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Measuring social-emotional development in middle childhood: The Middle Years Development Instrument

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A B S T R A C T
This paper discusses the conceptualization, development, validation, and application of the Middle Years Development Instrument (MDI) – a population-based child self-report tool that assesses children’s social-emotional development and well-being in the context of their home, school, and neighborhood. The MDI is administered at a population-level to 4th and 7th grade students within participating public school districts across British Columbia, Canada. Children respond to items in five domains: (1) social-emotional development, (2) connectedness to peers and adults, (3) school experiences, (4) physical health and well-being, and (5) constructive use of after-school time. Results are aggregated for schools and communities and reported back in comprehensive reports and community maps to inform planning and decision making at local and regional levels. Shared testimonials exemplify how MDI results have been used by educators, community organizers, and city planners as a catalyst for promoting children’s social and emotional competence and facilitating collaboration between schools and communities.

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1. Introduction

Parents, educators, and society at large have long agreed that a main goal for young people is to become independent, socially skilled, and well-rounded citizens who are ready to responsibly navigate their personal and professional pathways into adulthood (Greenberg et al., 2003). Yet, until the turn of this century, students’ social-emotional development and well-being played only a negligible role in school-based intervention and prevention programs that enhance social-emotional development and well-being in the context of their home, school, and neighborhood. The MDI is administered at a population-level to 4th and 7th grade students within participating public school districts across British Columbia, Canada. Children respond to items in five domains: (1) social-emotional development, (2) connectedness to peers and adults, (3) school experiences, (4) physical health and well-being, and (5) constructive use of after-school time. Results are aggregated for schools and communities and reported back in comprehensive reports and community maps to inform planning and decision making at local and regional levels. Shared testimonials exemplify how MDI results have been used by educators, community organizers, and city planners as a catalyst for promoting children’s social and emotional competence and facilitating collaboration between schools and communities.

Further, educational policies that mandate teaching social-emotional skills and assessing social-emotional growth alongside academic growth have emerged (e.g., school-district policies, state or provincial policies) (Mart, Weissberg, & Kendziora, 2015; Meyers et al., 2015).

Building on these milestones, scholars have discussed essential steps to advance the future agenda of supporting children’s social-emotional needs and prioritizing their social-emotional development in schools and communities (Weissberg, Durlak, & Gullotta, 2015). One essential step involves the development and implementation of psychometrically sound and developmentally appropriate measurement tools to assess and monitor children’s social-emotional development. “What gets assessed gets addressed” – this widely known axiom suggests that systematic assessment is key to create an accountable system in which social-emotional skills are prioritized, evaluated, and intervened upon to promote children’s ability to care for themselves and others and prevent adjustment problems later in life.

The present paper has four main objectives. First, we introduce the Middle Years Development Instrument (MDI) – a population-level measure of children’s social-emotional development and well-being in middle childhood that was developed to address key questions about children’s healthy development in schools and communities. Specifically, we illustrate the research-to-action project that led to the collaborative creation of the MDI in a partnership among researchers at the Human Early Learning Partnership (HELP) at the University of British Columbia (UBC), community leaders, and educators. Second, we review the development and validation of the MDI survey instrument. Third, we illustrate...
the infrastructure of knowledge mobilization strategies that has been developed to report research findings from the MDI back to the schools and communities in which students completed the MDI. Examples are provided that illustrate the ways in which MDI data have been used to inform practice by influencing decisions, policies, and actions in schools and communities including the development of jointly-operated after-school and school-based programs to promote children's social-emotional development and well-being. Finally, we close with a discussion of challenges encountered in the promotion and implementation of the MDI, and provide recommendations for overcoming these barriers that may be informative for other researchers and stakeholders involved in similar social-emotional assessment systems.

1.1. Addressing a community need: measuring social-emotional development in BC at a population-level

In concert with the increasing awareness of the importance of social and emotional learning (SEL) and its assessment in the United States (e.g., Durlak et al., 2011; Mart et al., 2015), educators and community members within the province of British Columbia (BC), Canada, have developed a heightened interest in measuring children's social and emotional development. In 2005, the United Way of the Lower Mainland engaged researchers at UBC in a large-scale cross sectional study to investigate children's social-emotional development, well-being, and experiences inside and outside of school (Schonert-Reichl, 2011). The study included over 1400 children ages 9–12 across eight school districts, and was supported by stakeholders invested in identifying ecological factors in children's schools and communities that are associated with children's social and emotional competence and healthy development. The study found that children's social-emotional well-being, belonging at school, and connectedness to adults at home and in the community was significantly lower among 6th and 7th grade students than in 4th and 5th grade. Furthermore, students in 6th and 7th grade spent significantly more time alone in their home after school compared to students in younger grades (Schonert-Reichl, 2011). These results corroborated other research documenting the decline of children's social-emotional well-being from early childhood to adolescence (Eccles, 2004) and raised the question of how schools and communities can support children's social-emotional competence and well-being during this transition. This study also emphasized the need to investigate students' social-emotional development and well-being across time and regional boundaries, and called for a longitudinal and a representative population-level approach to assessing and monitoring children's social-emotional development in communities.

1.2. MDI core properties: children's voices, population data, and community collaboration

In 2007, UBC researchers engaged in a further partnership with the United Way of the Lower Mainland and BC school districts to develop the original middle childhood study into a population-wide, recurring monitoring platform on children's social-emotional development, well-being, and social contexts, thus leading to the development of the MDI. The goal was to design an instrument that would routinely and reliably assess children's development and well-being during the transitional ‘middle childhood’ years between early childhood and adolescence. Grade 4 was selected as a relevant baseline measure before the documented decline of children's social-emotional well-being (Eccles, 2004) and at an age when children have the attention and capacity to reliably self-report their feelings and experiences (Riley, 2004). Later, a second version of the survey was developed for grade 7 to capture children's adjustment and assets at a critical transitional point in development from middle childhood to early adolescence. The resulting MDI surveys, administered to children in grades 4 and 7, ask children report on their social-emotional development and well-being, feelings about school, home, and life, and the presence of social and contextual assets at home, in schools and communities (e.g., the supportiveness of adults and peers, after-school program participation).

