THE *TeachABI* PROFESSIONAL DEVELOPMENT MODULE: A MIXED METHOD ANALYSIS OF CHANGE IN OPEN-ENDED CASE STUDY RESPONSES

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A THESIS SUBMITTED TO THE FACULTY OF GRADUATE STUDIES IN PARTIAL FULFULLMENT WITH THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

GRADUATE PROGRAM IN CLINICAL DEVELOPMENTAL PSYCHOLOGY
YORK UNIVERSITY
TORONTO, ONTARIO

July 21st, 2023

Abstract

Background. Educators have limited knowledge of acquired brain injury (ABI) and lack specific training on how to accommodate children with ABI in the classroom. This work evaluates an online professional development module, *TeachABI*, designed to build competence about ABI among elementary school educators.

Objective. To explore and evaluate educators' knowledge change following completion of the *TeachABI* module.

Method. Open-ended responses to a case study were analyzed before and after 49 elementary-level educators reviewed *TeachABI*. A mixed-methods analytical approach was used, whereupon researchers engaged with the data through qualitative methods, and then applied quantitative operations to test specific hypotheses.

Results. After completing *TeachABI*, educators developed a more accurate conceptualization of brain injury and were more likely to identify ABI as a precipitating factor for classroom challenges, $\chi^2(1, N=49) = 8.64$, $p < .01$. Teachers also described a rich variety of procedural steps and practical classroom strategies to support students with ABI. Post-module, educators outlined a greater diversity, $z = 4.7$, $p < .01$, and number, $t(49) = 3.2$, $p < .01$, $d = .46$, of steps and a greater number of classroom strategies, $z = 3.1$. $p < .01$, $r = .5$.

Conclusions. *TeachABI* was an effective professional development tool and improved educators' approaches to the case study.

Acknowledgements

To begin, I would like to acknowledge that this work was carried out at York University, which sits on the traditional land of the Mississauga of the Credit, Anishinabek, Haudenosaunee, and Huron-Wendat peoples, and is now home to many urban Indigenous folks. I am grateful for the opportunity to learn and grow on land that they have cared for since time immemorial.

To the broader *TeachABI* team, Sara, Brendan, Lauren, Christine, and Andie: thank you. Without all of your hard work in pushing the module and the pilot study forward, this project would not have been possible. My leap into your research space was made comfortable and seamless by your support, and your patience was unmatched.

Willow was my partner in data analysis, and also deserves many thanks for lending her time and experience to the *TeachABI* project. It has been a pleasure to teach you and to learn alongside you, Willow!

I would also like to recognize my supervisors, Dr. Shannon Scratch and Dr. Mary Desrocher. When I first met you both, I had no idea the impact that you would come to have on my life. Your support has been unwavering, and you have always been willing to go out on a limb for me. Thank you for your confidence and for your kindness. I love working with you!

This thesis was supported (in a broader sense) by my cohort and my pack of Toronto friends. I am lucky to have such a beautiful group of people to problem solve with, write with, and to relax with whenever we can find time. Toronto feels more and more like home because of all of you.

Lastly, I need to thank my parents and siblings. Their support is unmatched. Love you guys always.

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1 Introduction

Among children and young adults, acquired brain injury (ABI) is the leading cause of disability and death (Keenan & Bratton, 2006; *Neurological Disorders*, n.d.; Saly et al., 2022). ABI is an umbrella term which encapsulates any post-natal brain injury, with causes ranging from traumatic events (e.g., motor vehicle accidents, sports-related injuries, falls) to nontraumatic insults to the brain (e.g., infectious diseases, vascular weaknesses, tumors), (Keenan & Bratton, 2006; Saly et al., 2022). Depending on the severity of the injury, youth affected by ABI may have impairments across physical, cognitive, psychological, behavioral, and academic domains. Although the consequences of pediatric ABI are well-documented, supporting children with ABI through rehabilitation remains a challenge.

Our research team at Holland Bloorview Kids Rehabilitation Hospital (HBKRH) has developed a professional development module for educators, *TeachABI*. The *TeachABI* module aims to support children with ABI in the classroom by improving educators' knowledge, confidence, and self-efficacy in ABI. By providing teachers with much-needed tools and information, we hope to foster positive learning experiences and improve academic skills, psychosocial outcomes, and cognitive performance for young school-aged children with ABI. The goal of the current thesis was to capture educators' knowledge change following completion of the *TeachABI* module.

In service of this goal, I begin by describing the consequences of ABI in childhood, its impact on functioning, and by highlighting promising transfer effects of academic skills to improve outcomes across domains. Next, I will focus on classroom integration and academic support as a vehicle for improving outcomes for young school-aged children with ABI. Barriers to classroom-centered efforts will be discussed, and an overview of current approaches will be given. Lastly, I will introduce *TeachABI* and describe its development and usability. An overview of pilot testing for the *TeachABI* module will be presented, and a mixed-methods approach to analyzing knowledge change through both exploratory qualitative and evaluative quantitative methods will be reported on.

2 Pediatric ABI: Etiologies and Prevalence

As aforementioned, ABI is an umbrella term which encompasses brain injuries sustained

following birth through either traumatic or non-traumatic mechanisms.

2.1 Traumatic ABI

Traumatic brain injury (TBI) is defined as "a temporary or permanent disruption of the normal function of the brain due to an external force" (Warwick et al., 2020, p. 1). Relative to the broader, non-traumatic ABI category, TBI benefits from a constrained definition and its prevalence is therefore more easily captured through epidemiological surveillance. A prospective birth cohort study carried out among a New Zealand population found that as many as 1.1 per 100 school-aged children aged 5-10 sustained a TBI each year, and that approximately 30% of individuals tracked in the study had sustained a TBI by the time they had turned 25 (McKinlay et al., 2008). In young school-aged children, the most common mechanisms of injury are transportation-related (e.g., motor vehicle accidents involving child occupants, or child pedestrian accidents), cycling accidents, and falls (Keenan & Bratton, 2006).

2.1.1 Mild Traumatic Brain Injury

Notably, between 70 and 90% of TBIs are classified as *mild* (Cassidy et al., 2004). The mild TBI (mTBI) classification encompasses concussion, an injury that as many as 2,000 per 100,000 Canadian youth will experience annually (DuPlessis et al., 2022; Mayer et al., 2017; Zemek et al., 2017). Most often, mTBIs do not produce visible lesions on neuroimaging and are diagnosed primarily based on symptom self-reporting, observer reports, and clinical judgement (Emery et al., 2016). With proper care, the majority of mTBI symptoms and clinically detectable deficits will resolve within days to weeks following the injury, although a subset of youth—approximately 15 to 30% — will go on to experience persistent post-concussion symptoms (PPCS; Lambert et al., 2022; Wäljas et al., 2015).

2.1.2 Moderate-Severe Traumatic Brain Injury

Typically, moderate to severe traumatic brain injuries are characterized by a combination of the following: reduced scores on the Glasgow Coma Scale (a 15-point observational scale based on visual, verbal, and motor responses, with lower scores indicating higher impairment), positive neuroimaging findings, open head injury, loss of consciousness, and posttraumatic amnesia (Siebold et al., 2018). While Canadian data are absent, a recent nationwide retrospective cohort study in the Netherlands estimated the incidence of moderate to severe TBI among children as 14 per 100,000 person-years (Jochems et al., 2021). The burden of these injuries was high, as 56%

of participants received inpatient care and 30% were admitted to the intensive care unit (Jochems et al., 2021). A broader body of literature suggests that young males are significantly more likely to sustain TBIs relative to their female peers. Estimates of mortality rates for moderate to severe TBIs can range from 1% to approximately 7% of affected youth (Dewan et al., 2016). Importantly, the burden of post-injury disability correlates with the severity of injury (Rivara et al., 2011, 2012). Children with moderate to severe TBI also experience significantly diminished quality of life at 36 months post-injury, and many have persistent adaptive and communicative skills deficits (Rivara et al., 2012).

2.2 Non-Traumatic ABI

While much emphasis is placed on TBI, non-mechanistic insults to the brain are also present in childhood. These non-traumatic brain injuries (nTBIs) stem from varying causes such as vascular weakness (e.g., stroke), anoxia (e.g., drowning, pediatric cardiac arrest), brain tumours, substance toxicity, meningitis, encephalitis, and others (Chan et al., 2016). In part because of the diverse etiology of nTBI, it is challenging to collect population-based epidemiological data. A study of children and youth in Ontario estimated the rate of nTBI at 82 per 100,000, with the highest incidence of injury occurring in children aged zero to four (Chan et al., 2016). In approximately 6% of children, nTBI was fatal (Chan et al., 2016). The majority of children (77%) were discharged to home care, and an additional 9% were discharged to home with additional services (Chan et al., 2016). Notably, although there is a higher prevalence of TBI relative to nTBI, children with nTBI have significantly increased healthcare-related costs. This stems from longer hospital stays (an average of 13 days for nTBI relative to 5 for TBI) and up to three times as many patient services used (Chan et al., 2016).

3 Pediatric ABI: Outcomes

Following pediatric ABI, a number of factors influence recovery outcomes, including: injury characteristics (e.g., severity, localization), pre-insult level of functioning, individual characteristics (e.g., age, developmental stage, personality, co-occurring and/or pre-existing conditions), and the environment (e.g., access to care, community support) (Bennett et al., 2003; Eagan-Johnson, 2018). Deficits following pediatric ABI are as diverse as the injuries themselves, and may span cognitive, physical, psychosocial, communicative, and academic domains (Eagan-Johnson, 2018). Physical and communicative deficits are targeted by rehabilitation specialists

(e.g., physiotherapists, occupational therapists, and speech-language pathologists). Interventions targeting cognitive, psychosocial, and academic skills, however, may be less well-resourced within existing rehabilitative frameworks, despite being critical for day-to-day functioning. In light of this gap, the remainder of this thesis focuses on cognitive, psychosocial, and academic outcomes following pediatric ABI.

3.1 Cognitive Outcomes

In children with ABI, changes in cognitive functioning post-injury have been reported across attention, memory, processing speed, working memory, and executive functions (Chevignard et al., 2012). In particular, challenges in executive functioning have been the focus of rehabilitative efforts as impairments in higher-order planning and reasoning have been identified as a driving force behind impairment post-ABI (Ylvisaker et al., 2005). Perceptual changes may also occur, such as visual-spatial deficits, unilateral neglect, or verbal/auditory deficits (Bennett et al., 2003; Chevignard et al., 2012). Lastly, cognitive fatigue in daily life presents a significant obstacle following pediatric ABI, and impacts as many as 60% of children who experience TBI and upwards of 40% of children who have a history of stroke (Gordon et al., 2018; Riccardi & Ciccia, 2021).

3.2 Psychosocial Outcomes

Children living with ABI may also experience a myriad of social, emotional, and behavioral effects. Parents report that their children have challenges with emotion regulation, including a low tolerance for frustration, increased irritability, and problems with externalizing and internalizing behaviors (Bennett et al., 2003; Hendry et al., 2020; Keenan & Bratton, 2006). Compared to an orthopaedic injury control group, children with ABI are significantly more likely to develop subsequent mental health conditions (34-68% in ABI vs. 13-14% in orthopaedic injuries) and experience low self-concept (Hendry et al., 2020). Further, in a pediatric nTBI population, approximately 47% of children had clinical levels of emotional and behavioral psychological problems on a parent-report measure (Pastore et al., 2014). This impacts (and is in turn impacted by) reduced social participation in children living with ABI, which spans across home, community, and school settings (Bedell & Dumas, 2004). In an American study that tracked pediatric ABI patients following discharge from inpatient rehabilitation, at an average of 3.5 years post-injury, 73% of children were restricted in their participation in structured

community events, 71% had difficulties managing their schedule, and 55-61% had a reduced capacity to engage in social play with other children (Bedell & Dumas, 2004).

3.3 Academic Outcomes

Given the breadth of challenges described above, it is unsurprising that children with ABIs also experience academic difficulties. In an American study, following early childhood TBI (i.e., injury before age 6) children scored significantly lower on intelligence tests, as well as reading, mathematics, and language achievement assessments relative to controls (Ewing-Cobbs et al., 2006). For this sample, the odds of failing a grade or being placed in a special education classroom for more than two subjects was 18 times higher for students who had sustained an ABI than for those without (Ewing-Cobbs et al., 2006). On average, children with a history of ABI also have lower levels of academic achievement compared to their peers (McKinlay et al., 2008).

Academic success and classroom functioning are supported by intact cognitive abilities and psychosocial skills. These include executive functioning, memory, attention, impulse control, and information processing (Glang et al., 2012). As illustrated by Bennet and colleagues (2003) in their "Educating Educators About ABI" resource binder, developed by the Ontario Brain Injury Association in partnership with Brock University (Table 1), skills that may be taken for granted among typically developing youth in the classroom can pose significant challenges for students with ABI.

Table 1.

Classroom Expectations and ABI Challenges

What schools value most in students:	*Potential difficulties for students with ABI:*
Attention	Attention
Motivation	Motivation
Initiation	Initiation
Processing speed	Processing speed
Abstract thinking	Abstract thinking
Expressive and receptive language	Expressive and receptive language
Memory	Memory
Reasoning	Reasoning
Strategic Thinking	Strategic Thinking
Self-monitoring	Self-monitoring

Note. Adapted from *Educating Educators About ABI Resource Binder* (p. 53) by S. Bennett, 2003, OBIA and Brock University.

