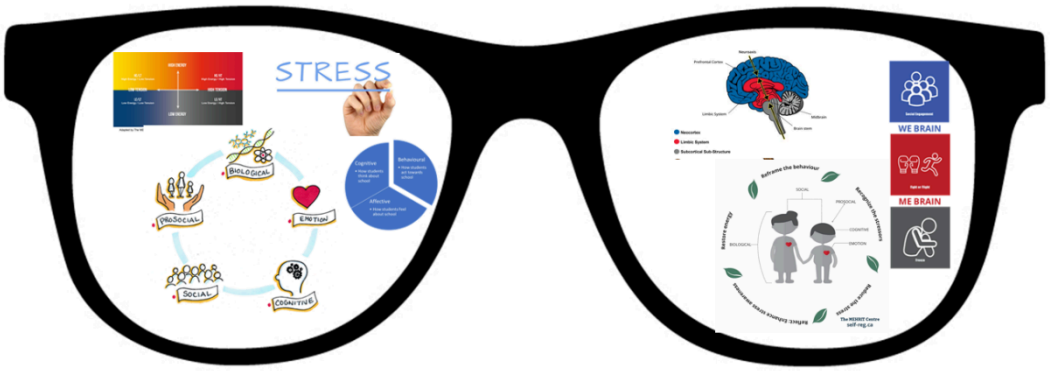

Figure 11: Theoretical Lens Metaphor with images from www. self-reg.ca

By placing the various theories and approaches into these lenses it becomes possible to notice new things and perhaps, as a result, respond in different ways, leading to growth in praxis. For these participants, the roll out of the 2-year Bachelor of Education program enabled two cycles of neuro-informed learning and application possibilities that lead to the development of this new lens. This had powerful affordances for the development of preservice teachers' stress praxis. It allows for establishing and developing a theoretical foundation interspersed with authentic opportunities for application. For this research, cycle 1 included Principles and Practices 1 coupled with the first practicum experience at the beginning of the Bachelor of Education degree providing an effective combination to learn and then apply neuroscience. Cycle 2 occurred as the degree culminated with Healthy Learning Environments (and Classroom Management for some) which took theory further and was immediately followed by the final practicum where authentic application could occur. Each cycle added to and strengthened the lens, supporting changes in perception, awareness, and practice.

Recommendation 2: Ensure Relevant and Authentic Opportunities to Apply Learning

Without authentic, personal and relevant ways to apply learning, learning itself can quickly become dull and meaningless. How can we authentically invite preservice teachers to apply what they are learning? Application is where learners enact cognitive concepts in practice. Preservice teachers developed their lens (Figure 11) then applied it across multiple situations/ documents/ assignments. Teacher educators need to ensure relevant and authentic opportunities are available for preservice teachers to apply and grapple with new learning and thinking. Data confirmed that applying the theories to self, through the mini action research project was insightful for most participants. Finding ways to extend the data collection period would further strengthen this activity allowing for more data to be collected leading to more opportunities to see trends and patterns, as well as more time to engage with the theories themselves. Applying theories to support others, through the school-based scenario response, as well as hearing how others apply

this in their everyday work (Self-Reg principal) all helped in activating this lens. Using this lens then led to new informed practices and actions.

Application beyond the coursework and school setting were also reported as preservice teachers brought this lens into their own homes and contexts. Self-Reg was helping them to navigate stressors and stress responses beyond the course work or practicum contexts.

Recommendation 3: Ensure Preservice Teacher Agency in Learning

Voice and choice in learning personalises and cultivates curiosity. Structuring the course with options and ways to personalise the learning was noted as an affordance by preservice teachers in the data. Rather than having fixed readings, being able to choose from a multimodal library allowed participants to follow areas of curiosity, engage in relevant not redundant learning, and bring different ideas to the learning conversations within class.

Personalising their action research also invited agency. Participants chose a wellbeing area that was meaningful to them. They chose the theory that would best suit this investigation and conducted the research in a way that fit into their time schedule.

Working collaboratively on responses to school-based scenarios also allowed for different perspectives and conversations. There was no one way that was correct and there were many opportunities for participants to apply theory and justify recommendations.

Conclusion

Essential components for today's preservice teacher education include learning about and applying science-based practices and theories about the brain (Coch, 2018). This research shares how Shanker Self-Reg can be a key mobiliser to meet this need for teacher candidates within their preservice teacher education. The research showed that most preservice teachers perceived growth in their understanding and application of neuro-related theories and processes and envisioned the affordances of future application for themselves and their future students. Five promising approaches/activities were highlighted including; engaging professionals in the field who are applying Self Reg principles to their work; conducting action research on personal wellbeing using neuro-connected Self-Reg theories; applying Self-Reg principles and theories to school based scenarios; supplying a library of neuro-informed resources for students to read and view based on their own needs and interests; and, deepening understanding about mental health literacy and social determinants of health to consider the stressors within educational contexts. Three considerations for designing post-secondary teaching and learning were also shared. These included the importance of cyclical learning where theoretical perspectives return across the two-year learning program and merge with the ever-deepening understandings and experiences of preservice teachers; the regular application of theoretical learning through authentic and relevant learning opportunities; and, preservice teacher agency in creating a learning path that meets their unique learning needs and aspirations. In this research, Shanker Self-Reg provided an effective vehicle for preservice teacher candidates to engage with neuroscience as they completed their Bachelor of Education degree and approached their teaching careers.

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Declaration of interest statement

I declare that I am an employee of both Acadia University and the MEHRIT Centre.

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