At its core, the MDI is characterized by three unique properties that have contributed to the survey's acceptance and usefulness within BC schools and communities: First, the MDI gives children a voice in reporting how they feel, how they spend their time, and what they would want to see changed within their school and community environments. Aligned with Article 12 of the United Nations Convention on the Rights of the Child (United Nations, 1989), the MDI enables children to participate in shaping their environments and emphasizes the value of listening to children’s perspectives by demonstrating valid and reliable psychometric properties (Schonert-Reichl et al., 2013). Second, the survey gathers data at a population-level; all children within participating school districts take part in the MDI unless they, or their parent, opt-out. This method avoids common sampling pitfalls including under-representation of children from ethnic minorities or families with lower educational attainment (Andeman et al., 1995; Ellwood et al., 2010). It also promotes stakeholder interest in the results as the survey data represent actual children within a local context as opposed to statistics derived from a weighted sample (Guhn et al., 2012). Third, implementation of the survey requires collaboration between schools, school districts, and community partners, which facilitates the use of the data once results are reported. Systematic evaluation of MDI knowledge translation activities has identified that knowledge users including policy-makers, community stakeholders, and school administrators value the MDI as a “common language” that facilitates resource allocation and goal-setting between otherwise isolated departments and organizations invested in children's healthy development. Between 2010 and 2016, the MDI has been implemented in 28 out of 60 BC school districts and has been completed by nearly 29,000 grade 4 children and over 15,000 grade 7 children.

1.3. Relevance of the MDI within the BC assessment landscape

Including school and community partners in the development of the MDI was an important step that led to buy-in for MDI implementation in schools and ensured the usability of data. Because stakeholders in schools and communities had a voice regarding core questions and concepts to address within the MDI, many were eager to implement the survey to learn how their children were doing in regard to their social and emotional skills and their social contexts. Furthermore, stakeholders were keen to implement the MDI specifically in grades 4 and 7 because it measured dimensions of children's development not currently being measured elsewhere in the system, but that complemented existing student data (i.e., measures of academic ability, and school readiness in kindergarten). In BC, academic skills are routinely assessed in grades 4 and 7 using the standardized Foundation Skills Assessment exam (FSA; BC Ministry of Education, 2016). Children's school readiness, including cognitive, motor, and social skills, is routinely assessed in kindergarten using the Early Development Instrument (EDI; Janus & Offord, 2007). In this context, many BC schools were experienced with implementing large-scale assessment systems. Furthermore, several school district and ministry administrators had personally participated in past collaborations with the MDI research team on the EDI survey which had already been administered province-wide for the past decade. Stakeholders therefore saw the MDI as a valuable expansion of the established assessment routine in BC; it was the first time children could routinely self-report on their own well-being, it provided insight into development during middle childhood and early adolescence, it was strengths-based, and it was linkable to children's development in kindergarten using the Early Development Instrument (EDI; Janus & Offord, 2007). In this context, many BC schools were experienced with implementing large-scale assessment systems. Furthermore, several school district and ministry administrators had personally participated in past collaborations with the MDI research team on the EDI survey which had already been administered province-wide for the past decade. Stakeholders therefore saw the MDI as a valuable expansion of the established assessment routine in BC: it was the first time children could routinely self-report on their own well-being, it provided insight into development during middle childhood and early adolescence, it was strengths-based, and it was linkable to children's 

1 The EDI is a teacher-reported measure of children's school readiness that has been implemented in BC province-wide since 1999. It is overseen by the same research team that administers the MDI.
kindergarten school readiness and grades 4 and 7 academic achieve-
ment data. In these ways, the MDI was regarded as a tool that could pro-
vide a more fulsome picture of children's development in BC for better understanding associations between early childhood development, aca-
demic success, and social-emotional well-being (Guhn, Gadermann, Almas, Schonert-Reichl, & Hertzman, 2016).

Since the MDI was first launched, the BC Ministry of Education has redesigned the education curriculum to include "personal and social competency" as one of three core competencies for all kindergarten to grade 12 students attending public and independent schools in BC (https://curriculum.gov.bc.ca/competencies; BC Ministry of Education, 2015). The new curriculum, effective as of 2015 with changes being im-
plemented gradually over a three-year period, further enhances the po-
tential role of the MDI in school-based assessments, because the criteria for 'success in school' now explicitly include positive personal and cul-
tural identity, personal awareness and responsibility, and social respon-
sibility—dimensions that are specifically assessed on the MDI. The policy-change may thus present a unique opportunity to evaluate the impacts of the SEL-focused curriculum on children's MDI scores at a province-wide level. Overall, the curriculum change reflects the increasing weight BC policy-makers are placing on children's social-emotional development.

