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Improving On-Task Behaviour in Grade Four and Five Indigenous Students with the use of Movement Integration.

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Abstract

The purpose of this study was to examine the effects of movement integration on the on-task behavior of Indigenous grade four and five participants at an on-reserve school. Movement integration is the use of physical activity in the classroom during normal classroom time. Movement integration can improve learning behaviors and outcomes for children. This community-based research project utilized participatory action research methodology, which engaged teachers and community leaders in its design. On-task behavior was assessed for thirteen participants through direct observation. A two way [time x period] repeated measures ANOVA revealed a significant interaction [$F(1, 12) = 36.067$, $p < .001$]. The movement integration intervention was effective in improving the on-task behavior of the participants.

***Keywords*:** Indigenous participatory action research; community-based; on-task behavior; movement integration.

Résumé

Le but de cette étude est d'examiner les effets de l'intégration d'activités de mouvement sur le comportement approprié ("on-task behaviour") d'élèves autochtones de 4è et 5e année dans une école située dans une réserve autochtone. L'intégration d'activités de mouvement est une utilisation d'activités physiques en classe durant les heures normales de classe. Ce projet de recherche communautaire a utilisé une méthodologie de recherche-action participative où les enseignants et les leaders de la communauté se sont impliqués dans la planification. Le comportement approprié de 13 élèves a été évalué par une observation directe. Une ANOVA à deux facteurs (temps X période) sur des mesures répétées a révélé une interaction significative. L'intégration d'activités de mouvement s'est avérée efficace pour augmenter les comportements appropriés des participants.

Mots clés: autochtone; recherche-action participative; communauté; comportement approprié;integration d'activités de mouvement.

Introduction

Physical activity is fundamental in the healthy growth and development of children (Janssen & Leblanc, 2010). Not only does physical activity promote muscular and skeletal growth, it aids in the prevention of chronic disease in childhood and later in life (Jansen & Leblanc, 2010). Physical activity is also important for psychosocial health, improving self-esteem, reducing depression and anxiety, while supporting learning and brain development (Biddle & Asare, 2011; Tomporowski, Lambourne, & Okumura, 2011). Research looking specifically at learning, academic performance, and physical activity conducted over the past decade, indicates that physical activity is positively related to academic outcomes such as standardized tests, executive functioning, on-task behaviour, and school enjoyment (Webster, Russ, Vazou, Goh, & Erwin, 2015).

Children spend most of their day at school, making it an ideal place to optimize the interrelated benefits of physical activity and academic performance. However, this potential is often not realized due to time and budgetary constraints limiting the inclusion of daily physical activity in the curriculum (Riley, Lubans, Morgan, & Young, 2015; Vazou & Vlachopoulos, 2014; Webster et al., 2015) and the [public] view that physical activity is in contradiction to academic achievement (Donnelly & Lambourne, 2011). In an effort to maximize the positive link between physical activity and learning, researchers and educators have collaborated to examine movement integration that incorporates academic content. Movement integration is built on a model of short activity periods within the traditional sedentary academic instruction period. During these periods, some type of physical activity occurs in the classroom. Often the physical activity is done in a way that it reinforces what is being taught in the lesson plan or curriculum (Donnelly & Lambourne, 2011). Curriculum incorporated movement integration has many positive outcomes; it increases physical activity, reinforces academic content, and positively enhances multiple measures of academic performance (Erwin, Fedewa, Beighle, & Ahn 2012; Grieco, Jowers, & Bartholomew, 2009; Mahar et al., 2006; Rasberry et al., 2011) all the while preserving the majority of the time allotted to academic instruction (Bartholomew & Jowers, 2011).

Many outcomes can be measured in response to movement integration; of these, on-task behaviour may be one of the most valuable outcomes to assess (Greenwood, Horton, & Utley, 2002; Marks, 2000; Mahar et al., 2006). On-task behaviour is behaviour that follows the class rules and is appropriate to the learning situation (Mahar et al., 2006). When students are on-task the teacher can teach the curriculum, and the students have the opportunity to learn in a productive learning environment (Mahar, 2011). On-task behaviour is also related to all aspects of learning and is not subject or content specific (Greenwood, 1991). Research results have demonstrated a positive effect of movement integration on on-task behaviour (Carlson et al., 2015; Grieco et al., 2009; Mahar et al., 2006; Mullender-Wijnsma et al., 2015; Riley et al., 2015).