One such example is executive dysfunction, which may manifest as an inability to focus, challenges with organization and planning, difficulty approaching novel problems, and trouble initiating tasks independently (Glang et al., 2012). As children age and task demands increase, the impact of ABI on their academic trajectory can worsen, creating increasingly broad achievement gaps relative to peers (Glang et al., 2012).

4 Academic Intervention as a Vehicle for Rehabilitation

It is evident that children with ABIs face significant challenges surrounding cognitive, psychosocial, and academic skills. However, the question of how best to remediate and rehabilitate these skills is ongoing. Current approaches to pediatric ABI rehabilitation vary widely in scope and scale. Examples include traditional intensive inpatient rehabilitation programs, and more recently proposed at-home cognitive training (e.g., through *Lumosity* programming; Corti et al., 2020) and attention process training (Hooft et al., 2003). Compensatory and psychoeducational approaches have also been developed, including the use of memory aids, and providing family education through informational booklets (Laatsch et al., 2007).

Approaches that seek to train specific skills are limited by their lack of transfer to other critical areas of functioning (Peng & Kievit, 2020). For example, training cognitive skills like memory or executive functioning in children with ABI may not result in favourable or improved academic outcomes. This lack of transfer reflects a trend in the broader literature; domain-specific cognitive interventions often fail to bolster skills in other non-trained areas of functioning (Jacob & Parkinson, 2015; Peng & Kievit, 2020). However, the *inverse* relationship can be leveraged. That is to say, by improving academic abilities, we can support cognitive skill building (Kievit et al., 2019; Peng & Kievit, 2020). Research in this area demonstrates that by remediating reading, educators can consequently impact IQ scores, and that improvements in mathematics are tied to improved executive functioning (Peng & Kievit, 2020)

This provides an important foundation for intervention building, as direct academic instruction is therefore a tool that can be applied not only to impact academic outcomes, but also to rehabilitate cognitive skills more broadly. In keeping with this, a growing body of literature suggests that perhaps the best interventions to improve cognitive, academic, and psychosocial skills for children leverage direct and supported classroom learning (Stockard et al., 2018). For

children with ABI, by supporting academic skill development, teachers can consequently foster positive outcomes in other areas that are not being explicitly trained. By focusing on classroom integration and leveraging educators' skillsets, interventionists can adopt a cost- and time-efficient model of community-based rehabilitation that allows children with ABI to return to important activities of daily living.

5 ABI in Ontario Classrooms

Although the consequences of pediatric ABI are well-documented, supporting children with ABI within the Ontario education system remains a challenge. Children are returning to school earlier post-ABI due to shortened hospital stays (Glang et al., 2012). As a result, schools and teachers have become frontline service providers for children and adolescents living with ABI (Glang et al., 2012). As aforementioned, the classroom is an exciting space with significant potential as a vehicle for pediatric rehabilitation. However, students with ABI and their teachers may encounter significant barriers to implementing evidence-based strategies to support direct instruction in the classroom (Glang et al., 2012).

In a systematic review, Hartman and colleagues (2015) surveyed the literature on clinician and educator experiences facilitating return to classroom learning for children with ABI. Broadly, six themes emerged from the included studies (Hartman et al., 2015), which are summarized in Table 2. This work reinforces that the transition from hospital to school is overwhelming and challenging for families, and that educators lack the tools necessary to support students with ABI through this process. Key themes relevant to the Ontario classroom context are described below.

Table 2.

Themes of Clinician and Educator Experiences in Facilitating Hospital-to-School Transitions for Students with ABI

Themes of Clinician and Educator Experiences
1. Lack of training and knowledge among educators regarding students with ABI
2. Lack of communication between educators, clinicians, schools, families, and students
3. Lack of preparation for the hospital-to-school transition
4. Supports available
5. Linking agents between hospitals, schools, and students
6. Policy practices affecting hospital-to-school transitions

Note. Adapted from "Clinician and educator experiences of facilitating students' transition back

to school following acquired brain injury: A qualitative systematic review" by L. Hartman, 2015, *Brain Injury, 29*(12), 1397-1399

An example of policy practices affecting hospital-to-school transitions (theme six described by Hartman et al., 2015) within the Ontario education system can been observed in the Province's failure to recognize ABI as a category of exceptionality (Bennett et al., 2004; Saly et al., 2023; Stevens et al., 2021). To receive formal educational support within the current system, students must be identified by their Identification Placement and Review Committee (IPRC) as falling within one of five categories of exceptionality: physical, intellectual, behavioral, communication, or multiple (Government of Ontario, 2022; Saly, 2021). Due to symptom overlap with other common exceptionalities like attention-deficit/ hyperactivity disorder (ADHD) or learning disability (LD), students with ABI are often misidentified and misdiagnosed. Conversely, students with ABIs may also be intentionally misdiagnosed to fit within the assigned categories so that they may access much-needed support (Saly, 2021). Regardless of intention, misdiagnoses and a lack of recognition as a category of exceptionality within the school system create challenges surrounding proper surveillance of ABI (Zinga et al., 2005).

A lack of proper data contributes to the under-recognition of ABI in the classroom, and thereby limits student support, system funding, and educator training in this area (Zinga et al., 2005). As described in theme one by Harman and colleagues (2015) and more broadly in the literature, this lack of educator training stands out as a critical barrier to supporting children with ABI in the classroom (Bennett et al., 2003; Glang et al., 2012; Hartman et al., 2015; Saly, 2021; Stevens et al., 2021). It has been established that educators' expectations influence academic achievement (Jussim, 1989) and proper training for classroom leaders also contributes to positive psychosocial outcomes for children post-ABI. As teachers' knowledge increases so does life satisfaction for students with ABI in both school and in their friendships (Wlodarczyk, 2012). Additionally, as educators' knowledge increases, subjective stress levels decrease for children with ABI (Wlodarczyk, 2012). In this way, increasing educator knowledge becomes an imperative to support positive classroom integration and learning for students with ABIs.

In a recent study by Stevens and colleagues (2020), a majority of surveyed Ontario educators reported low to minimal knowledge of pediatric ABI. When students with ABI were placed in the classroom or returned to learn post-injury, educators reported feeling unprepared and underequipped to accommodate student needs (Stevens et al., 2021). When asked how to

build these skills, educators suggested a two-phased approach to learning: beginning with a short, flexible, e-learning module as their preferred format, which could be followed up with a targeted in-person session with an educator with expertise in ABI (Stevens et al., 2021). Notably, similar educator-focused e-learning interventions have been successfully implemented to increase knowledge and confidence surrounding concussion within the school setting (Davies & Tedesco, 2018).

6 Current Approaches to Educating Educators

Given the importance of increasing educator knowledge to facilitate academic skill-building through direct instruction, and to support the psychosocial well-being of children with ABI, Saly and colleagues (2022) conducted a multi-year scan of Canadian-relevant internet resources that aimed to educate educators about ABI. A total of 96 online resources were identified, which were delivered through varying modalities including: webpages, web guides, handbooks, academic articles, videos, magazine articles, worksheets, protocols, and e-learning modules (Saly et al., 2022). Of these, the majority addressed TBI and concussion. Only one resource was presented in the interactive e-learning format preferred by educators: the "Concussion Awareness Training Tool eLearning Module" put forth by British Columbia's Injury Research and Prevention Unit (Hartman et al., 2015; Saly et al., 2022). More than a third of the resources were published prior to 2012, possibly including outdated information about ABI (Saly et al., 2022). Given that educators are not receiving sufficient formalised training to build ABI knowledge and self-efficacy in developing classroom accommodations, resources like those captured above can bridge an important gap. However, the quality of content, suitability of format, and accessibility to educators, leaves room for improvement.

7 The TeachABI Module

To bridge this gap, researchers at HBKRH developed the *TeachABI* professional development module: an evidence-informed online resource to improve ABI knowledge among Ontario elementary school educators. This is a short (< 1 hour) professional development module that takes a case-based approach to information provision. Educators work through four key learning objectives: (1) define ABI; (2) identify challenges for students with ABI in the classroom; (3) discuss the importance of an individualized approach to supporting students with ABI; and (4) describe how to support a student with ABI in the classroom. To address these objectives, they

follow the fictional story of Mr. H, an elementary school teacher, who is working with Olivia, a new student in his classroom who has a history of ABI. The module allows educators to learn from Mr. H as he inquires about Olivia's brain injury, how it affects her classroom behavior and academic performance, and how he can best accommodate her needs. Critically, *TeachABI* also highlights how tools that are used to support other exceptional students within the classroom can be applied to children with ABI. An emphasis is placed on the idea that educators *already* possess these skills, and that they are highly transferable to a pediatric ABI population. The module also incorporates tip sheets, videos of educators, clinicians, and parents with experience supporting children who live with ABI, as well as links to external evidence-based resources to enrich learning. Visuals of the module are provided in Appendix A.

7.1 Usability Testing

The *TeachABI* module was rigorously co-designed with key knowledge holders, including clinicians, knowledge translation specialists, teachers, families and youth with lived experience of ABI (see Appendix B: Saly et al., 2023). To assess educators' ability to navigate *TeachABI* and their satisfaction with the module's content, usability testing was carried out with eight teachers (Saly et al., 2023). Teachers navigated through 11 key tasks in the module, while their task completion and feedback was documented. After reviewing the module, participants were provided the opportunity to expand on their experience through a semi-structured interview and completed the System Usability Scale (SUS), a validated measure of perceived usability.

Overall, the *TeachABI* module demonstrated excellent usability (mean SUS = 86). Out of eight participants, 85% completed 10 of the 11 tasks independently (Saly et al., 2023). In qualitative interviews, participants commented on the ease of use and informativeness of the module. Minor technical challenges were documented and have been rectified in the current iteration of the module. Teachers also provided constructive feedback on the content, design, navigation, and implementation strategies in *TeachABI*. These included suggestions of changes to font size, integrating more multimodal presentation of content, and creating more supplementary resources to allow for in-depth exploration of key topics (Saly et al., 2023). Given strong usability and high educator satisfaction, further refinement of the *TeachABI* module was carried out. In line with our commitment to user-centered design, feedback from teachers garnered through usability testing has been incorporated into the current iteration of the *TeachABI* module.

7.2 Pilot to Date

Following usability testing, the team at HBKRH completed a pilot trial with 50 elementary school educators that aimed to: (1) pilot the *TeachABI* online professional development module to evaluate participants' experiences, and (2) use mixed methods to critically evaluate the influence of this intervention on educator knowledge of ABI and confidence supporting students with ABI. Pre-module, educators completed an ABI knowledge questionnaires and a knowledge application case study. Post-module, the ABI knowledge questionnaire and case study were repeated. Additionally, a subset of educators provided feedback through a semi-structured qualitative interview. Lastly, a follow-up was carried out 60 days following module completion to re-assess educator knowledge.

Preliminary data are promising. The *TeachABI* module improved educator's knowledge of ABI, and these gains were retained at 2-month follow-up (Scratch et al., 2023). Teachers also reported increased self-efficacy in supporting children with ABI in the classroom, and this was retained across timepoints (Marshall et al., 2023). Findings also indicate that more than 80% of the educators rate themselves as very likely to recommend the *TeachABI* module to a colleague. This work is ongoing, and published abstracts detailing these and other quantitative findings from the *TeachABI* pilot are attached in Appendix C.

8 Current Work

8.1 Our Team

The present project is driven by a cross-disciplinary team including mixed-method researchers, neuropsychologists, clinicians, clinical trainees, and people with lived experience. I (DD) have led this work, which is supported by my background in qualitative research, ongoing training as a developmental neuropsychologist and rehabilitation scientist, and by my lived experience with mTBI. The framing of the project was supported by my supervisors, Dr. Shannon Scratch and Dr. Mary Desrocher, both of whom have extensive experience supporting children with ABI through research and in clinical practice. Key insights were also provided by Sara Marshall, a clinical trainee in school psychology, who was a leader in developing and carrying out the *TeachABI* pilot study. Lastly, analyses were supported by Willow Barton (WB), a research assistant with lived experience of ABI and its accompanying challenges.

8.2 Mixed-Methods Approach

In our study development, we anticipated carrying out a conventional qualitative content analysis, to explore themes of knowledge and learning generated by the *TeachABI* module. After becoming immersed in the data, however, it seemed valuable to contextualize our qualitative analysis with evaluative quantitative methods. The qualitative analyses described below capture educators' group-level knowledge and themes extracted following completion of *TeachABI*. Our quantitative analyses, on the other hand, emerged from a desire to also capture change within our participants, and to assess the statistical significance of educators' response changes. We tested a specific set of hypotheses surrounding response change (described below) by developing rating scales informed by the *TeachABI* module and accompanying resources.

This progression is a form of mixed-method analysis known as a quantitative follow-up design (Morgan, 2015). The addition of a supplementary quantitative analysis allows researchers to address goals that are not easily captured within a qualitative framework (Morgan, 2015). Further, it allows researchers to leverage quantitative strengths and move forward their interpretation and understanding of a concept by testing specific hypotheses. This mixed-method approach is also in keeping with previous resource evaluations, which draw operations from conventional and summative content analyses, as well as quantitative analyses (Davies & Tedesco, 2018; Glang et al., 2012; Hickey & Kipping, 1996). The qualitative and quantitative approaches to data analysis for *TeachABI* are described in detail below.