2. MDI theoretical framework, item selection, and psychometric properties

The MDI was derived from research and theory in the fields of social and emotional learning, resilience, and positive youth development (e.g., Luthar, 2006; Masten & Coatsworth, 1998; Masten & Motti-Stefanidi, 2009; Scales, Benson, & Mannes, 2006; Weissberg, Payton, O'Brien, & Munro, 2007). An extensive literature review provided the basis of identi-
fying the constructs and developmental domains that were considered essential in positive social-emotional development and well-being in middle childhood and early adolescence (e.g., Eccles, 1999; Masten & Coatsworth, 1998). Next, a collaborative team comprised of researchers, educators, and other relevant stakeholders worked together to select constructs and items that had relevance to understanding children's so-
cial and emotional development and the protective and promotive fac-
tors that influence healthy child development and resilience. Moreover, it was critical that the MDI include items that were seen as "actionable" and "malleable" to ensure that the data would be beneficial for the de-
sign and implementation of intervention and prevention efforts across multiple contexts. Educators and community program and service pro-
viders were consulted via focus groups, interviews, and surveys to find out what self-report information from children would be particularly rel-
vant for their work with children. At the end of this this process, five broad domains were identified which define the core assessment dimen-
sions of the MDI. A detailed discussion of the MDI domains has been de-
scribed previously (Schonert-Reichl, Guhn, Gadermann, Hymel, Swiss, & Hertzman, 2013) and the 4th and 7th grade versions of the MDI can be downloaded from http://earlylearning.ubc.ca/mdi/. Below we briefly summarize the rationale for the inclusion of each of the five domains as an indicator for social and emotional competence and healthy develop-
ment in middle childhood, as well as the relation of these domains to other known assessment frameworks.

2.1. Five domains of social-emotional development in middle childhood

2.1.1. Social-emotional development

The social-emotional development domain assesses children's opti-
mism, satisfaction with life, self-regulation (short-term and long-term), general self-concept, empathy, prosocial behavior, depressive symp-
toms, and anxiety symptoms. Additional social and emotional develop-
ment constructs added to the grade 7 MDI include: responsible decision-making, self-awareness, perseverance, assertiveness, citizen-
ship and social responsibility. Differences between the grade 4 and 7 surveys are further described within the section on item selection and validation. Together, these indicators reflect children's social and emo-
tional development and well-being as a marker of positive mental health, resilience, and thriving in childhood (Pollard & Lee, 2003; Scales, Sesma, & Bolstrom, 2004; Masten & Coatsworth, 1998) and set the stage for positive developmental trajectories throughout adoles-
cence and adulthood (Masten & Tellegen, 2012; Olsson, McGee, Nada-Raja, & Williams, 2013). Furthermore, several of these measures (i.e., empathy, prosocial behavior) are indicators of social-emotional competence, which in turn has been related to thriving and success in both school and life (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000; Oberle, Schonert-Reichl, Guhn, Zumbo & Hertzman, 2014b; Jones, Greenberg, & Crowley, 2015; Oberle, Schonert-Reichl, Hertzman and Zumbo, 2014a).

2.1.2. Connectedness

The connectedness domain assesses children's sense of support and belonging at home, at school, in the peer group, and in the neighbor-
hood/community, as well as their experiences of friendship intimacy, number of important adults at school, availability of safe places for chil-
dren in the community, and availability of programs for children in the community. On the grade 7 MDI, children are also asked to indicate what makes an adult important to them. Research has consistently shown that children's social connectedness in core developmental con-
texts (i.e., family, peer group, school, community) is an asset for their well-being, health, and success in life (Benson, 2006; Gadermann et al., 2015; Hamre & Pianta, 2005; Leventhal & Brooks-Gunn, 2000; Oberle et al., 2014b, Theokas et al., 2005). Taking into account supportive relation-
ships and connectedness in multiple ecological contexts is particularly important in middle childhood and early adolescence, a time during which children shift their social focus away from the family and begin to immerse in ever-widening circles of interactions (Wigfield, Byrnes, & Eccles, 2006). As children's independence is growing, the availability of places in which children can spend time safely unsupervised, and access to child and youth programming in the community becomes increasingly important for positive and healthy child development.

2.1.3. School experiences

The school experiences domain assesses children's academic self-effi-
cacy, perceived school climate, school belonging, victimization, moti-
vation, and future goals and ambitions. The school is arguably one of the most important ecological contexts that shapes development, health, and well-being in middle childhood and early adolescence (Eccles & Roeser, 2013). From age 7 to 14 young Canadians spend on aver-
age 6710 hours in classrooms, not counting recess, lunch, and time spent in non-instructional projects (OECD, 2012). Whereas positive and supportive school environments promote thriving, stressful and unsupportive environments can jeopardize positive growth and con-
tribute to mental health problems and school failure (Hamre & Pianta, 2005; Roeser, Eccles, & Sameroff, 2000). Children's experiences in the school at large are influenced both through interactions with peers, teachers, staff, and their perception of the norms and values that define the school climate (e.g., Blum et al., 2004; Hamre & Pianta, 2005; Masten & Motti-Stefanidi, 2009).

2.1.4. Physical health and well-being

The physical health and well-being domain assesses children's over-
all health, physical health, body image, and health habits (i.e., nutrition, sleep). There is a substantial body of evidence that regular sleep, exer-
cise, and nutrition are critical for children's healthy physical develop-
ment as well as social and psychological adjustment (Allender, Cowburn, & Foster, 2006; Janssen & Leblanc, 2010; Neumark-Sztainer, Goeden, Story, & Wall, 2010). Evidence also suggests that connected-
ess to adults at home may also be associated with physical health out-
comes through moderating health risk behaviors such as poor nutrition and sleep habits, and lack of physical activity (Carter, McGee, Taylor,
2.1.5. Constructive use of after-school time

The after-school time domain assesses what children do after school, with whom, and where they go. Children report whether they participate in structured activities (e.g., education, art & music, sports) or other activities (e.g., homework, sports, TV/videos, computer, reading), what activities they wish to be doing after school, and perceived barriers that prevent them from pursuing those activities. The ways in which children spend their time after school was a particular interest raised by the community leaders involved in the MDI development who were interested in the ‘critical hours’ during which children are out of school but parents are still at work (Schonert-Reichl, 2011). A large number of elementary school children spend the out-of-school hours unsupervised at home (Canadian Safety Council, 2009), whereas some children attend organized after-school programs or participate in other structured extracurricular activities (e.g., sports, art classes, music classes), or stay with friends or relatives (National Institute of Out of School Time, 2007). Scholars in the field of after-school time have argued consistently that the availability of high quality after-school programs is essential for supporting the development of social and emotional skills (Durlak, Weissberg, & Pachan, 2010) and the needs of parents, children and communities (Decier, 2011).