Despite the growth in this area of research, gaps still exist. Previous work has not addressed the identities of participants (Rasberry et al., 2011). Many studies do not explain who their participants were in regards to their ethnic composition, while the studies that do give better descriptions of their participants identify them as primarily Caucasian. Different cultural groups have distinct values and beliefs, particularly around physical activity, that may vary from other cultural groups (Kerpan & Humbert, 2015). The values a person or group hold about physical activity affects how physically active they are and whether they promote physical activity to others, such as students or children (Kerpan & Humbert, 2015; Webster et al., 2015). The same

holds true for values around learning and academic performance (Musquash & Bova, 2007; Preston, Cottrell, Pelletier, & Pearce, 2015).

Thus, it is important to investigate whether movement integration is of value to different cultures and if so, how might it be implemented in a way that harmonizes with beliefs and behaviours of that specific group. Likewise, researchers have yet to ask groups of people from different cultures if the outcomes measured in respect to movement integration are important to them, and thus worth investigating within their community. These questions and approaches to examining movement integration are congruent with decolonizing research strategies, which place the perspectives and interests of communities at the centre of the research (Zavala, 2013). Decolonizing research strategies for movement integration, and physical activity research in general, need to incorporate ongoing collaboration, flexibility, and ensure that the groups or communities who are engaging in the research process hold decision making power (Wilson, 2001; Zavala, 2013).

Indigenous Education

To our knowledge, physical activity and outcomes associated with learning have not been studied specifically with Indigenous Peoples in Canada. The term Indigenous Peoples is an inclusive term that globally represents descendants of those who inhabited a geographical region prior to colonization (First Peoples Worldwide, 2016). In this paper, the term Indigenous is used to represent all Aboriginal groups in Canada: First Nations, Métis, and Inuit (Constitution Act of Canada, 1982). If a certain group is specifically being referred to, as defined by the Canadian Constitution, or research pertaining solely to that group is being discussed, then that group's particular name will be used.

Canadian Indigenous children as a whole are distinct in that they fall behind in most indicators of academic success (Friesen & Krauth, 2009; Mushquash & Bova, 2007). The national rate of high school non-completion for on-reserve Indigenous Peoples is approximately 61% (Statistics Canada, 2013). In the 2008/2010 First Nations Regional Health Survey, data showed that 14% of First Nations children living on reserve aged 6 to 11 years repeated a grade, compared with 3.5% of children in the general Canadian population (First Nations Information Governance Centre, 2012). Aside from this survey, there is very limited national data on the educational outcomes of Indigenous elementary school children (Canadian Council on Learning, 2009), but off reserve provincial and school-level data indicate that a large achievement gap exists between Indigenous children and non-Indigenous children (Friesen & Krauth, 2009; McCarty, 2009; Steeves, Carr-Stewart, & Marshall, 2010).

The disparity in academic outcomes that exists between Indigenous children and non-Indigenous children does not exist because of individual deficits (Baydala et al., 2009). This academic achievement gap is related to processes that use education as a tool for assimilation and oppression, including the Canadian Indian Residential School System and contemporary Euro-Western education methods (Battiste, 1998; The Truth and Reconciliation Commission of Canada, 2015). For over 150 years the Government of Canada removed Indigenous children from their homes and communities and placed them in Residential Schools for the purpose of colonization (The Truth and Reconciliation Commission of Canada, 2015). The legacy of the Canadian Residential School System has caused damage of grand proportions still visible in the Canadian education system and Indigenous communities across the country (Preston et al., 2012; The Truth and Reconciliation Commission of Canada, 2015). Although Indigenous children no longer attend Residential Schools they are still educated in a largely Euro-Western Canadian education system, where the knowledge, values, and beliefs of Indigenous communities are not always integrated or even recognized (Battiste, 1998; The Truth and Reconciliation Commission

of Canada, 2015). In addition to these issues, many on-reserve schools face enormous challenges in providing quality educational experiences for their students due to chronic under-funding and poor infrastructure (Haldane, Lafond, & Krause, 2013).