8.2.1 Objective One: Exploration

Our primary objective was to carry out a qualitative analysis of the knowledge application case study completed by educators both pre- and post-engagement with the *TeachABI* module (Appendix D). Through a conventional content analysis approach, we aimed to:

- ***Explore*** the steps and strategies that educators generated to support students with ABI, both spontaneously and following module completion.
- ***Capture*** which components of the module were highly salient (i.e., those mentioned most frequently).

8.2.2 Objective Two: Evaluation

To supplement our qualitative exploration, we also evaluated response change quantitatively by

testing the following hypotheses:

- ***Hypothesis One:*** After completing the *TeachABI* module, educators will be more likely to identify ABI as a possible cause for classroom challenges.
- ***Hypothesis Two:*** After completing the *TeachABI* module, educators will describe a greater number of steps and a greater diversity of steps for supporting a student with ABI within the Ontario education system.
- ***Hypothesis Three:*** After completing the *TeachABI* module, educators will describe more strategies and a greater breadth of strategies to accommodate a student with ABI in the classroom.

9 Methods

9.1 Recruitment

Both pre-service (i.e., enrolled in Ontario Teacher's College) and practicing teachers were recruited to participate in the *TeachABI* pilot study. Participants were recruited using broad means including recruitment flyers distributed through HBKRH, school boards, principals, and on social media (e.g., Facebook, Twitter, LinkedIn). Study information was also shared at community outreach events facilitated by the Holland Bloorview Concussion Centre. Participants were sampled purposively to ensure representation across professional groups (e.g., special education teachers, general classroom teachers, pre-service teachers).

Inclusion criteria required that participants were: (1) working as an Ontario College of Teachers (OTC) certified educator or enrolled in an Ontario Teacher's College program that provides certification within the OTC; (2) working at (or training to work at) the elementary school level; and (3) fluent in reading English. Participants could be excluded on the basis of: (1) being non-English speaking; (2) having physical, visual, or cognitive impairments that would require accommodation to use the TeachABI module; or (3) being unable to provide informed consent.

9.2 Participants

Fifty educators participated in the *TeachABI* pilot study and completed the knowledge application case study. One participant only completed pre-module measures and was therefore excluded, so forty-nine educators are included in the analyses reported below. Participant

characteristics are summarized in Table 3. The majority of teachers taught in general classrooms, and most of the sample worked in a public-school setting. Notably, the sample skewed towards female educators, and was highly educated. While over half of our sample had prior special education training, only two educators had received training specific to ABI.

Table 3.

Demographic information for educators

Demographic	***N***	**Proportion**
Gender		
Women	45	92%
Men	4	8%
Highest level of education		
Bachelor's	27	55%
Master's	21	43%
Not Specified	1	2%
Position		
Pre-service teacher	3	6%
General Classroom Teacher	27	55%
Special Education Teacher	17	35%
Principal	2	4%
Number of years in education		
1-4 years	6	12%
5-9 years	6	12%
10-19 years	8	16%
20+ years	13	27%
Missing	16	33%
School setting		
Public	33	67%
Private	12	25%
Catholic	3	6%
Missing	1	2%
Prior special education training		
Yes	28	57%
No	21	43%
Previous ABI training		
Yes	2	4%
No	47	96%
Previous experience working with ABI		
Yes	20	41%
No	20	41%
Unsure	9	18%

9.3 Measures

The knowledge application case study that educators completed pre- and post- module is described in Appendix D, and screenshots of the current iteration of the *TeachABI* module are provided in Appendix A. The case study presented educators with a profile of a student, Seth, and described his struggles throughout the school day. Educators then responded to open-ended prompts regarding *identification* (Q1: "What do you think is going on with Seth?"), *procedural steps* for support (Q2: "What steps would you take to support Seth?"), and *practical classroom strategies* to accommodate the student (Q3: What strategies would you implement?").

This case-based approach to knowledge evaluation has been successfully implemented for other more circumscribed internet resources for educators. Examples include a video-based online concussion tool for teachers and school administrators in Ohio (Davies & Tedesco, 2018), as well as a TBI-focused online resource for American educators (Glang et al., 2012). In both instances, resource efficacy was evaluated through mixed measures including a case which was delivered by either video (Glang et al., 2012) or as a written scenario (Davies & Tedesco, 2018). Afterwards, qualitative coding of open-ended responses was carried out by the research team.

9.4 Analysis

In keeping with previous studies, the analysis of the *TeachABI* case study applied a mixed-methods approach that integrated operations from both qualitative (i.e., conventional content analysis, summative content analysis) and quantitative (i.e., hypothesis testing) designs (Davies & Tedesco, 2018; Glang et al., 2012; Hickey & Kipping, 1996). To carry out this analysis, I (DD) and a second coder (WB) began by briefly reviewing responses to familiarize ourselves with the data. This allowed for a data-driven approach to analysis as key ideas and potential codes were extracted from this overview. Having established a broad understanding of the data, our twofold approach to analysis was developed and iteratively refined, beginning with the exploratory qualitive analysis of content and themes, followed by a quantitative evaluation of responses.

To establish an initial codebook, we (DD and WB) collaboratively coded the first 20 responses by hand. These codes were transitioned into NVivo qualitative data analysis software (*NVivo,* 2018) to support the systematic analysis of the remainder of the dataset. Coding was carried out cyclically; as new codes were added, earlier responses were iteratively re-analyzed.

Whenever possible, data was coded “in vivo”, using participants’ own words to label codes (Saldaña, 2016). I completed coding of the remaining data, at which point all codes were reviewed for accuracy by independent coder WB. Any discrepancies were noted by WB, after which group consensus was achieved through ongoing review and discussion (DD, WB). Importantly, to ensure rigour, both researchers were blinded to timepoint (i.e., pre- or post-module) and participant characteristics (i.e., teaching background). We also built a glossary of commonly used acronyms to support shared understanding of the educators’ responses (Appendix E). Further, analyses were tracked using an audit trail and an iterative code book (Appendix F).

9.5 Qualitative Analysis: Approach to Exploration of Data

To explore changes across our group of educators following completion of the *TeachABI* module, a conventional content analysis was carried out. This analysis centered around understanding which steps and strategies emerged spontaneously (pre-module) and which were learned (post-module). This supports an educator-focused approach to data synthesis as, through experience in the classroom, respondents may have adopted individualized and valuable approaches to accommodating students that are not captured in the module. Additionally, the salience of information presented in *TeachABI* was evaluated by capturing the frequency at which educators mentioned each step/ strategy.

To facilitate analysis of a dataset of this size, codes were first organized broadly into categories of learning:

- ***Identification:*** descriptions of what may have catalyzed the change in the student.
- ***Procedural Steps:*** actions taken to support the student at the institutional/ systems level.
- ***Practical Strategies:*** actions taken to support the student at the classroom/ individual level.

Throughout coding by myself and verification by WB, emergent themes and the grouping of parent and child codes were discussed and refined as a group. Given the number and breadth of steps and strategies (corresponding to > 120 unique codes), this was instrumental to support the creation of a scaffold through which researchers could organize and interpret the data. Codes, their utilization pre-and post-module, and their frequency, are described below for each of the

categories of learning. Comprehensive terms and definitions are provided in Appendix E, the glossary of acronyms, and Appendix F, the codebook.

9.6 Quantitative Analysis: Approach to Evaluating Response Change

To supplement our group-level exploration of educators' knowledge (pre-module responses) and learning (new post-module information), we carried out a quantitative analysis of within-participant response change. Our initial qualitative approach produced a rich understanding of the data through the generation of themes, and allowed participants' responses to be divided into smaller, meaningful units of analysis: our individual codes (Morgan, 2015).

These codes provided a foundation for our subsequent quantitative approach to evaluative response change pre- and post-module. Codes were tabulated according to frequency, and questions were rated based on response quality (operationalized below in tables 4 and 5). Importantly, our immersion in the data and familiarity with the module gained over the course of qualitative analysis supported the thoughtful preparation of our measures for quality rating, which was discussed and collaboratively improved upon by the entire *TeachABI* team.

For each of the three hypotheses described above, responses were rated by myself and independently verified by WB. Ratings were compared using intraclass correlation (ICC) estimates and their 95% confidence intervals, which were calculated using the R statistical package "Psych" based on a single rater, consistency, two-way mixed effects model (Koo & Li, 2016; Revelle, 2023). For dichotomous variables, the McNemar test (a paired chi-squared test) was used. For categorical variables, if the distribution of differences pre- and post-module followed a normal distribution, a paired t-test was carried out. If the distribution of differences was non-normal, a Wilcoxon Signed-Rank was utilized.

10 Results

Results are reported below using an integrated approach. For each category of learning, qualitative analyses of group-level change are presented, followed by quantitative analyses of within-participant change. Lastly, both analyses are integrated and synthesized.

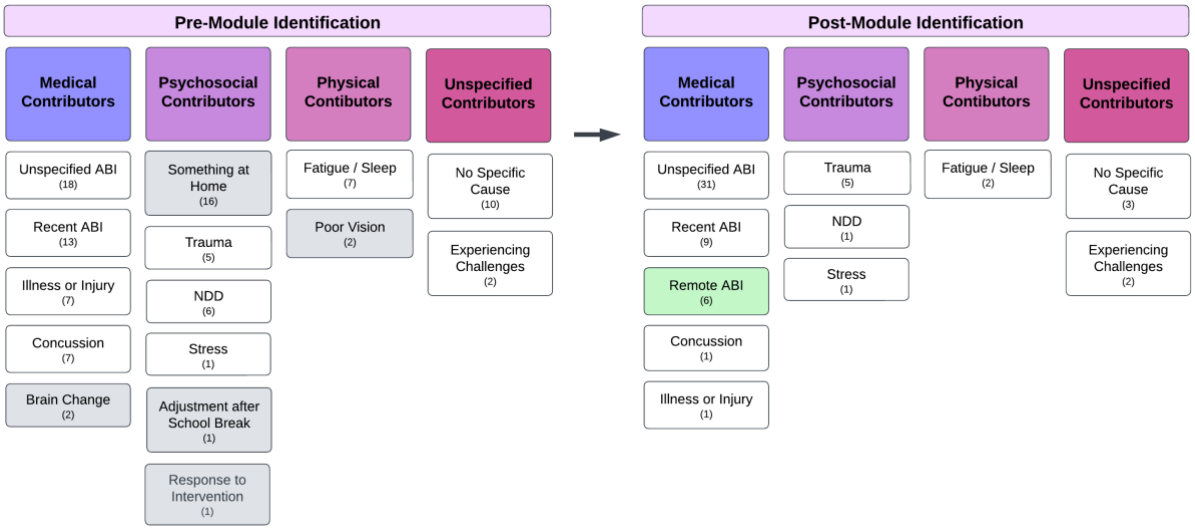
10.1 Identification

Content Analysis: **Identification**

In response to the case study question, “What do you think has happened to Seth?”, educators produced a wide range of responses. They were organized into four themes: medical contributors, psychosocial contributors, physical contributors, and unspecified contributors. Figure 1 depicts changes in codes following completion of the *TeachABI* professional development module.

Figure 1.

Pre- and Post-Module Contributors to Change Identified by Educators



Note. Numbers in brackets represent the number of educators who described a given code in their response. Codes are ordered top to bottom based on their frequency. Grey colouring indicates a code that was present pre-module, but that was not repeated following completion of *TeachABI*. Green colouring indicates a code that was only generated after educators reviewed the module.

Prior to completing *TeachABI,* educators provided multiple thoughtful explanations for the student’s change in behavior that spanned medical, psychosocial, and physical domains. In particular, educators described being on the lookout for psychosocial contributors to behavioral challenges like instability in the home or trauma. Comparatively, following completion of the module, more teachers focused on medical contributors to classroom challenges.

Hypothesis One: **Identification**

To evaluate whether educators were more likely to correctly identify ABI as a possible cause for cross-domain classroom challenges following module completion, all responses were scored with either a zero (no mention of ABI), or a one (mention of ABI). McNemar’s chi-squared test with a Yates correction was used to analyse changes in educators’ responses from pre-module to post-

module. Results indicated that after completing the *TeachABI* module, educators were significantly more likely to correctly identify ABI as a contributing factor to broad challenges in the classroom, $\chi^2(1, N=49) = 8.64$, $p < .01$.

***Synthesis:* Identification**

Given that educators were aware that they were engaged in a study about supporting students with ABI, and that our sample has a high proportion of special educators, baseline identification of ABI as a contributing factor for classroom challenges is likely higher that it would be with a blinded sample. However, the module still produced notable changes in educators' responses. It is particularly noteworthy that following exposure to *TeachABI*, educators were more likely to identify either a remote or unspecified ABI as a factor. This indicates that the module expanded educators' knowledge from a narrow conceptualization of brain injury (i.e., that it must have happened recently to produce behavior change, as in the case of a concussion sustained over the school break) to a broader, more accurate understanding (i.e., that recent or remote brain injuries can impact classroom behavior). Further, the module produced significant change in educators' attributions of ABI as a possible catalyst for challenges within a student.