2.2. Alignment with existing assessment frameworks

After identifying these five broad MDI domains, connections were drawn with measurement frameworks developed by leading experts in children’s social and emotional skills, specifically the Collaborative for Academic, Social, and Emotional Learning (CASEL; www.casel.org) and the Developmental Assets™ framework by the Search Institute (www.search-institute.org). Particularly within the grade 7 version of the MDI (which allowed for the inclusion of more items) all of the MDI subscales can be linked to abilities and skills outlined in CASEL’s core social-emotional competencies (i.e., self-awareness, social-awareness, self-management, relationship skills, and responsible decision-making; CASEL, 2013, Elias et al., 1997). A comparison of CASEL’s core competencies and the constructs measured on the MDI is presented in Table 1. Similarly, the “developmental assets” identified by the Search Institute informed the personal and ecological factors in the home, school, and community included in the MDI, that have previously been connected to children’s healthy development (Scales et al., 2006; Theokas & Lerner, 2006).

2.3. Selection, adaptation, and validation of MDI scales and items

Final selection and validation of the items/scales to assess the constructs on the MDI involved a multi-stage consultation and piloting phase with children, educators, parents/guardians, youth program providers, and an interdisciplinary research team (Schonert-Reichl et al., 2013). Items/scales used in previous developmental research were considered. Inclusion criteria were strong psychometric properties as indicated by previous research evidence for reliability, validity, and age appropriateness (for ages 9–12) of the items/scales, School and community partners and a group of parents provided information on items that were of particular interest and relevance to them, and also flagged items that could lead to potential conflict with parents, educators, and/or policy makers. As a result, some questions/scales that were originally identified as suitable for the purposes of the MDI were eliminated, because they were considered too sensitive. For example, teacher representatives requested elimination of a scale that assessed to what extent students felt that their teachers provide students with opportunities for autonomy and democratic decision making in the classroom because of concerns that the MDI results would specifically target classroom teachers. They instead suggested that the MDI should gather information on students’ perceptions of the overall school climate. Similarly, parent representatives asked to eliminate questions concerning parenting styles, because such questions may be considered as intrusive. The rationale for the MDI development team to acknowledge these requests was based on the fact that some previous other large-scale voluntary school surveys had to be terminated due to parent and teacher complaints.

Out of an original item pool of more than 300 items, the initial version of the MDI (created for grade 4) contained 96 items and 8 demographic questions, which were tested in several pilot studies using qualitative and quantitative methods. Feedback was obtained via focus groups involving teachers and students from a diverse range of cultural and language backgrounds representative of BC classroom compositions. Comments were overall very positive. For example, students indicated that they enjoyed taking the survey and felt the information obtained was important. Teachers commented that the MDI is an important tool to better understand students and to discuss students’ needs and possible ways to help students with communities.

After the completion of multiple pilot studies and revisions, a final version of the MDI containing 71 survey and 8 demographic items was administered district wide in three school districts in BC. Using data from that implementation, the factor structure of the three domains of the MDI that contain scales (social and emotional development, connectedness, and school experiences) was tested using exploratory and confirmatory factor analyses (Schonert-Reichl et al., 2013) and the magnitude of the correlations among scales were examined. This research documented strong psychometric properties of the subscales of the MDI, providing evidence for the factor structure, subscales’ reliabilities, and convergent and discriminant validity. A further example of the ongoing validation work with the MDI subscales was a validation study examining cognitive processes of children in grades 4–7 when responding to the Satisfaction with Life Scale adapted for Children – one of the MDI subscales within the social-emotional development domain (Gadermann, Guhn, & Zumbo, 2011). The study used so-called think-aloud protocols, meaning that children explained their responses to a researcher while filling out the scale. It was found that the students’ response strategies were in line with theoretical frameworks of quality of life and matched previous empirical findings that were based on studies with adolescents and adults. This has been critical, because the study provided further evidence for the validity of the student responses, and has proven invaluable in discussions with sceptics, who claim that children at age 9 are not able to provide meaningful answers regarding their own lives and social contexts.