The Congress of Aboriginal Peoples has identified some strategies to address the disparity in educational success that Indigenous children experience, which include: integrating Indigenous pedagogy, appropriate assessment, teaching resiliency, parent and community involvement, connection to Indigenous role models, and early intervention when necessary (Congress of Aboriginal Peoples, 2010). There is a body of evidence emerging that indicates that integrating Indigenous knowledge and pedagogical principles is a promising practice, and more focus needs to be given to exploring and developing Indigenous pedagogy (Baydala, et al., 2009; Battiste & Henderson, 2009). Indigenous pedagogy features learning through experience, observation, individualized instruction and assessment, and enjoyment, all while bringing together Indigenous values and knowledge in a holistic and flexible manner (Battiste, 2002; Battiste & Henderson, 2009). The Congress also notes that there is a need for empirical research on all initiatives and strategies to support academic success for Indigenous students.

In addition to the need for rigorous research on factors that may contribute to academic success for Indigenous children, it is crucial to work with Indigenous communities to investigate ways to reduce the education gap and ensure that the outcomes are of value to the community (Mushquash & Bova, 2007). Often in research, Indigenous communities are constrained to the investigation of variables that are seen as important in Euro-Western culture and their beliefs and values are not integrated into the research process (Oosman, Smylie, Humbert, & Henry, 2016). In this study collaboratory processes were utilized to ensure that the research, including the variable under investigation, was reflective of the community's values. Thus, the purpose of this study was to collaborate with Indigenous school partners to examine the effects of movement integration on the on-task behaviour of Indigenous students.

Methods

Participatory Action Research

Participatory action research (PAR) methodology was used to guide this study. PAR is community engaged research that shares power with, and engages community partners in the research process that aims to enact change and action (Baum, MacDougall, & Smith, 2006; Israel, Eng, Schulz, & Parker, 2005). The partnership between researchers and community partners in PAR is based on both parties having valuable knowledge, not just the researchers (Baum et al., 2006). PAR is an appropriate methodology for researching with an Indigenous community because it can produce relevant research that may enact change through decolonizing approaches. The fundamental principles of PAR: meaningful relationships, shared power, collaboration, long-term engagement, and mutual benefits, all contribute to research that is done in a decolonizing way (Canadian Institutes of Health Research et al., 2014; Zavala, 2013).

PAR has been utilized succesfully in school settings with Indigenous youth over the past decade (McHugh & Kowalski, 2009; Oosman et al., 2016). PAR is an excellent fit within an Indigenous school setting because it requires and fosters strong relationships. In both schools and Indigenous communities relationships are crucial to engaging in research. In schools particularly, relationships are often formed with all types of school members: administration, teachers, and students, which allows for a rich understanding of the setting and a well-informed project (McHugh, Kingsley, & Coppola, 2013; Oosman et al., 2016). Relationship building as a research process is crucial to conducting decolonizing research (Wilson, 2001). Throughout all the stages of this project, the primary researcher engaged in reciprocity with the school community by

regularly volunteering to help at school events such as feasts, recess and lunch supervision, and aided in classroom activities. These actions resulted in the development of positive relationships throughout the school community.

Within the school-based physical activity and learning literature there have been few, if any, studies that have used a PAR model. A review concluded that research on classroom-based physical activity should be developed in consultation with teachers because teachers hold valuable knowledge on the students they teach (Rasberry et al., 2011). Likewise, when teachers are involved in the development of interventions for their students, there is a much higher likelihood of sustainability for that intervention (Riley, Lubans, Holmes, & Morgan, 2016).

For this study, researchers, school leaders, and teachers worked together from the beginning stages of designing the study to the final stages of determining what further actions should occur and how the results were to be used. Key decisions, such as how the principles of ownership, control, access, and possession (OCAP) were going to be upheld were laid out in a community research agreement (First Nations Information Governance Centre, 2016). OCAP is defined as First Nations having control over data collection processes in their communities and control over the storage and use of that data (First Nations Information Governance Centre, 2016). The key features of PAR, respectful relationships and collaboration, assist in ensuring OCAP principles are upheld because research decisions are made together with the best interest of the community in mind (First Nations Information Governance Centre, 2016). For this project specifically, it was decided that the primary researcher and school would co-own the data, the data would be stored by the primary researcher, and accessible at any point by the school. Decisions on how and where to disseminate findings were also placed in the research agreement.