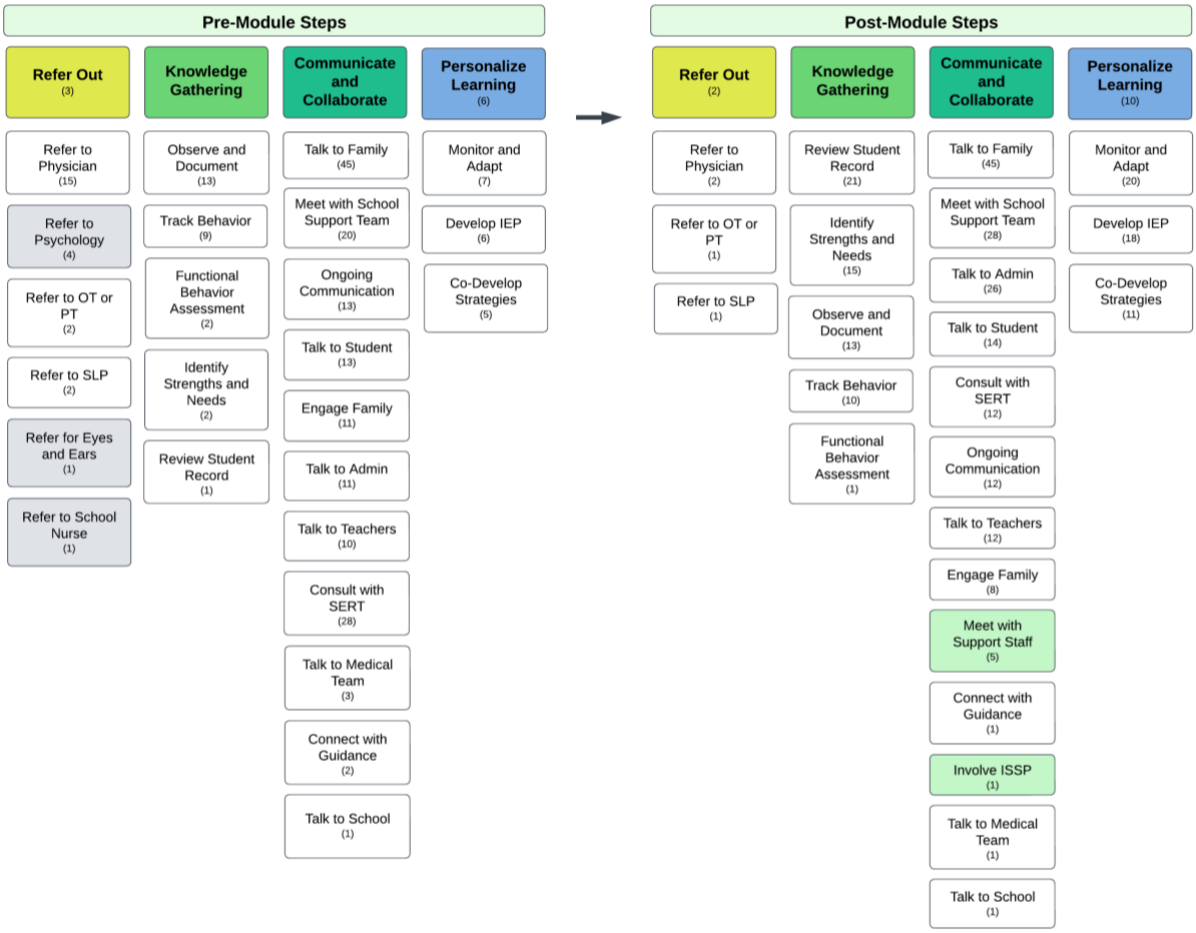
10.2 Procedural Steps

***Content Analysis:* Procedural Steps**

Educators provided instances of procedural steps across both questions two and three of the module: "What steps would you take to support Seth?" and "What strategies would you implement?". Responses to either question that fell within the procedural steps category were amalgamated and analyzed. These administrative/ systems-level steps were divided into four themes: refer out, knowledge gathering, communicate and collaborate, and personalize learning. Data are represented visually in Figure 2.

Figure 2.

Pre- and Post-Module Procedural Steps Described by Educators



Note. Numbers in brackets represent the number of educators who described a given code in their response. Some themes have no numbers in brackets, as they were generated by the research team to provide a scaffold for the data. Codes are ordered top to bottom based on their frequency. Grey colouring indicates a code that was present pre-module, but that was not repeated following completion of *TeachABI*. Green colouring indicates a code that was only generated after educators reviewed the module.

Steps mentioned by teachers were varied, and likely differed based on the resources available at their school and in their school board (e.g., school nurses, speech language pathologists). This exploration also highlights that teachers engage in extensive collaboration with colleagues (e.g., special education resource teachers, other subject teachers, teachers who previously worked with the student), administrators, and families. This reinforces the *TeachABI* premise that educators are *already* experts at navigating within their systems to advocate for exceptional children and leverage their professional networks with proficiency. Targeted training for supporting children with ABI may improve the efficiency of this progress. For example, after

reviewing *TeachABI*, more educators described connecting with their school support team and school administrators upon identification of the injury.

Hypothesis Two: Procedural Steps

We hypothesized that following completion of the *TeachABI* module, educators would describe a greater number of steps and a greater diversity of steps for supporting a student with ABI within the Ontario education system. The number of steps was quantified by tallying codes that fell within the "procedural steps" theme on NVivo. To assess the diversity of steps educators suggested to support children with ABI, pre- and post-module responses were scored according to criteria outlined in Table 4. A maximum score of six could be achieved if an educator's response spanned all categories of procedural steps described. Rater consistency on this scale was good to excellent, ICC = .92, 95% CI [0.82, 0.96] (Koo & Li, 2016). Mean scores for both number and diversity of steps are depicted in Figure 4.

Table 4.

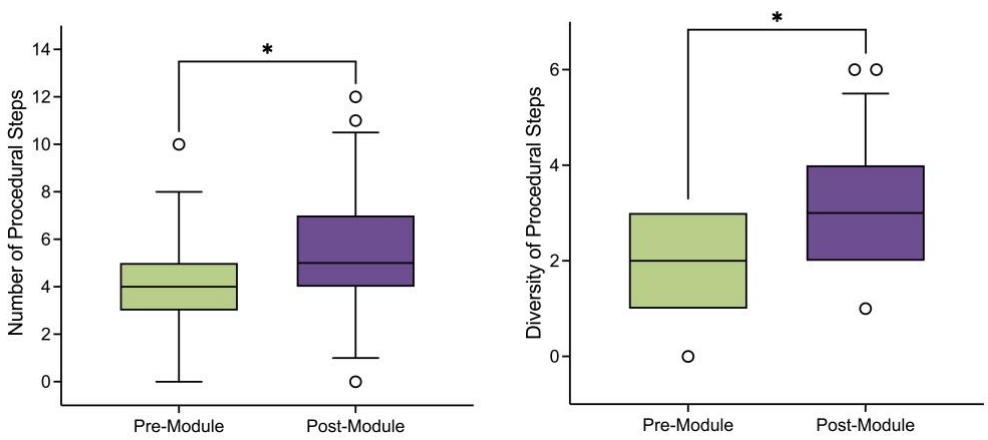
Procedural Steps outlined in the TeachABI *Module*

	Step	**Description**
1	*Check*	**Check** the student's Ontario Student Record for information about their progress.
2	*Record*	**Record** the student's strengths and weaknesses.
3	*Inform*	**Inform** special education staff and/or the principal that the student is struggling.
4	*Meet*	**Meet** with the parents and/or guardians to discuss concerns and potential strategies.
5	*Implement*	**Implement** strategies to help support the student.
6	*Modify*	**Modify** strategies when necessary.

Note. Module content adapted from the *TeachABI* module and "Information from Special Education in Ontario, K-12, Policy and Resource Guide" by the Ontario Ministry of Education (2017).

Figure 3.

Mean Scores on Measures of Procedural Steps Pre- and Post-Module



A paired t-test was carried out to investigate changes in the number of steps suggested by educators following completion of *TeachABI*. Results indicated that there was a small significant difference in number of procedural steps from pre- to post-module, $t(49) = 3.2$, $p < .01$, $d = .46$. After being exposed to *TeachABI*, educators generated an average of three additional steps ($M = 3.27$, $SD = 2.32$) that could be taken to support a child with ABI within the Ontario education system.

A Wilcoxon Signed-Rank test was used to analyze whether completion of the *TeachABI* module increased the diversity of procedural steps proposed by educators. Results indicated that after completing the *TeachABI* module, educators identified significantly more diverse steps for supporting a student with ABI, $z = 4.7$, $p < .01$, with a large effect size $r = .8$. On average, steps described by educators touched on one additional domain after reviewing *TeachABI* ($M_{pre} = 2$, $SD = .79$; $M_{post} = 3.1$, $SD = 1.21$).

Synthesis: **Procedural Steps**

As depicted in Figure 2, educators came into the *TeachABI* study with a high level of baseline knowledge regarding how to navigate the Ontario education system and advocate for their students. This may account for the small effect on the mean difference of number of procedural steps pre- and post-module. In particular, educators seemed to benefit from learning about the various levels at which they can advocate for their students within the education system. This is supported by the large effect on mean difference in diversity of steps mentioned.

After reviewing the *TeachABI* module, educators provided fewer suggestions that the student should be referred out to external services. This may be a reflection of educators' increased self-efficacy in supporting students with ABI after completing the module (Marshall et al., 2023). Educators were also more likely to engage in knowledge gathering by reviewing the student's Ontario Student Record, a key source of information to support planning and individualized learning. With regards to communication and collaboration, it is clear that educators are already highly collaborative. In Ontario, all children have the right to an Individualized Education Plan (IEP), and students with exceptionalities are often streamed into general classrooms. Given this, most educators have experience in special education, even if they are not trained as special educators, per se. Collaboration with the student, their family, the in-school support team, school administrators, and so on, is therefore likely a familiar concept to our study teacher participants. The educators in our study also placed an emphasis on the importance of personalizing learning for the student both pre- and post-module. However, after reviewing *TeachABI*, a greater number of educators highlighted the transience of challenges stemming from ABI and the need to continually monitor efficacy and adapt strategies as needed.

Also notable was the lack of references to consulting with the student's medical team—only three teachers incorporated this information into their response post-module. This step was not presented in *TeachABI*, but rather was provided to teachers via an additional tip sheet. This highlights that not all educators accessed the tip sheets, or that information contained within this supplementary resource was less salient than that within *TeachABI* proper.

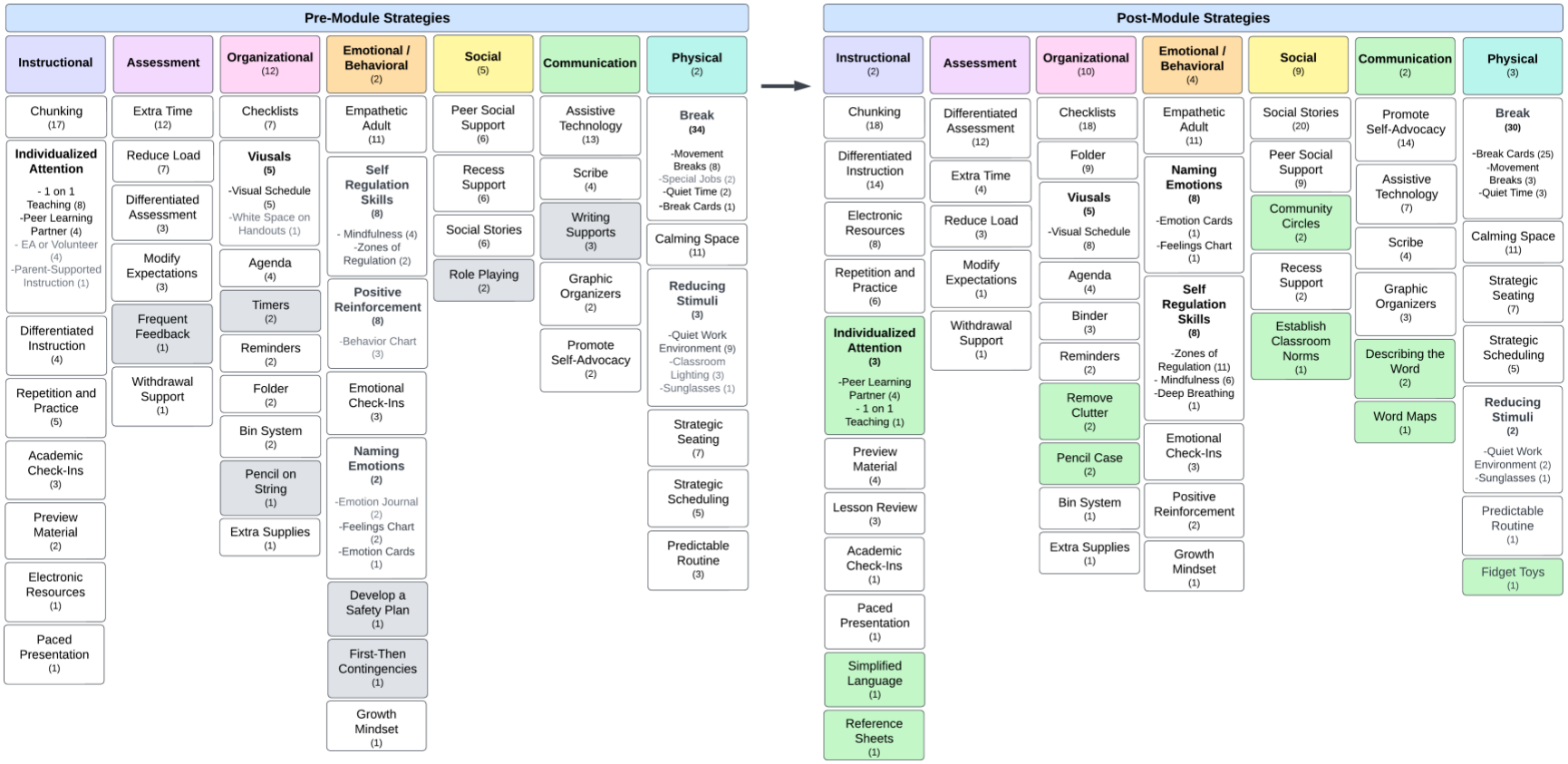
10.3 Practical Strategies

***Content Analysis:* Practical Strategies**

A plethora of practical strategies were suggested by educators in response to both questions two and three in the case study. These were grouped together, and divided into themes including: instructional strategies, assessment strategies, organizational strategies, emotional and behavioral strategies, social strategies, communication strategies, and physical strategies. All classroom strategies described have been organized and summarized in Figure 3.