A final step in the development of the MDI was the later expansion of the survey for children in grade 7. Three years after the grade 4 MDI was initially implemented in schools, a grade 7 version was introduced. The grade 7 MDI enables educators to monitor students’ social-emotional well-being during a developmental period when children begin to face greater pressures socially and academically (Eccles, 2004; Eccles & Roeser, 2013) and when many chronic mental health issues related to social-emotional health begin to be observed (Kessler, Berglund, Demler, Jin, & Walters, 2005). The grade 7 survey contains all of the items in the grade 4 version as well as an additional five measures that were either more relevant to older children’s experiences (i.e., “citizenship and social responsibility” including volunteering experiences and graduation plans) or were only validated as a self-report scale for children in grades 6 or higher (i.e., “self-awareness” [Moilanen, 2007] and “responsible decision-making” [Fuligni & Eccles, 1993; Wentzel, 1993]). Other constructs (“perseverance” [Kern, Benson, Steinberg, & Steinberg, 2016] and “assertiveness” [Springer & Phillips, 1997]) were developmentally appropriate at both ages, but had been cut from the grade 4 version to keep the survey manageable length for younger children as determined in the feasibility studies.
Administering the MDI at two grade levels is particularly useful for researchers and educators to be able to measure and accommodate changes in students’ social-emotional needs at a school level. Examined longitudinally, the data are useful for observing population trends between birth cohorts as well as observing developmental trajectories among the same students over time. To date, over 5000 MDI records have been linked for the same children between grade 4 and grade 7. A further 15,000 grade 4 MDI records have been linked to kindergarten school readiness records from the EDI (many of these linked records will be further linkable to the grade 7 MDI). Together, these datasets are being utilized to answer questions about associations between early and later developmental outcomes (e.g., Guhn et al., 2016), as well as to identify mediating and modifying factors that can influence children’s trajectories to promote healthy child development (in progress). Future plans include developing a grade 10 version of the MDI survey (“Youth Development Instrument,” age 15) that will build further capacity to investigate children’s health and development across adolescence.

3. From data to action: engaging schools and communities in knowledge translation

The increasingly widespread recognition of children’s social-emotional competence as a foundational component of life-course success and well-being is a significant accomplishment of collaborative efforts between researchers, practitioners, and policymakers (Humphrey, 2013; Weissberg et al., 2015). That said, assessment systems that fail to involve key stakeholders or fail to present data in an accessible format are unlikely to have meaningful impacts (Baumbusch et al., 2008; Green, Ottoson, García, & Hiatt, 2009). From its inception, the purpose of the MDI was to yield findings that can facilitate meaningful change in children’s environments and enhance their social and emotional competence and well-being. Informed by what has been called the “science and practice of knowledge translation” (Straus et al., 2011), the MDI was developed in accordance with recommended best practices for encouraging stakeholders’ use of the data. This included engaging knowledge users throughout the entire research process, from determining what items should be measured on the MDI, to how data should be reported, and how we could facilitate sustained use of the data over time (Baumbusch et al., 2008; Green et al., 2009; Straus et al., 2011).

## 3.1. HELP’s knowledge translation model

Building on previous success in the field of early child development knowledge translation, a model of integrated knowledge translation (iKT) was developed at HELP (Fig. 1). The foundation for this model was the scientific integrity of the data. The iKT process itself, as depicted in the model, takes into account four key knowledge translation considerations: 1) the need for careful planning that, in particular, focuses on understanding which audiences could use the data and for what reasons; 2) ensuring that, while the data may be complex, the messages that they convey are made simple and clear using a range of synthesis and visualization techniques; 3) recognizing that knowledge users access information using a wide range of tools thus requiring a multiplicity of dissemination techniques; 4) the importance of a deep engagement process with data users, founded on strong relationships, with the overall focus being making meaning of the data. As a population-level measure, the MDI data are used in a wide range of ways to support the education system, schools, out-of-school programs, and government in effective program and policy decision-making. From this perspective, four key knowledge user audiences were considered of particular importance for knowledge translation: policy-makers, educators and education administrators, community planners, and children. These are the audiences directly engaged in receiving comprehensive reports, interpreting data, and using data to drive decisions. In consultation with members of each of these four groups, a variety of knowledge visualizations and syntheses were developed, and knowledge products and tools that would best meet their needs, including comprehensive reports, maps packages, webinars, networking events, and development of an online knowledge user field guide, were designed. This process was highly interactive and iterative. Although researchers began to make meaning of the MDI data, the way in which data users were absorbing and interpreting the data informed improved approaches that had increased relevance and resonance. This process of adaptation and improvement has continued since 2010, and is an essential aspect of our ongoing community engagement and knowledge translation strategy. One final note, that although the MDI reporting structure was developed with these primary groups in mind, parents have also been valuable knowledge users engaged in understanding more about the middle years and issues affecting their children through public presentations and Parent Associate Committee meetings. In addition to having access to free online MDI community reports and maps, specifically designed resources for parents and children
Data visualization and dissemination strategies

Relevance and usability are regarded as two of the most important aspects of whether or not research results translate into practice (Green et al., 2009). As such, knowledge translation products were designed according to the criteria of being clear, yet complex enough to be useful for our diverse key audiences. Based on our previous research collaborations with knowledge users, we had learned that (i) educators were motivated to see the practical relevance of the data for their own day-to-day activities, (ii) administrators wished to recognize or envision the data's potential benefit for their schools, and (iii) policy-makers wished to obtain research evidence that enhances their political mandates (Guhn et al., 2012). Timeliness of data reporting (i.e., receiving MDI results prior to budget decisions for the following fiscal year) was also identified as an important factor for determining uptake within schools and communities. Consequently, two levels of reporting were developed to meet these diverse needs.

At the first reporting level, confidential school reports created separately for grade 4 and grade 7 are provided to each participating school. These reports feature a variety of visual representations of each school’s data (i.e., children’s average scores across SEL indicators) compared to the school district average. The purpose of these reports is to help school staff identify areas of social-emotional development and assets in each grade level (i.e., adult relationships, peer relationships, nutrition and health, constructive use of after school time, school experiences) in which their children fared well or excelled, and areas in which their social-emotional development and assets needed to be enhanced and supported. Grade 4 and 7 surveys contain slightly different items and are used by slightly different audiences. For example, high school principals will often request the grade 7 reports from the principals of elementary or middle school “feeder” schools in their area. We also developed a series of infographics to communicate summary statistics that would be easily interpretable and engaging enough for students to be able to participate in the unpacking of their MDI results with their teachers. Fig. 2 provides examples of these infographics illustrating the number of adults at school that children feel are important to them, children’s plans to graduate, and children’s average self-reported social-emotional development within a school compared with the school district average. Based on consultation with educators and administrators, it was determined that the school-level reports remain confidential to each school and school district in order to avoid public comparisons or rankings of schools. This decision also addressed a public reaction to previously perceived misuse of provincially collected academic achievement data (i.e., the FSAs), which had been used for purposes other than intended, by publicly ranking schools according to students’ scores on standardized achievement tests, and without contextualizing the school achievement data (that is, without, for example, taking into account socioeconomic status differences).