The first stage of this PAR project was consulting with teachers and school administrators on the role of physical activity in their school community. It was clear that the school had strong values around physical activity and wanted to find more ways to provide movement opportunities for their students. Based on these conversations the researcher decided to share some of the emerging research regarding classroom physical activity; however, it was explained that if the school wanted to collaborate on a project, the topic of investigation did not have to be movement integration. There was a great deal of interest when discussing movement integration because of the dual benefit of additional physical activity and potentially improved learning outcomes.

The second stage of the PAR process was working to design an intervention with processes and outcomes that aligned with the schools needs and values. To do this the researcher provided a host of examples of timelines, study designs, and outcomes to evaluate to a group of teachers and administrators (n=12). There were only a few timeline and study design options that worked around winter break, spring break, and the small class sizes, so this collaborative decision was easily made. The outcome of assessment, on-task behavior, was highly favored by the school members because of its universal applicability to learning. Whether young people are learning technology, math, or cultural teachings, they need to be on-task so that learning can occur (Greenwood et al., 2002; McClelland & Cameron, 2011; Rink, 2001).

The third stage of the PAR process was conducting the intervention. The emergent and flexible nature of PAR was imperative in this stage. Intervention delivery needed to work around school events that would periodically come up, such as ceremonies, field trips, and school closures due to weather. Despite some changes that had to be made during data collection the rigor of the study was preserved due to the extra time allotted in the data collection phase.

The fourth stage of this PAR project was disseminating findings to the school, First Nation community, and the greater educational and research community. This included reviewing findings with teachers and school leaders and deciding together what content would be

included in community reports and research publications.

The final stage of this PAR project was determining what the next actions, if any, would be. During this stage, two of the three key collaborators, including the school principal, took positions at other elementary schools. Findings were discussed with the new principal and it was decided that a workshop on movement integration should be provided to all teachers at the beginning of the following school year. The workshop was delivered, and shared research that supports movement integration, advice on safely engaging students in classroom physical activity, examples of movement integration activities, and take-home resources. Unfortunately, because of the changes in the school staff and other projects that were being developed, no further plans were made to continue on with this research project.

Participants

This study was conducted in a grade four and five combined class at an on-reserve elementary school located half an hour from a Canadian prairie city. The entire class of fourteen students took part in the movement integration intervention; however, data were only collected on students who assented to participate in the study and whose parents provided consent. Thirteen students (n=13) gave both assent and received parental consent (92% participation rate). Ethical approval for this study was acquired from the researcher's university ethics board and from the participating school's First Nation Council.

The teacher of the grade four and five combined class is a First Nations woman who earned her education degree at a large Canadian university and had been teaching for seven years. This teacher had no prior experience or training in integrating physical activity into her classroom.

The mean age of the participants was 9.5 years old and 57% of the participants were male. The power calculation to determine sample size was done using G Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009). An effect size of 0.6 was used in the calculation; this was based on previous work by Mahar el al., (2006). Using α of 0.05 at 80% power, it was predicted that six participants were needed to yield a significant effect when combined with the repeated-measures design that allowed for a within-subjects factor with four levels that utilized the same participants in four measurements over time. Repeated measures designs increase statistical power for detecting a change and they allow for a more decisive assessment of within-person change over time (Guo, Logan, Glueck, & Muller, 2013).

Intervention

The movement integration intervention was a series of physical activities that included curricular content. At the request of the teacher, the researcher led the activities. The teacher explained that she would feel more comfortable learning to use the activities by watching the researcher use them throughout the intervention phase. The activities were taken from *Energizers*, developed by the Activity Promotion Laboratory in the Department of Exercise and Sport Science at East Carolina University (Mahar, Kenny, Shields, Scales, & Collins, 2010). In a previous study by Mahar et al. (2006), it was established that *Energizers* improved on-task behaviour for participants. *Energizers* are available free of charge from the East Carolina University Department of Exercise and Sport Science website (http://www.ecu.edu/cs-hhp/exss/apl-projects.cfm). The researcher suggested the use of *Energizers* to the teacher and school leaders involved in the study design because of their previous success in other studies. Another benefit of *Energizers* is that they require no equipment, other than basic classroom supplies such as paper, tape, and pens.