Figure 4.

Pre- and Post-Module Practical Classroom Strategies Described by Educators



Note. Numbers in brackets represent the number of educators who described a given code in their response. Some themes have no numbers in brackets, as they were generated by the research team to provide a scaffold for the data. Codes are ordered top to bottom based on their frequency. Grey colouring indicates a code that was present pre-module, but that was not repeated following completion of *TeachABI*. Green colouring indicates a code that was only generated after educators reviewed the module.

Both pre- and post- module, educators provided an impressive breadth of strategies used to support exceptional students in the classroom, and displayed creativity in their responses. Notably, educators acquired multiple new strategies after reviewing *TeachABI*, and were able to provide more targeted recommendations. For example, post-module, 24 additional educators indicated that they would use break cards to facilitate allowing the student to rest when needed.

Hypothesis Three: **Practical Strategies**

A key consideration when supporting children with ABI in the classroom is accommodating the full scope of their needs and challenges, which may span multiple domains. We hypothesized that after completing the *TeachABI* module, educators would describe a greater number and a greater breadth of strategies to accommodate a student with ABI in the classroom. To evaluate whether educators described a greater number of strategies following exposure to *TeachABI*, codes that were encompassed by the "practical strategies" theme on NVivo were tallied. The breadth of strategies was assessed via criteria described in Table 5, with respondents receiving a maximum score of five. Rater consistency on this scale was excellent, ICC = .96, 95% CI [0.90, 0.98] (Koo & Li, 2016). Figure 5 depicts mean scores for number and breadth of practical strategies.

Table 5.

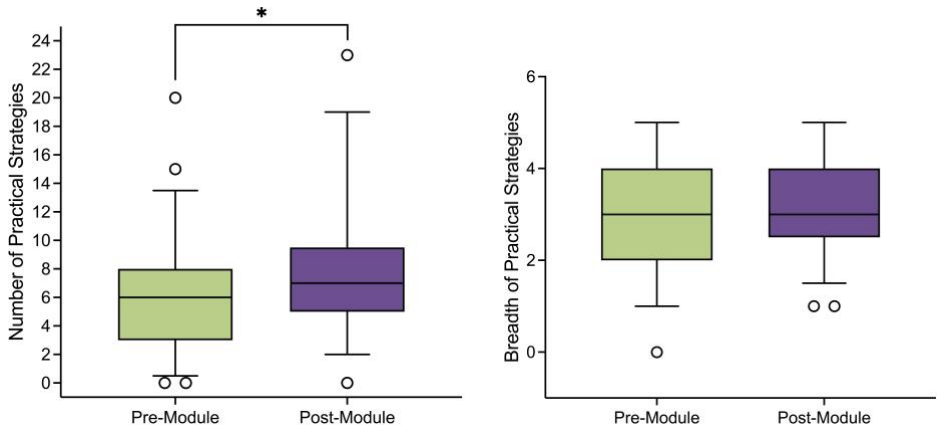
Domains of Practical Strategies Described in the TeachABI *Module*

	Strategy	**Description**	**Module Examples**
1	*Cognitive*	Encompasses instructional, assessment, and organizational strategies to support the student.	• Chunk instruction. • Use repetition when teaching new information. • Post lessons, activities to a common tech platform for students to access. • Provide the student with a file folder to keep their work organized.
2	*Emotional*	Strategies that support social and emotional well-being.	• Develop a social story. • Teach students examples and definitions of emotions and feeling words. • Implement the student's choice of calming activity. • Incorporate mindfulness into the daily schedule.
3	*Behavioral*	Strategies to promote appropriate behavior.	• Provide explicit instruction on appropriate behavior. • Establish a behavior reward system. • Implement consistent classroom routines.

			• Employ peer support to model appropriate behavior.
4	*Physical*	Strategies to support the student by adapting to their physical limitations.	• Encourage the student to take breaks. • Prepare a comfortable place for the student to rest. • Seat students with vision difficulties away from windows and bright lights. • Implement writing aids for students with fine motor difficulties.
5	*Communication*	Strategies to facilitate the student in communicating with others.	• Match the student with a peer buddy to support positive communication. • Use strategies to organize narratives (e.g., Graphic Organizers). • Use communication strategies like "describing" when students have trouble finding words.

Figure 5.

Mean Scores on Measures of Practical Strategies Pre- and Post-Module



A Wilcoxon Signed-Rank test was carried out to test whether the *TeachABI* module produced a change in the number of classroom strategies suggested by educators to support students with ABI. Analyses indicated a significant medium effect; after exposure to the module, educators described a greater number of strategies, $z = 3.1$. $p < .01$, $r = .5$. On average, educators acquired an additional 6 unique strategies ($M = 6.35$, $SD = 4.4$) to support students with ABI after exposure to *TeachABI*. Further, educators provided significantly more examples of classroom-wide strategies post-module, with a large effect size, $z = 3.3$, $p < .01$, $r = .77$

A second Wilcoxon Signed-Rank test was used to analyze whether exposure to the *TeachABI* module increased the breadth of strategies proposed by educators. No statistically significant difference was found in breadth of strategies pre- and post-module, $z = -1.44$, $p = .15$.

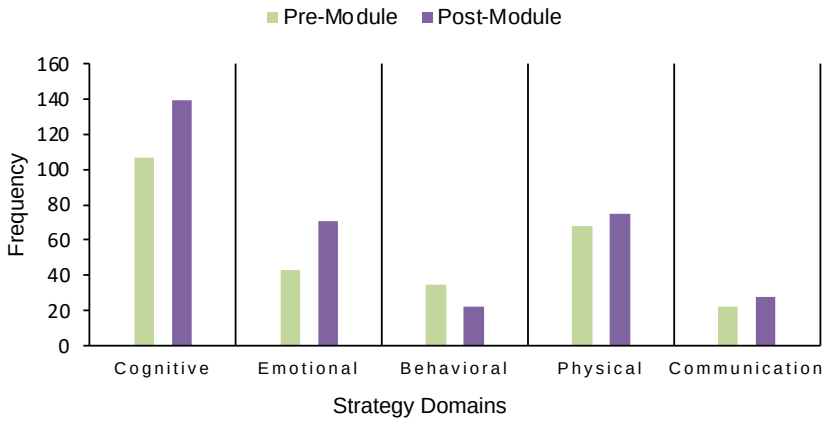
Synthesis: **Practical Strategies**

A key component of the *TeachABI* module was highlighting that educators *already* have the tools and experience required to support children with ABI. This proved true for our sample, as educators outlined a comprehensive list of creative classroom strategies to support exceptional students pre-module. After completing *TeachABI*, educators increased their recommendation that differentiated instruction and assessment (e.g., multimodal presentation of content) would be a critical tool in supporting a student with ABI. Post-module, a greater number of educators also described social stories, break cards, and promoting self-advocacy as strategies they would implement in their classroom. Breaks and chunking were salient tools both prior to and following completion of *TeachABI.*

While educators did acquire new classroom strategies after reviewing the module, *TeachABI* did not produce significant change in the breadth of strategies mentioned across cognitive, emotional, behavioral, social, physical, and communication domains. Both pre- and post-module, educators' strategies spanned an average of three out of a possible five domains. As depicted in Figure 6, educators were less likely to provide strategies to support the student's communication or to target behavioral challenges, while cognitive strategies were an area of relative expertise.

Figure 6.

Comparison of Categories of Strategies Pre- and Post-Module



11 Discussion

The goal of this project was to capture educators' knowledge change following completion of the *TeachABI* module. To this end, we used changes in open-ended responses to a case study as a proxy for knowledge acquisition. Multiple analysis strategies were leveraged, beginning with an exploratory content analysis, and supplemented by a hypothesis-driven evaluative qualitative analysis. Insights gained in each of the categories of learning—identification, procedural steps, and practical strategies—are summarized below. In addition, I reflect on our outcome measure and methodological choices.

11.1 Key Lessons Learned

Analyses of case study responses completed before and after completing *TeachABI* have yielded the following key lessons:

Educator Knowledge

Educators have high baseline knowledge of how to support exceptional students, both through systems-level advocacy (i.e., procedural steps) and classroom-based tools (i.e., practical strategies). However, they require support in identifying ABI as a possible factor contributing to classroom challenges, and benefit from understanding that the strategies they already know are directly applicable to children with ABI. It is our hope that the *TeachABI* module has reinforced for these educators that they already possess the competence and tools to support students with ABI. They are already aware of, and likely implementing, many of the strategies described in the module. This may be a vehicle for the increased educator confidence and self-efficacy documented post-module (Marshall et al., 2023; Appendix C).

Educator Learning

The *TeachABI* professional development module produced significant response change across educators' likelihood to identify ABI, the number and diversity of procedural steps taken to advocate for students within the Ontario education system, and the number of supportive strategies teachers describe. If response change is taken as a proxy for learning, we can therefore conclude that *TeachABI* is an appropriate tool to incite knowledge acquisition, even among a research sample with a high proportion of special educators.

Notably, the *TeachABI* module did not produce significant change in the breadth of practical strategies generated by educators. As noted above, our sample contains a significant proportion of educators with special education training (57%), and many Ontario teachers have students with exceptionalities and IEPs in their classrooms. Beyond high baseline knowledge, the lack of increased breadth may be attributed to: (1) the lack of specificity in our rating scale (the cognitive domain, for example, encompassed over 30 codes across organizational, instructional, and assessment strategies); or (2) the vagueness of the case study not lending itself to evoking domain-specific strategies.

As a whole, when coupled with quantitative pilot data (Appendix C), this research contributes to a growing body of evidence that the *TeachABI* module is an effective tool for fostering professional development (Scratch et al., 2023). I propose that the strength of *TeachABI* stems from the diligent work that supported its development. The module was designed following extensive foundational work including: an environmental scan (Saly et al., 2022), a qualitative assessment of educator needs (Stevens et al., 2021), and engagement with key knowledge holders (Saly, 2021). In keeping with educators' recommendations and the broader e-learning literature, the research team at HBKRH developed a concise professional development module that takes a case-based format to knowledge provision and incorporates multiple modalities of presentation. *TeachABI* was then refined through a mixed-method usability study, which reinforced its relevance and provided feedback to support the next iteration of the module (Saly et al., 2023). This process has produced a product that is both highly usable and that effectively addresses the gap in educator knowledge surrounding ABI.

Previous research has emphasized that we can increase life satisfaction across school and friendships, and decrease subjective stress for children with ABI, by increasing teachers' knowledge of ABI (Wlodarczyk, 2012). Further, educators' perceptions of students' capabilities have demonstrable impacts on their classroom performance (Yoon et al., 2007). Professional development modules like *TeachABI* provide an avenue to build understanding and skill among educators and consequently improve academic achievement (Yoon et al., 2007). Evidence also points to classroom integration as powerful vehicle for rehabilitation among children, with impacts reaching beyond the academic domain (Jacob & Parkinson, 2015; Peng & Kievit, 2020; Stockard et al., 2018). The school system and its educators are uniquely positioned to provide support to children with ABI, if given the appropriate foundation to do so (Hartman et al., 2015;

Todis et al., 2018). By increasing educator knowledge, the *TeachABI* professional development module is a promising intervention to produce impactful change for students with ABI (Hartman et al., 2015; Marshall et al., 2023; Scratch et al., 2023; Stevens et al., 2021).

Method and Analytical Approach

This thesis highlights the use of mixed methods as an avenue for rich exploration of data (Morgan, 2015). Our quantitative follow-up design provided complementary information through hypothesis testing that allowed us to better contextualize and understand the efficacy of *TeachABI* as a learning tool. These analyses, however, would not have been possible without prior immersion in the data and rigorous coding. By integrating across both qualitative and quantitative analytical traditions, our work also provides strong footing for the refinement of *TeachABI*.

Given the richness of the current data, further analyses could be carried out to supplement the work described in this thesis. Future work may probe the relationship between responses pre- and post-module, to determine whether baseline knowledge moderates response change. It would also be informative to systematically compare the content of the *TeachABI* module to the codes captured above. This analysis would be particularly relevant to capture whether any information described in *TeachABI* was lost (i.e., not present in post-module responses), and whether there were differences in the salience of information across presentation modalities (i.e., videos, written text, quiz format). In this vein, work should also be done to improve the salience of the supplementary tip sheets, which contain valuable information.

11.2 Limitations

Although this work provides a strong foundation for the utility of *TeachABI*, it is not without its limitations. The case study format was both a strength and a weakness of the present work. At times, analyses were limited by educators' brevity of responses. For example, multiple teachers began to list specific strategies and would trail off with an "etc.". It was also challenging to interpret vague references and, despite doing our best to decode educational terminology and jargon, may have made errors as the researchers are not trained as educators. In the future, more explicit instructions could be provided (i.e., "Please list *all* examples that come to mind.").