A key strategy supporting the uptake of the information in these reports, thus ensuring a higher degree of translation into action, has been direct and concerted knowledge brokering strategy. This function has been described in a range of public health settings (Ward, House, & Hamer, 2009) and has been employed broadly by HELP across a number of years to facilitate uptake of research. In the case of the MDI, this has included a range of activities that include direct contact face-to-face with school users (including workshops and presentations), training and discussion webinars, and smaller strategic discussions. This process has proven extremely valuable in developing on-going relationships with knowledge users and in understanding more fully how MDI data can be used more effectively in a school context. This has fed directly into the process of on-going adaptation and improvement as reporting approaches are increasingly focused on the needs of users.

At the second reporting level, school district and community reports are provided that aggregate children’s MDI scores by the total school district, and by neighborhood (accessible from http://earlylearning.ubc.ca/maps/mdi/nh/). Similar to the confidential school reports, scores for each neighborhood can be compared against the school district total to identify areas of relative strength and weakness. In addition, one of the most important features of the MDI reports is geo-spatial data mapping that reports MDI data using ‘heat maps’ using existing recognized neighborhood boundaries (Fig. 3). Data are mapped according to children’s block-level residential address rather than the school address, thereby maintaining the relevance of the data for neighborhood communities while discouraging school comparisons, as many children attend school outside their school catchment area. The maps in Fig. 3 illustrate two composite scores that were developed to quickly summarize child outcomes at the neighborhood level. The well-being index (green map, top) is an aggregate measure of children’s optimism, self-esteem, happiness, sadness, and general health. Darker colors indicate
a higher level of overall well-being (thriving). The Peer Relationships asset (brown map, bottom) is one of four contextual assets (including Adult Relationships, Nutrition and Sleep, and After-School Activities) that indicates the strength of supports in that domain. Darker colors indicate that children report better relationships with peers.

The maps have been powerful in their ability to effectively create awareness around the large neighborhood-to-neighborhood variability in foundational child well-being indicators and social context factors (inequities are easily visible). The maps also provide representative research evidence about children and their environmental context for local communities (as opposed to be aggregated at a provincial level) that engage audiences differently and allows knowledge users to engage in meaning-making. That is, community members can relate their own knowledge of their children and their community contexts to the research findings presented to them. As a result, the MDI community maps have been particularly useful to community planners and policy-makers for quickly identifying geographic areas within their municipalities where children are experiencing vulnerabilities and where they are experiencing strengths. Furthermore, because the data can be collected every year, these maps and reports can also be used to track children's well-being and social contexts over time to evaluate impacts of interventions at local and municipal levels. Unlike the school reports that are only available to schools, the community level reports are publicly available and make it possible to compare results across neighborhoods and across districts. These comparisons can be useful if the purpose is to find similarities and differences within regions that can help explain the data. For example, accompanying neighborhood-level data presented within the reports further enable knowledge users to unpack the data to identify which particular indicators (e.g., peer belonging, friendship intimacy) are driving social-emotional development outcomes. Engaging stakeholders in these discussions has been helpful in promoting collaboration toward the common purpose of improving children’s well-being, rather than creating competition. A similar strategy of knowledge brokering used with schools has also unfolded with community organizations and collaborative structures. This has been essential in ensuring that MDI data are used to connect schools with the broader after-school sector so that more seamless and comprehensive approaches to supporting children can be developed.

3.3. MDI outcomes and impacts

An increasingly important part of knowledge translation activities in the MDI project has been the collection of community stories about how MDI data has been used and how it has impacted children. These stories are essential in connecting MDI users with each other so that learning about how to move to action happens at a peer-to-peer level rather than being mediated through HELP. Stories have been shared with other knowledge users through an online field guide to inspire engagement in similar initiatives (see http://earlylearning.ubc.ca/mdi/tools/). Here we present three examples of how the MDI has initiated direct impacts for children within schools and communities.

3.3.1. Engaging students to promote social-emotional well-being

Within a rural community in southeast BC, children typically experience a positive childhood, but in recent years, school administrators have observed a considerable increase in children's reported anxiety and family stressors. Located over 2 hours from the nearest city, one of the unique challenges this community faces is disconnection from the social planning networks and initiatives that tend to be focused in the urban centres. In response, the Superintendent of Schools leveraged...
the MDI results as a talking point to invite children’s participation in helping adults to understand why they were feeling increasingly anxious. In three different projects, students engaged in discussions about the MDI results, and responded with personal interpretations and generated possible actions to address areas of concern. Students who were too shy to speak with an adult in person could record a video message that they were told would be shared with students and staff. After sharing their experiences, students were surprised and relieved to learn that many other students in their class were experiencing the same feelings. Together, the students turned this into an opportunity to brainstorm strategies for overcoming worries and managing negative feelings. Strategies included creating a mandatory break during the most difficult
class (math) for students to calm their nerves and collect their thoughts, or expressing their feelings through song-writing and music. Further developing their empathy and responsible citizenship, students also initiated a project that involved filling origami boxes with “good wishes” that they took to local business owners so that customers could collect a “good wish” when they entered the store.