In the morning, before school started, the researcher and teacher would get together and

pick out the Energizer activities for that day to ensure the content of the *Energizers* reflected the content being taught in the lessons. During the intervention, *Energizers* were used during classes where students were learning literacy skills such as reading and writing, or during social studies when students were learning about geography or history. An example of one of the *Energizers* used in this intervention was Frozen Vocabulary. The class would be divided into two teams (e.g. boys vs. girls) and an activity would be called out such as jumping jacks, hopping, knee lifts, or twists and the students would do it until the researcher instructing the activity said "freeze". Students would stop what they are doing and the researcher would ask a student to spell one of the weekly vocabulary words or use it correctly in a sentence, if the student performed the task correctly their group got a point. Then the researcher would call out another activity to be done while she selected another word for another student on the opposing team. The game would continue on for five minutes and students from both teams were given multiple opportunities to spell and use words correctly while engaging in physical activity.

Assessment of On-Task Behaviour

The measurement of on-task behaviour was conducted according to the guidelines established by Mahar (2011). This required (a) accurately defining the behaviour so it can be measured reliably; (b) training observers to be objective and nonjudgmental; (c) ensuring inter-observer reliability prior to field research; (d) ensuring inter-observer reliability in the research data.

The definitions for on and off-task behaviour used for this study were similar to those used in previous research (Grieco et al., 2009; Mahar et al., 2006; Shapiro, 2011). The six categories used were: on-task motor, on-task verbal, on-task passive, off-task motor, off-task verbal, and off-task passive. Each of these six coding categories had specific operationalized definitions and a list of examples of behaviours. See Table 1 for definitions and examples of on- and off-task behaviours. After each observation period (discussed in subsequent section) a frequency count of how many times the individual participants were on and off-task was conducted. From that, a percentage of on-task behaviour was calculated. For example, if a participant was measured ten times in the observation period and six of those measures were of the three on-task categories (on-task motor, on-task verbal, on-task passive) then they were recorded as 60% on-task for that observation period.

Table 1
Definitions and Examples of On- and Off-Task Behaviours

Behaviour	Definition	Examples
On-task Verbal	Any time the student is verbally engaged in the topic being taught.	Asking questions related to his/her work, talking to others about work, answering questions when requested to do so.
On-Task Motor	Any time the student is actively attending to the assigned task.	Writing, raising a hand, and leaving his/her desk for a reason applicable to the assigned task.
On-Task Passive	Any time the student is passively attending to the assigned task.	Listening to the teacher, looking at their work, listening to a peer talk about the assigned task.
Off-task Verbal	Any audible verbalizations that are not permitted or not related to the assigned task.	Talking to others about unrelated topics, making unauthorized comments, or noises.
Off-Task Motor	Any instance of motor activity that is not directly associated with the assigned academic task.	Reading or writing inappropriate or unassigned material, leaving the desk without receiving permission, physically touching other students.
Off-Task Passive	Any time a student is passively not attending to assigned academic task.	Gazing off, placing his/her head on the desk, looking at other students when not part of a given task.

A two-observer system was used for this study to ensure reliability of the results. The observers were a research assistant and the primary investigator. In a pilot phase, the two observers trained to conduct the on-task measurement in another elementary school with the same age of students. The observers reviewed and memorized the data collection protocol and the operational definitions for each observational category (on-task motor, on-task verbal, on-task passive, off-task motor, off-task verbal, and off-task passive). The inter-rater reliability for the observers assessing on-task behaviour and off-task behaviour during training was found to be Kappa = 0.615 (p <.0.001), 95% CI (0.788, 0.442). This indicated there was substantial agreement between the observers. During data collection for the study, the second observer was present for 50% of the observations. The inter-rater reliability for the actual study observations was found to be substantial with Kappa = 0.666 (p <.0.001), 95% CI (0.701, 0.630).