Another limitation of the present study was the composition of our sample. Women teachers were slightly overrepresented in our sample; although 84% of Canadian elementary educators are women, they comprised 92% of our sample (Government of Canada, 2013). As it is important to include a breadth of voices and perspectives in pilot testing, future work may strive for more equal representation across genders, as well as classroom position (i.e., including more pre-service teachers, principals). The skewing of our participant pool towards special educators, who have significant experience accommodating children with exceptionalities and many of whom have experience specific to ABI. This was likely due to self-selection bias. Again, this is both an area of strength and of weakness. That the module was able to produce significant change in educators who already have considerable background knowledge reinforces the quality and necessity of its content. Further, through inductive exploration of the data, a rich and creative set of innovative strategies to support students with ABI has been collected. These can be used to inform the ongoing refinement of *TeachABI* and can help produce a broader resource of practical classroom strategies to support students with ABI that is built by educators, for educators.

11.3 Knowledge Mobilization

Next steps for the broader project include continuing to probe quantitative pilot data, analysis of qualitative interview data, adapting the module for high-school educators, and modifying *TeachABI* for educators in other countries. It will also be critical to evaluate whether the module is suitable for school support workers (i.e., educational assistants), who spend significant time with exceptional children in the classroom, or if adaptation is needed. Lastly, should results continue to trend in the direction of positive outcomes for educators, knowledge mobilization efforts should be undertaken to disseminate the *TeachABI* module widely so that teachers can foster much-needed positive classroom experiences for children living with ABI.

12 Conclusion

Children with ABI are underserved within the Ontario education system and educators are not well-equipped to accommodate their needs (Saly, 2021). Increasing educator knowledge is one avenue for fostering positive learning experiences for children with ABI (Glang et al., 2012; Hartman et al., 2015). Co-developed by researchers at HBKRH and key knowledge holders, the *TeachABI* professional development module takes a case-based approach to building knowledge

among elementary school educators on ABI. The current work supports a growing body of evidence that this tool provides a time-efficient and accessible way to provide educators with information needed to support direct instruction and classroom integration. The *TeachABI* module produced significant change in educators' approaches to the case study. These data also suggest that teachers already possess many of the skills and tools to support children with ABI in their classrooms but would benefit from reinforcement of their applicability to this population. Ultimately, results presented herein will inform the ongoing refinement of *TeachABI*, as this professional development module is prepared for dissemination to elementary school educators across Ontario.

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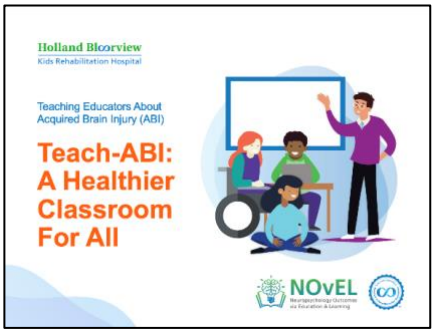
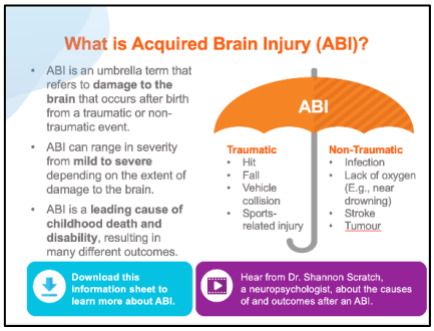
Appendix A. *TeachABI* Professional Development Module: Example Screens

Title



Sample content and resources



Sample case study content, strategies and resources

Appendix B. Link to *TeachABI* Usability Publication

JMIR HUMAN FACTORS Saly et al

Original Paper

The Teach-ABI Professional Development Module for Educators About Pediatric Acquired Brain Injury: Mixed Method Usability Study

Lauren Saly[1*], BA, BEd, OCT, MA; Christine Provvidenza[1,2*], MSc; Hiba Al-Hakeem[1], MA; Andrea Hickling[1,3], MScOT, OT Reg (Ont); Sara Stevens[1,2], PhD, C Psych; Lisa Kakonge[1,4,5], MSc, Reg CASLPO, CCC-SLP; Anne W Hunt[3,6], PhD, OT Reg (Ont); Sheila Bennett[7], EdD; Rhonda Martinussen[8], PhD; Shannon E Scratch[1,2,6,9], PhD, C Psych

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Abstract

Background: Acquired brain injury (ABI) is a leading cause of death and disability in children and can lead to lasting cognitive, physical, and psychosocial outcomes that affect school performance. Students with an ABI experience challenges returning to school due in part to lack of educator support and ABI awareness. A lack of knowledge and training contribute to educators feeling unprepared to support students with ABI. *Teach-ABI*, an online professional development module, was created to enhance educators' ABI knowledge and awareness to best support students. Using a case-based approach, *Teach-ABI* explains what an ABI is, identifies challenges for students with ABI in the classroom, discusses the importance of an individualized approach to supporting students with ABI, and describes how to support a student with an ABI in the classroom.

Objective: This study aims to assess the usability of and satisfaction with *Teach-ABI* by elementary school educators. The following questions were explored: (1) Can elementary school teachers use and navigate *Teach-ABI*?, (2) Are the content and features of *Teach-ABI* satisfactory?, and (3) What modifications are needed to improve *Teach-ABI*?

Methods: Elementary school educators currently employed or in training to be employed in Ontario elementary schools were recruited. Using Zoom, individual online meetings with a research team member were held, where educators actively reviewed *Teach-ABI*. Module usability was evaluated through qualitative analysis of think-aloud data and semistructured interviews, direct observation, user success rate during task completion, and the System Usability Scale (SUS) scores. The usability benchmark selected was 70% of participants performing more than half of module tasks independently.

Results: A total of 8 female educators participated in the study. Educators were classroom (n=7) and preservice (n=1) teachers from public (n=7) and private (n=1) school boards. In terms of task performance, more than 85% of participants (ie, 7/8) independently completed 10 out of 11 tasks and 100% of participants independently completed 7 out of 11 tasks, demonstrating

Appendix C. Early Publications: *TeachABI* Pilot Analyses for Quantitative Measures

1. Published Abstract – International Brain Injury Association (Dublin, 2023)

Teaching educators about acquired brain injury: improvements in confidence and self-efficacy through an online professional development module

Sara Marshall, Brendan Lam, Andrea Hickling, Shannon Scratch

Background: Acquired Brain Injury (ABI) is the leading cause of death and disability in young children and can result in persisting cognitive, physical, behavioral, and emotional difficulties. However, many educators have limited or only some knowledge of ABI and its consequences for a child. This limited knowledge may have a negative impact on educator confidence and self-efficacy supporting students with ABI in the classroom. In the Ontario, Canada education system, ABI is not a recognized exceptionality, creating a barrier for the identification and support of students with ABI. Following research that found limited online resources for educators, an online professional development module, Teach-ABI, was developed by our team. Teach-ABI takes a case-based approach and defines ABI, reviews ABI symptoms and how they might present in school, and outlines practical strategies educators can use to support students with ABI in the classroom. This abstract focuses on Teach-ABI's impact on educators' confidence and self-efficacy in supporting students with ABI.

Method: 50 teachers from Ontario public and private schools took part in this study over Zoom. Participants completed a set of surveys (ABI knowledge questionnaire, knowledge application case study, self-efficacy questionnaire) at three time points: before completing the module (T1), immediately after completing the module (T2), and 60 days after completing the module (T3). 29 participants also participated in a semi-structured interview about their experience with the module. Through deductive content analysis, concepts related to participants' confidence and self-efficacy were examined, and salient quotes related to these outcomes of interest were extracted.

Results: Participants' confidence in their ABI knowledge and their ability to support students in the classroom increased significantly from T1 to T2 ($Z = -10.5$, $p < 0.001$) and from T1 to T3 ($Z = -10$, $p < 0.001$), with no differences between T2 and T3 (n.s.). Salient quotes reflect that the strategies, resources, and examples made the module information easily applicable to daily life, that relating module content to personal experiences put the strategies in context, and that knowledge improvement impacted participant confidence. Participants also suggested that the module presents an ideal situation and that more case studies or examples would improve the applicability of the strategies to their teaching.

Implications: This promising pilot study indicates that the Teach-ABI online professional development module has a lasting, positive impact on educators' confidence supporting students with ABI. In the future, we aim to make these resources accessible to teachers in Ontario and elsewhere to improve outcomes for students with ABI.

Teaching Educators about Acquired Brain Injury: Improvements in Confidence and Self-Efficacy through an Online Professional Development Module

Marshall SA[1], Lam B[1], Hickling A[1,2], Scratch SE[1,3,4]

[1]Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Canada; [2]Department of Occupational Science and Occupational Therapy, University of Toronto, Canada; [3]Rehabilitation Sciences Institute, University of Toronto, Canada; [4]Department of Pediatrics, University of Toronto, Canada.

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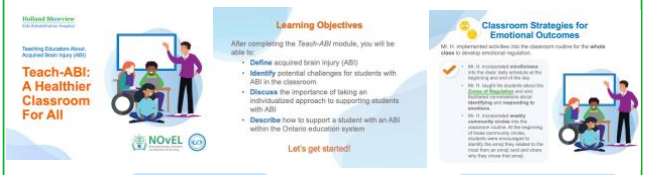
Background

- Acquired Brain Injury (ABI) is prevalent in youth[1] and can cause impairments in cognition, behaviour, sensorimotor abilities & emotion.[2,3,4]
- Educators suggest a course with a short, self-directed eLearning component would **help close their ABI knowledge gap**.[5]
- Few online resources address ABI in a concise, comprehensive, and accessible eLearning course for educators.[6]
- Our *Teach-ABI* module aims to fill this gap.



Teach-ABI covers: ABI definition | ABI symptoms in school | Practical strategies

Objective

Examine the impact of the *Teach-ABI* module on educators' confidence supporting students with ABI in their classroom.

Methods

Participants: n = 50 Ontario teachers (46 female, median years of teaching = 14)

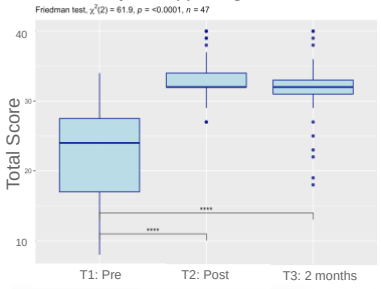
Measures: ABI self-efficacy questionnaire (8 questions) and confidence in module learning objectives (4 questions) on Likert-type scale from *strongly disagree* to *strongly agree*.

Procedure

- Participation over Zoom.
- Questionnaires at 3 time points: before completing the module (T1), after completing the module (T2), 60 days after completing the module (T3).
- n = 29 semi-structured interviews.

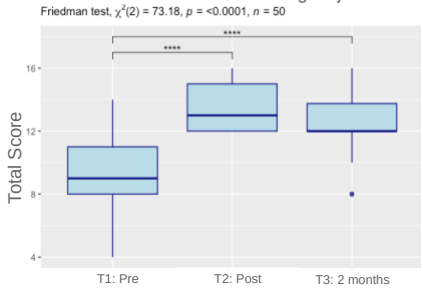
Results

Self-Efficacy in Supporting Students with ABI



- Self-efficacy **increased significantly** from T1 to T2 and T1 to T3.
- Self-efficacy **did not decline** significantly from T2 to T3.

Confidence in Module Learning Objectives



- Confidence **increased significantly** from T1 to T2 and T1 to T3.
- Confidence **did not decline** significantly from T2 to T3.

- Salient quotes reflect the questionnaire findings

Improvements in confidence

…when I first started filling out this survey I didn't feel as confident that I could manage [students with ABI] with the cognition…

Module impacting future behaviours

…the information that I got from this module will have me advocate for [accommodations] more….

Module usefulness and applicability

I think [*Teach-ABI*] could definitely be useful… specifically for ABI but for all learners so…that's definitely useful.

Implications & Next Steps

- *Teach-ABI* has a lasting, positive impact on educator's confidence supporting students with ABI.
- Next steps include formal analysis of qualitative data, adapting module content for other contexts including high school, other Canadian provincial education systems, and Australian education systems.
- We aim to make *Teach-ABI* available to educators in Ontario and elsewhere to improve outcomes for students with ABI.

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The *Teach-ABI* module **improves educators' self-efficacy** in supporting students with ABI.

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Teaching educators about acquired brain injury: improvements in knowledge and attitudes through an online professional development module

Shannon Scratch, Sara Marshall, Brendan Lam, Andrea Hickling

Background: Acquired Brain Injury (ABI) is the leading cause of death and disability among young children and can result in persisting cognitive, physical, behavioral, and emotional difficulties. However, many educators have limited or only some knowledge of ABI and its consequences for a student in the classroom. In Ontario, Canada, ABI is not an identified exceptionality in the education system, creating a barrier for the identification and support of students with ABI. Our previous research found limited ABI resources online for educators, and as such we developed an online professional development module, Teach-ABI. The module takes a case-based approach and defines ABI, reviews ABI symptoms and how they may affect learning and behavior, and outlines practical strategies educators can use to support students with ABI in the classroom. This abstract focuses on the impact of Teach-ABI on teachers' knowledge and attitudes about supporting students with ABI in the classroom.