3.3.2. Fostering collaboration between schools and communities

Consistent with other jurisdictions across BC, a suburban community observed from their MDI results that children were reporting low nutrition and sleep as well as isolation from adults at school which was affecting their overall well-being. The Children’s Community Coordinator for the region recognized that this was a systemic problem that could not be addressed by schools or the community alone. The coordinator organized a meeting between members from their community’s middle childhood round-table, school district administrators, and the city’s Parks and Recreation board to collaborate on what she called ‘their MDI action plan’. The plan resulted in the creation of a play-based program called Active Kids Hour which was designed by all three stakeholder groups but was implemented within schools. The lunch-hour program incorporates play and literacy to educate children on healthy habits including sleep and nutrition promoting the SEL skills of self-awareness, self-management and responsible decision-making (Elias et al., 1997). Teachers and school administrators lead the program, fostering relationships that children previously identified as missing. Even the grade 7 students are provided opportunities to mentor younger students in the activities, promoting social awareness and relationship skills. Active Kids Hour has had significant buy-in from students with many students reporting it to be the best part of their week. Schools might begin to evaluate the impact of this program by comparing changes in MDI results over time, alongside complementary research to examine any causal associations between the program and children’s social-emotional outcomes.

3.3.3. Addressing a service gap in the after-school hours

The fastest growing city in BC welcomes over 800 new residents every month, and over 43% of its population speak a first language other than English (City of Surrey, 2016). The city's Middle Childhood Manager was faced with a growing concern around the lack of space and programming available for children in their middle years (particularly ages 8–12), who were too young to be left at home alone but too old to want to participate in day care. Compared to children in other age groups, she felt there was a noticeable lack of intentionality behind middle years programming and the city had no plan on the horizon. The city manager brought MDI data to the city’s planning table to show what children in this age group wished to be doing with their time after school, cross-validating this with research evidence demonstrating the importance of physical activity for children’s physical health, social skill development, and emotional well-being (Janssen & Leblanc, 2010; Neumark-Sztainer et al., 2010). The MDI data became the catalyst for developing ‘MY Zone’ (Middle Years Zone), a safe, affordable, and high quality after-school drop-in program which children helped to design and name. Whereas previously the city had allocated no space and no budget for middle years programming, MY Zone has now been implemented across eight city sites and in the last year alone engaged over 630 children (http://www.surrey.ca/culture-recreation/17668.aspx).

As the MDI expands within BC and becomes routinely used to collect data within the same school districts, MDI data are useful in broadly understanding the possible impacts of such programs and interventions. Several school districts in BC have used the MDI consistently for four years. In these locations, clear, monotonic trends in children’s well-being can be correlated with school level program and district-wide policy changes that have been implemented with the express intention of responding to needs as identified by MDI data. There is evidence from MDI trend data that these effects are actually being seen. It is important to recognize that on its own, the MDI is not designed to assess causal associations between an intervention and an outcome, nor does it detect changes in individual children. For example in the above community stories, improvements in children’s reported anxiety were not observed the following year in the rural community. It is possible that anxiety improved for the children involved in the intervention, but not for the whole population. In contrast, children’s social-emotional scores did improve following implementation of the Active Kids Hour, but again it cannot be determined without further research whether these improvements were the result of this program. That said, the MDI data and reports contain a substantial level of detail – particularly regarding known mediators of children’s health development including supportive relationships and physical activity – that are an essential foundation for monitoring and explaining changes in child wellbeing at the level of the population (whether school, neighborhood, or community-wide). In concert with leading education experts emphasizing the importance of universal interventions benefiting entire populations of children (Greenberg & Abenavoli, 2017), building a more fulsome evaluation plan that connects intervention research with MDI population trend data is an essential next step in this program of research. The impacts of population-level interventions on children’s development (including the recent adoption of social-emotional skills as a key learning outcome in BC) are of particular interest to researchers at HELP.

4. Lessons learned: challenges and facilitators of social-emotional assessment

Initial buy-in to the MDI may have been influenced by the novelty of social-emotional assessment in BC, ability of data to be linked to other assessment tools, or familiarity with HELP’s existing research including the EDI school readiness measure. Its staying power, however, is likely creditable to the value schools and communities see in the results. While evaluating the effectiveness of HELP’s knowledge translation activities remains a priority, initial feedback indicates that the data are presented in a way that is accessible and interpretable to our four key audiences, including children themselves. That said, several set-backs have been encountered within the MDI project that we describe in this section to assist others in developing and implementing similar assessment tools.

4.1. Barriers and facilitators of implementation

The current funding model for survey implementation has been a source of contention. Although a proportion of MDI implementation is supported by the BC government, school districts are still asked to cover the cost of generating the school and school district reports. Costs are calculated on a sliding scale contingent on the number of schools within the district (i.e., number of reports to be generated) and the relative size of the district within the province. The fees go directly to support cost recovery; this is not a for-profit model. However, the time commitment and financial cost have been barriers to several districts participating, and have limited implementation of the survey to grades 4 and 7 although it could be modified for use in other grades as well. Often school districts will be interested in the survey but have to make sacrifices based on budget. In other cases, school districts will not be interested because they perceive the MDI (and SEL assessment in general) to have low value or no direct benefit to them. In our experience, several school administrators remain focused on academic assessment and perceive social-emotional skills as a distraction, rather than promoter, of academic success. Most commonly however, school districts are perturbed with covering the cost of the survey when both schools and the larger community benefit from the data and maps. In truth, the system was designed this way because the initial MDI pilots had been supported by school districts, and not every region has a consistent community organization that could be relied upon for support.
Since this query was raised, however, the MDI implementation model has been adjusted to encourage partnerships between school districts and community organizations to bring the MDI to their area. A beneficial side-effect of this model is that schools and communities become equally invested in promoting the use of the results as well as sharing ongoing communication with school partners.