Method: 50 teachers from Ontario public and private schools took part in this pilot study over Zoom. Participants completed a set of surveys (ABI knowledge questionnaire, knowledge application case study, self-efficacy questionnaire) at three time points: before completing the module (T1), immediately post-module (T2), and 60 days after completing the module (T3). 29 participants also participated in a semi-structured interview about their experience completing the Teach-ABI module (content, resources, format) and reflected on their knowledge, practice, and attitudes. Through deductive content analysis, concepts related to participants' knowledge and attitudes were examined, and salient quotes related to these outcomes of interest were extracted.

Results: Participants' knowledge (i.e., correct answers to questions about ABI signs and symptoms) increased significantly from T1 to T2 ($Z = -1$, $p < 0.001$) and this knowledge change was maintained at two-month follow-up (T1 to T3 ($Z = -1.5$, $p < 0.01$)). No differences in knowledge was found between T2 and T3. Salient quotes support these findings, with participants expressing their realization of their lack of ABI knowledge, that the module content was relevant for their teaching, that the external resources included in the module were helpful, and that they will now consider ABI when supporting students experiencing challenges. Minor changes within the module were also suggested for future implementation including developing additional case studies and testimonies, and improving one aspect of functionality (the "read to me" feature).

Implications: Results from this exciting pilot are encouraging and indicate that the Teach-ABI online professional development module has a lasting, positive impact on educators' ABI knowledge and attitudes toward students. We aim to make these resources accessible to educators in Ontario and elsewhere to improve outcomes and classroom experiences for students with ABI.

3. Published Abstract – Canadian Concussion Network (Calgary, 2023)

Teach-ABI: An Online Professional Development Module to Improve Educator Knowledge and Confidence Supporting Students with Acquired Brain Injury in the Classroom

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Background. Many educators have limited knowledge of acquired brain injury (ABI) and its impact on a child. In Ontario, Rowan's Law mandates that educators learn about concussion specifically but does not emphasize learning how to support students once they have returned to school. Our team developed the Teach-ABI module after a needs assessment confirmed Ontario educators' knowledge gap regarding pediatric ABI, and an environmental scan found limited online resources about supporting students with ABI. Teach-ABI defines ABI, reviews symptoms and their presentation at school, and outlines practical classroom strategies for educators.

Objectives. Examine the usability and impact of the Teach-ABI module on educators' knowledge and confidence supporting students with ABI.

Methods. In a usability study, 8 educators completed Teach-ABI using a think-aloud method and completed the System Usability Scale (SUS). In a pilot study, 50 educators completed a set of surveys (ABI knowledge, knowledge application, self-efficacy) at 3 times: before (T1), immediately after (T2), and 60 days after (T3) completing Teach-ABI. Twenty-nine participants participated in a semistructured interview.

Results. Teach-ABI had above average usability (SUS M = 86.25) and educators were satisfied with its navigation. Participants' ABI knowledge and self-efficacy supporting students in class increased significantly from pre- to postmodule ($Z = -6.41$, $P < .0001$; $Z = -6.71$, $P < .0001$) with these gains maintained at 60 days ($Z = -6.41$, $P < .0001$; $Z = -5.73$, $P < .0001$). Educators reflected on their previous lack of knowledge and described that the module format and content made information applicable to the classroom.

Conclusions. The Teach-ABI module has a lasting, positive impact on educators' ABI knowledge and attitudes toward students. We aim to make this resource accessible to educators in Ontario and elsewhere to move past concussion and ABI awareness into improving classroom experiences for students with ABI.

The *Teach-ABI* module helps Ontario educators **understand ABI** and **support students with ABI.**

Learn more about the NOvEL Lab!

Holland Bloorview Kids Rehabilitation Hospital

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Teach-ABI: An Online Professional Development Module to Improve Educator Knowledge and Confidence Supporting Students with Acquired Brain Injury

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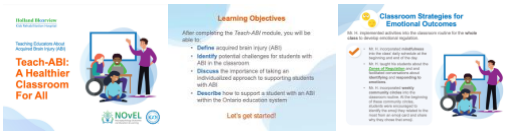
Background

- Although Ontario educators receive concussion training under Rowan's law[1], often this education **does not emphasize how to support students in the classroom** and **does not focus on broader ABI.**[e.g.,2]
- Ontario educators suggest a course with a short, self-directed eLearning component would **help close their ABI knowledge gap.**[3]
- Few online resources address ABI in a concise, comprehensive, and accessible eLearning course for educators.[4]
- Our *Teach-ABI* module aims to fill that gap.



Teach-ABI covers: ABI definition | ABI symptoms in school | Practical strategies

Usability Testing

Methods

- 8 Ontario educators completed module using think-aloud method.
- Outcomes: qualitative comments, direct observations, task completion, System Usability Scale.[5]

Results[6]

- Educators are **satisfied with the usability** of *Teach-ABI*
- **Above average**[7] System Usability Scale score of 86.25
- Qualitative analysis revealed participants **like the module** content, find the module **relevant** and **easy to navigate**. They had minor suggestions for content and design improvements.

Pilot Study Methods

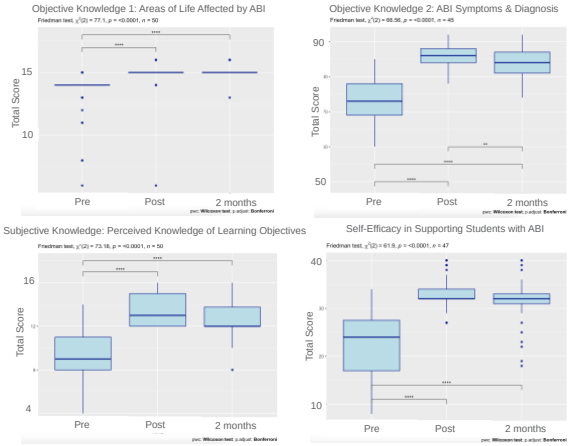
Participants: n = 50 Ontario educators (46 female, median years of teaching = 14)

Measures: ABI knowledge questionnaires (2 objective knowledge scales, 1 perceived knowledge scale), ABI self-efficacy questionnaire.

Procedure:

- Participation over Zoom
- Questionnaires at 3 time points: before completing the module (T1), after completing the module (T2), 60 days after completing the module (T3).
- n = 29 semi-structured interviews at T2.

Pilot Study Results



- Knowledge increased significantly from T1 to T2 and T3 on all scales.
- Knowledge decreased significantly from T2 to T3 on only one scale.
- Self-efficacy increased significantly from T1 to T2 and T3.
- Interview data supports these findings: reflections on lack of prior ABI knowledge, module format and content made the information easily applicable to the classroom.

Implications & Next Steps

- *Teach-ABI* has a lasting, positive impact on educator's confidence supporting students with ABI.
- Next steps include formal analysis of qualitative data; adapting module content for other contexts including high school, other Canadian provincial education systems, and Australian education systems.
- We aim to make *Teach-ABI* available to educators in Ontario and elsewhere to improve outcomes for students with ABI.

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Appendix D. Knowledge Application Case Study

Seth is in Grade 3. He is an average student with an energetic and friendly personality. After Winter Break, his teacher noticed that Seth has started to fall behind his classmates. He often comes to school seeming very tired, and by the end of the day struggles to stay awake. He has started getting very frustrated when he is asked to complete tasks and assessments, especially related to reading and mathematics. He often expresses his frustration through physical outbursts, either pushing nearby objects or his peers. By the end of the day, Seth often complains of a headache, and he typically spends the last two periods distracting himself and his peers, rather than getting any work completed. Seth's desk is a mess, he is always losing his pencils and worksheets, and he frequently leaves his agenda at home or at school. His handwriting is almost unintelligible. His teacher has tried to support him, but she finds it confusing and frustrating that some days the strategies work to help Seth, and other days the same strategies have no effect.

Lately, the outdoor supervisors have had to intervene with Seth while he is playing with his peers. They have noticed that he is playing very aggressively and are worried that someone is going to get hurt.

Educator Questions:

1) ***What do you think is going on with Seth?***
2) ***What steps would you take to support Seth?***
3) ***What strategies would you implement?***
4) ***Please share any final comments you have.***

Appendix E. Glossary of Acronyms

- ***AAC:*** Assistive and Augmentative Communication (Device)
- ***ABA:*** Applied Behavior Analysis
- ***CYC:*** Child and Youth Care worker
- ***EA:*** Educational Assistant
- ***FBA:*** Functional Behavior Assessment
- ***GC:*** Google Classroom
- ***IEP:*** Individualized Education Plan
- ***ILP:*** Individualized Learning Plan
- ***ISSP:*** Intensive support and supervision program
    - This is targeted towards students who fall under the Youth Criminal Justice Act.
- ***IST:*** In-school support team
- ***SERT:*** Special education resource teacher
- ***ISTM:*** In-School Team Meeting
- ***LST:*** Learning Support Teacher
- ***OSR:*** Ontario student record
- ***SEA:*** Special Education Amount
- ***SEL:*** Social and Emotional Learning
- ***SLP:*** Speech-language pathology

Appendix F. Code Book

The code books below are separated into three categories, which reflect the areas where educators' knowledge was probed: (1) identification; (2) procedural steps; (3) practical strategies. Note that parent codes reflecting broad themes were used to organize the codebook and may or may not contain specific references. Capitalization, punctuation, and spelling of the excerpts below is reflective of the responses written by participants.

Codes for: Identification (What do educators think is going on with Seth?)		
Code	**Definition**	**Example**
Adjustment After School Break	The student is struggling to settle back into school routine after their break is over.	P60: "Sometimes after some time away, changes become more apparent or the child has a hard time adjusting back into the routine."
Brain Change	Reference to a change in the brain, but not a specific or general ABI.	P9: "Either a physical change, like something to do with his brain (...)"
Concussion	Teacher attributes changes to concussion	P19: (…) he may have suffered from a concussion that no one had witnessed and attended to."
Experiencing challenges	Broad mention of challenges (as opposed to a "cause"/ effect).	P4: "I think Seth is experiencing some serious challenges that should draw the teachers attention immediately."
Fatigue	The student's behaviours are stemming from fatigue.	P32: "The first thing that Seth is experiencing is cognitive fatigue. He is not having breaks, and this is causing unwanted behaviours to arise as a result of his fatigue."
Remote ABI	An ABI that occurred in the distant past.	P3: "(...) an outcome of an ABI in the past"
Illness/Injury	Changes in student are caused by onset of an illness or an injury	P88: "Possibly Seth has suffered some trauma impacting his behaviour and academics. Brain injury, illness, stress?"
NDD	The student has a neurodevelopmental	P73: "The disorganized desk, impulse control and forgetfulness makes me consider if this child may struggle with ADHD or ADD."

	disability (autism, ADHD, LD).	
Non-Specific Cause	No specific cause/ incident noted.	P2: "(...) find out what happened (if something happened) over the break."
Poor Vision	Poor vision causing change in student's behavior/ classroom performance.	P47: "Eyesight issues."
Recent ABI	An ABI that occurred within a recent time frame.	P5: "I think that Seth may have suffered an acquired brain injury. I think this because there are signs of cognitive, physical, emotional, and communication challenges that appear to be significantly out of character for the child. With winter being a more likely time for slips and falls, it is possible something happened to Seth over the break to cause these changes."
Response to Intervention	Changes are a result of additional interventions (therapy)	P11: "Sometimes students behaviour escalates when they are getting therapy or interventions because their awareness increases."
Something at Home	Reference to any event at home.	P11: "It could be something happening at home (divorce, abuse, death in the family, etc.)".
Stress	Behaviour changes are attributed to elevated levels of stress.	P18: "stress"
Trauma	Reference to a trauma or traumatic event that occurred.	P7: "There is probably something traumatic that has occurred at some point (...)"
Unspecified ABI	An ABI that is not tied to a particular time point.	P10: "I think it is likely that Seth has suffered an ABI due to the sudden rise in changes in behaviors/ personality."

Codes for: Procedural Steps (What steps would you take to support Seth?)		
Code	**Definition**	**Example**
Communicate and Collaborate	**Parent Code:** all of the people/ groups teachers mention having to liaise with.	
Connect with Guidance	Connect the student with their school's guidance counsellor.	P94: "I would reach out to a guidance counsellor"

Consult with SERT	Engage the special education resource teacher.	P4: "(...) the teacher should connect with the school SERT."
Develop IEP	Develop an individualized education plan	P12: "Move forward with developing an IEP for Seth to create consistency as he moves through school."
Engage Family	Engage family in the current support plan.	P1: "I would also talk with parents and about goals they would like for him and what they feel his strengths and needs are."
Functional Behavioral Assessment	Carrying out a Functional Behavioural Assessment. This is a process for gathering information about behaviours of concern.	P84: "possible ABA/FBA observations"
Identify Strengths and Needs	Map out the student's profile of strengths and needs.	P12: "List Seth's strengths and needs"
Involve ISSP	Engage the Intensive Support and Supervision Program.	P3: "(...) involve ISSP committee."
Knowledge Gathering Strategies	**Parent Code.** Activities that teachers engage in to develop their understanding of the student.	
Meet with Support School Team	Discuss the student with the in-school support team.	P2: "Bring to School support team-- esp because the behaviors are sudden."
Monitor and Adapt	Monitor the student's progress, and/ or adapt if needs change.	P5: "I would implement strategies and collect data regarding their effectiveness, adapt and change as needed"
Observe and Document	Teacher is observing changes in the	P4: "The first thing that should be done is documentation. The teacher should be documenting the behaviours and challenges that Seth is having."

	student, documenting them.	
Ongoing Communication	Engage in ongoing communication with teachers, admin, family to support student.	P78: “ongoing communication with parents and other teachers, regular check-ins with him”
Personalize Learning	Ways to adapt and individualize learning for the student.	P9: “Personalized learning plan to match his needs. Modified and alternative plans would always have to be ready for a student like Seth.”
Refer for Eyes & Ears	Have the student’s eyes and ears checked.	P2: “(...) recommend check eyes/ ears at doc.”
Refer Out	Referring the student to other health resources.	P3: “Seek professional help.”
Refer to OT or PT	Refer the student to occupational or physical therapy.	P28:“It sounds like professional services (psych, OT) are necessary.”
Refer to Physician	Refer the student to a medical doctor.	P27: “have a conversation with parents to see if he can get assessed at the doctors”
Refer to Psychologist	Refer the student to a psychologist.	P28: “It sounds like professional services (psych, OT) are necessary.”
Refer to School Nurse	Recommend that student sees the school nurse for assessment.	P95: “Connect with school nurse to check Seth.”
Refer to SLP	Refer and/or discuss with a speech language pathologist.	P1: “I would also get some input from Speech and language about other strategies I could do to help with reading.”
Review Student Record	Review the student’s Ontario Student Record and/or IEP.	P3: “Review is OSR”
Talk to Admin	Discuss student with school administrators.	P3: “Speak to the principal”
Talk to Family	Ask parents about Seth’s history, and behaviors.	P9: “Speaking with his parents to gain some more context as to why these changes are occurring.”
Talk to Medical Team	Connect with the student’s current medical team	P20: “Consult (...) involved medical professionals (with permission).”

Talk to Student	Talk to student about what has happened.	P9: “Speak with Seth himself and ask him what he thinks is going on.”
Talk to Teachers	Discuss history and current learning with former and current teachers.	P3: “Talk to his former teachers if possible.”
Track Behaviour	Track the student’s behaviour to support planning.	P8: “I would start a behaviour tracking sheet. This would let me see the environments and situations that may be problematic for Seth.”

Codes for: Practical Strategies (What strategies would you implement?)		
Code	**Definition**	**Example**
Academic Check-In	Checking in with the student to make sure that they are on track academically.	P25: “Frequent check-ins to ensure understanding”
Agenda	A tool to help the student stay on top of and keep track of all of their work, classes, and assignments.	P5: “Support use of an agenda.”
Assessment Strategies	**Parent Code:** Strategies that accommodate the student during learning evaluations/ assessments	
Assistive Technology	Use technology aides to assist the student in the classroom.	P4: “Access to assistive technology (if available) (...) in order to help Seth show his learning”
Behavior Chart	Implement a visual tracker where the student earns stickers or points for completing desired behaviors, which can be exchanged for rewards.	P74: “behaviour chart for positive behaviour”
Bin System	Allow the student to use a bin system to	P4: “possibly a bin system to de-clutter desk and help Seth stay organized”

	manage clutter at their desk.	
Binder	Use binders to organize handouts/ class materials	P1: “tabs on binder to help organization skills”
Break	Allowing the student to take breaks.	P4: “Taking breaks when feeling overwhelmed or frustrated (laps around the school, to the office, etc.)”
Break Cards	Use of break cards in the classroom.	P10: “implement the use of break cards so Seth can take a break when he needs”
Calming Space	A space where the child can go when feeling overwhelmed/ dysregulated/ tired.	P2: “Set up a quiet space for him to come to when overwhelmed”
Check-In	Engage in general check-ins with the student.	P14: “provide more frequent check-ins”
Checklists	Provide step-by-step instructions for the student.	P6: “give him step by step instructions”
Chunking	Breaking down large tasks into smaller steps.	P2: “chunking work to assist him being successful throughout the day”
Classroom Lighting	Low level lighting to help student if they have visual sensory sensitivities.	P40: “Low level classroom lighting, away from direct sun, use of sun-glasses to support with any sensory. concerns”
Classroom-Wide Strategies	Strategies that benefit all students in the classroom.	P83: “I would implement cognitive, emotional, behavioural, physical, and communication strategies for Seth and for the whole class”
Co-Develop Strategies	Engage the student in developing and implementing their current support plan.	P22: “Try different strategies as needed, and build a plan with Seth.”
Communication Support	**Parent code -** strategies to help the student express themselves through writing or orally.	P36: “Find other ways of writing & reading (communication: oral, listening, scribing, tech support)
Community Circles	Engaging the students in a sharing circle where they	P1: “Community circles.”

	pass an object, speak one at a time, and respond to a prompt.	
Deep Breathing	Using deep breathing as a strategy for self regulation.	P91: “teach self regulation strategies like mindfulness, deep breathing…”
Describing the Word	Allow student to describe what they mean/ what word they would like to use if they are struggling with word-finding.	P45: “describing the word”
Develop a Safety Plan	Develop a safety plan to support the student.	P31: “An IEP would probably be helpful as well as a safety plan.”
Differentiated Assessment	Allowing the student to demonstrate their knowledge through a variety of means.	P1: “(...) different ways to present learning, oral vs. pen and paper)”
Differentiated Instruction	Present materials in a variety of formats (text, oral, digital)	P1: “present information in different ways (promethean board; oral; highlighted notes)
EA or Volunteer Support	Provide the student with an educational assistant or an adult volunteer	P29: “Having another adult working with him (volunteer) come in everyday for 1/2 day to assist him with his work.”
Electronic Resources	Use online classroom to share lessons and resources.	P5: “Provide access to classroom resources electronically.”
Emotion Cards	Picture cards that allow the student to select one that reflects their emotions.	P66: “emotional cards and strategies”
Emotion Journal	Journal where a child can express their feelings.	P75: “ask him to write daily journals to try to express his feelings in writing”
Emotional and Behavioral Supports	**Parent Code:** A collection of strategies that support the student’s emotional and	P37: “help them use tools and strategies that support them in self regulating emotions, behaviours, academic needs etc”

	behavioural functioning.	
Emotional Check-In	Check-in with the student to see how they are doing.	P1: “discuss how they are feeling at beginning of day and check in after lunch and at the end of the day”
Empathetic Adult	Ensure that Seth is supported by an empathetic adult figure, whether this is the teacher (self), guidance counsellor, or child and youth worker.	P5: “I would continue to try and be a caring adult and supportive teacher.”
Establish Classroom Norms	Create and share rules and standards of behavior for the whole classroom.	P83: “Co-create expectations for appropriate behavior with the class, and post them for all to see daily.”
Extra Supplies	Ensure the classroom has additional stock of supplies.	P5: “Ensure there are extra supplies in the class for use.”
Extra Time	Give the student additional time when needed	P17: “extra time for processing”
Feelings Chart	Use of a visual aid to help students communicate their feelings/emotions.	P61: “feelings chart”
Fidget Toys	Give the student access to fidget toys.	P5: “Provide Stress balls fidgets.”
First-Then Contingency	Speak to the child to explain “First you do X, then you will get to do Y.”	P28: “First-then contingency etc”
Folders	Incorporate folders for loose papers to support organization.	P5: “Provide a folder for loose sheets.”
Frequent Feedback	Provide the student with more frequent feedback on their assignments.	P58: “Assignments broken down into smaller parts with feedback more regularly.”
Goal Setting	Set goals with student.	P5: “Set small goals collaboratively”

Graphic Organizers	Display information using graphic organizers.	P17: “graphic organizers”
Growth Mindset	Encourage the student to think with a growth mindset, which describes how you can learn from challenges to build your abilities.	P2: “Use Zones [of] Regulation, Growth mindset to teach him how to communicate his emotions and needs”
Individualized Attention	**Parent Code:** Support the student with targeted academic support from adults (i.e., parents, teachers, EAs, volunteers).	
Instructional Strategies	**Parent Code**: Incorporate tools and methods to help deliver instruction to the student.	P20: “Implement instructional strategies that accommodate students with ABI.”
Mindfulness	Promote the use of mindfulness strategies.	P5: “(...) model mindfulness”
Modify Expectations	Change or reduce the expectations for the student	P29: “modify his Curriculum expectations to start with as he is having problems academically”
Movement Break	A movement break for the student.	P52: “give him movement breaks”
Naming Emotions	Help them identify and label their emotions.	P10: “practice identifying emotions and feelings to help Seth articulate how he is feeling”
One-on-One Support	Provide the student with one-on-one support.	P28: “Offer more 1:1 support.”
Organizational Supports	**Parent-Code:** A method/ tool/ strategy to help the student stay organized.	P4: “ (...) a bin system to de-clutter desk and help Seth stay organized”
Paced Presentation	Deliver materials in a manageable way for the student.	P7: “bring in new learning in a paced manner according to what he can handle without becoming frustrated”

Parent-Supported Instruction	Have parents support learning at home.	P100: “Parental support with major concepts at home.”
Peer Learning Partner	Pair the student with a peer who can support their learning.	P46: “Pair that student with a classmate to help him/her stay on task”
Peer Social Support	Partner the student with another individual for role modelling and social support.	P25: “buddy-system for support from a peer”
Pencil Case	Support organization by providing the student with a pencil case.	P71: “pencil case to keep his personal belongings together.”
Pencil on String	Attach student’s pencil on a string to their desk so that it doesn’t get lost.	P21: “attach a pencil to a string at his desk so it doesn't go missing or use a pencil case if he has one and have other pencils avail”
Physical Strategies	**Parent-Code:** Physical/ environmental supports in the classroom to accommodate the student’s needs.	P43: “Physical: where he is sitting in the class, lighting, proximity to the door, away from instructions”
Positive Reinforcement	Provide the student with positive reinforcement for their learning/ work (e.g., encouragement, praise).	P23: “I would try to integrate different strategies at first, as well as a reward program, which could be through the use of a 10 frame, classroom gems and rewards that encourage positive and on-task behaviours.”
Predictable Routine	Build a predictable classroom routine for the student.	P24: “Ensuring that structured routines, frequent breaks, quiet spaces are available.”
Preview Material	Sharing the material with the student first so they have multiple exposures to the material.	P10: “preview material with Seth before lessons”
Promote Self-Advocacy	Encourage the student to advocate for themselves by	P3: “Supporting Seth to self advocate and be independent”

	foster independence and confidence.	
Quiet Time	A quiet break for the student.	P82: “Include “quiet time” in the daily schedule”
Quiet Work Environment	Provide the student with a quiet environment to do their work in.	P21: “provide a quieter work space for him to increase focus”
Recess Support	Support the student during recess time.	P2: “Support him at recess- help him with the social issues.”
Reduce load	Lowering the amount of work the student is required to do.	P1: “(...) less questions on a test.”
Reference Sheets	Allow the student to use reference aids during assessment.	P3: “(...) reference sheets”
Reminders	Provide the student with frequent reminders.	P95: “Verbal and Written Reminders - Prompts and gentle reminders. Giving support.”
Remove Clutter	Remove items that clutter the student’s desk.	P62: “remove any unnecessary items.”
Repetition and Practice	Repeat the material for the student.	P1: “go over information before; during and after lessons”
Role Playing	Working on social skill building through role-playing.	P33: “In the classroom I would work on social skills and problem-solving skills through role-play”
Scribe	Have a scribe help the child translate their ideas into writing.	P4: “a scribe in order to help Seth show his learning”
Self-regulation Skills	Encourage the student(s) to practice self-regulation skills.	P7: “make sure he knows he has access to self-regulation tools”
Simplified Language	Provide materials in language that is accessible to the student.	P46: “simplify the language”
Social Stories	Utilize this social learning tool among students to increase social awareness	P20: “Create social stories to increase Seth’s awareness and ability to interact successfully with others.”
Social Support	**Parent Code:**	P5: “Provide support with social situations (debrief

	Help the student develop their social skills.	s/ conflict resolution strategies)
Special Jobs	Before learning new material, review and reinforce previously learned material.	P31: “special jobs to keep him occupied”
Strategic Seating	Put the student in preferential seating in the classroom.	P1: “Strategic seating (close to front).”
Strategic Scheduling	Schedule assessments to accommodate student fatigue.	P10: “monitor progress and changes and keep a log to document what time/subjects are most effective for certain strategies”
Sunglasses	Allow student to wear sunglasses to reduce visual sensory sensitivities.	P40: “Use of sun-glasses to support with any sensory concerns.”
Timers	Use timers to keep the child on track in the classroom.	P28: “Timers”
Universal Design	Create a classroom environment that is accessible and inclusive to all.	P15: “Universal Design in the classroom”
Visual Schedule	Incorporate the use of visuals to help with student understanding.	P12: “Visual Schedule”
Visuals	Reference to non-specific visual aides for the student.	P15: “Visuals.”
White Space	Add more white space on worksheets.	P40: “More white space added to worksheets.”
Withdrawal Support	Allow the student to write tests in a different room.	P80: “withdrawal support for assessments”
Word Maps	Support the student in using word maps to help with word-finding and communication.	P83: “when they are having a hard time finding a word or explaining something, such as describing, word maps, graphic organizers, etc.”
Writing Supports	Support and accommodate writing.	P95: “Writing - Provide larger lined paper, give a structured area to write,”

Zones of Regulation	Using a tool to help students identify and communicate their feelings.	P8: “Zones of Regulation with the entire class to help us all understand our emotions and help us manage them.”