Secondly, a major challenge that we have experienced has been the struggle between keeping the MDI items and reporting consistent over time versus adapting items based on knowledge user feedback. From a research perspective, it is integral that measurement tools stay consistent over time in order to make appropriate comparisons and monitor annual changes in children’s social-emotional outcomes. From knowledge user and participant perspectives, however, some of the initial MDI measures have proved cumbersome for teachers to administer (e.g., completing the after-school activities section takes students a long time) or reporting methods have been difficult to understand (e.g., reporting the data in relative tertiles lost meaning once the survey was expanded to multiple school districts). Over the past six years, there have been cases where a problem was deemed significant enough to warrant changing either the survey measure itself or the reporting structure. However, in our experience, every ‘improvement’ made has been matched by significant losses in comparability of data that has frustrated researchers and knowledge users, alike. One solution to circumvent this problem has been to provide school districts and communities with raw data tables that lack attractive visualization but nonetheless remain comparable from year to year.

4.2. Unintended consequences

Related to the threat of lack of data comparability across time, an anticipated consequence of the MDI has been the lack of comparable relevance of some of the measured indicators across place. Within BC, rural communities in particular felt unrepresented in the list of after-school activities that was provided in the original survey. For example, youth organizations such as Girl Guides/Scouts or instructor-based activities such as tennis or gymnastics were perceived as activities that would only be attended by children of a certain affluence or demographic. Many children did not see themselves in a survey that was designed to represent all children. Experience tells us that the issue of cultural relevance will only become larger as we expand the MDI survey nationally and internationally. At the time of writing, the MDI has been piloted within Canada as far as the Northwest Territories, Nova Scotia, and Ontario, and internationally within Australia, Croatia, the United Kingdom, and Peru. Again, attempts have been made to solve this problem by providing abbreviated versions of the survey that only include the personal and interpersonal social-emotional indicators but do not measure after-school time, or provide flexibility to adapt the time use section to reflect local activities. However, the struggle to meet the needs of diverse communities while retaining the uniformity of the measure is a continual conflict that has not yet been fully resolved.

Another unintended consequence of the MDI survey has been survey fatigue. Although being able to link MDI results to kindergarten EDI data (teacher completed school readiness ratings) and grade 4 and grade 7 FSA (student-completed standardized academic achievement tests) remains a desirable feature for many stakeholders, we discovered that many of the grade 4 and grade 7 teachers were weary of administering multiple school-based surveys in one year when it was unclear how the MDI could benefit their school or students. Although we provided teacher letters, webinars, and had staff available by phone throughout the implementation window, the MDI’s unique funding model and inconsistent diffusion across the province made it difficult to support teachers through traditional means, such as facilitating professional development days or providing in-person assistance. Accordingly, there was push-back that the MDI survey was taking too much class time in a year when students also completed the FSA and a provincial “student satisfaction survey.” The implementation team’s primary justification for this was that administering the MDI in the same year provided a holistic picture of children’s development that would be missed by measuring children’s academics alone. Before implementing the MDI in schools the implementation team also ensured that we received endorsement from the BC Teachers’ Union. Whereas teacher support for the FSA is low, by opening communication channels with educators we have been able to garner relatively high support for the MDI survey.

Finally, the comparability between the EDI and MDI – which was also initially perceived as a stakeholder benefit – ended up causing confusion when it came to the design of the maps. A heat map typically shows a saturation of color where an indicator is most prevalent. However, based on key informant interviews with MDI knowledge users, it was discovered that knowledge users who were already familiar with the EDI maps (where darker colors represent higher vulnerability) found difficult to interpret the MDI maps (where darker colors represent higher assets). Although different colors were used for each survey, the similarity of the maps (due to shared neighborhood boundaries to facilitate comparison) continues to prove difficult for a number of knowledge users that are involved in cross-cutting action plans across early and middle childhood.

4.3. Conclusions and future directions

From the outset, the goal of the MDI was to develop an assessment tool that reliably and validly measured children's social-emotional skills that at the same time facilitated improvements to children's environments by identifying modifiable, "actionable" factors such as adult and peer connectedness, sleep and nutrition, and after-school opportunities. The MDI measure has been well-received by participants and stakeholders and is garnering more national and international interest. Knowledge users also report high satisfaction with the reports and maps. Furthermore, from an academic standpoint, data collected from the MDI have significantly contributed to an improved understanding of the importance of social-emotional well-being in the middle years and identification of factors that predict children’s health and well-being throughout childhood and adolescence (Gadermann et al., 2015; Guhn, Schonert-Reichl, Gadermann, Hymel, & Hertzman, 2013; Guhn et al., 2016; Oberle et al., 2014b). The questions that remain are whether the data are consistently being used by all knowledge users, and what real impacts these are having for children. Although we have seen examples of the MDI’s usefulness — to advocate for children’s services, unite stakeholders around a common goal, or initiate a process of further inquiry — we have also heard stories of administrators not sharing school reports (for example, because of a lack of confidence that child self-report data have any value). Continued research that cross-validates MDI results and EDI data (e.g., Guhn et al., 2016) will begin to address this issue, however it speaks again to the importance of buy-in. Particularly as social-emotional development becomes integrated into education systems within BC and worldwide, it will be critical that assessment systems engage schools and communities early and meaningfully in their evaluations in order to facilitate the full utilization of the data and promote collaborative initiatives that optimize the chances of improving social-emotional outcomes for children.

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