Study Design

This study used a two-way, [time (beginning of lesson vs end of lesson) x phase (active lesson vs non-active lesson)] repeated measures design. The study was three weeks in length. The length of the study was dictated by the school's schedule; three-weeks was the longest period of time without a substantial break such as winter break, spring break, and Easter break. Moreover, there is no strong evidence available yet for a specific length of physical activity intervention that is successful at improving learning or learning behaviours. In previous research examining classroom-based physical activity, the interventions ran from one week to three years. Studies examining on-task behaviour specifically have ranged from three weeks to an entire school year. The three-week study by Ma, Le Mare, and Gurd (2014) was successful at improving on-task behaviour. The three-week study was divided into one week of non-active lessons and two weeks of active lessons (intervention). A longer intervention phase was chosen

to allow for more time for an intervention effect to take place.

During the non-active lesson phase, the teacher would teach through all of her lessons without any physical activity break during the lessons. Most lessons were approximately 45 minutes and covered one subject (e.g. spelling, and reading). Observations of on-task behaviour during the usual practice phase started five minutes into the lesson and continued for the next fifteen minutes. Starting five minutes into the lesson allowed the students the time to settle into regular instruction. After observing on-task behaviour for 15 minutes, observers would then take a five-minute break to replicate the time that the intervention would take in the following weeks. After the five-minute break, observation of on-task behaviour continued for another 15 minutes. Accordingly, there was a total of 30 minutes of on-task behaviour observation broken into two 15-minute time frames during the 45 minute classes. The two 15-minute observation blocks were chosen as it allowed for maximal observation time of on-task behaviour in the 45-minute class. Also, 15-minute observation blocks were used by Grieco et al. (2009) in a similar study on movement integration and on-task behaviour. On-task behaviour was measured twice each day, once in the mid-morning class and once in the mid-afternoon class. During the active lesson phase the same observation pattern was followed, however, there were five minutes of movement integration between the two observation periods. All lessons were taught at the same time of day, covered the same academic subject, and were the same length in time in both phases.

Momentary time sampling was used to measure on-task behaviour. This requires that observers record what happens exactly at a predetermined moment (Hintze, Volpe, & Shapiro, 2002), and is a method that has been shown to give an accurate estimate of percentage time when sampling intervals of less than 30 seconds are used (Saudargas & Zanolli, 1990). The momentary time sampling interval length for this study was 10 seconds. During piloting, ten seconds was found to be an adequate amount of time to record the behaviour and locate the next participant listed on the on-task behaviour-recording sheet. Each observer wore a wireless headset that delivered a synchronized beep every ten seconds. At the moment the beep occurred the behaviour of the participant was recorded, and then the observer visually located the next participant on the list and waited for the next beep. Once all thirteen participants were recorded, the observers would start again and record all the participants again. This pattern was continued until the 15 minutes were up. The extensive volunteering at the school aided the researchers in identifying the participants, allowing them to visually locate students in a short period of time.

On-Task Data Analysis

Mean on-task behaviour was calculated for the beginning of lesson and end of lesson in both the non-active lesson phase and the active lesson phase, resulting in four means. The six off and on-task categories were collapsed into two categories, off-task and on-task. Group series means were used to replace missing data from participant absentees (Tabachnick & Fidell, 2013). All data was checked for normality and analyzed using SPSS 20.0. A two-way, [time (beginning of lesson vs end of lesson) x phase (active lesson vs non-active lesson)] repeated measures ANOVA was used to observe for a significant interaction between time and phase. Significance was accepted at $p<0.05$ for the interaction. Paired t-tests were used to analyze main effects after a significant interaction was observed. The paired t-tests were used to analyze differences between beginning of lessons in both the active and non-active phase, end of lessons in both the active and non-active phase, beginning of lesson and end of lesson in the non-active lesson phase, and beginning of lesson and end of lesson in the active lesson phase.

Results

A two way [time (beginning of lesson vs end of lesson) x phase (active lesson vs non-active lesson)] repeated measures ANOVA was conducted to determine if the classroom-based physical activity intervention was successful in improving on-task behaviour for participants. The analysis revealed a significant time x phase interaction [$F(1, 12) = 37.96$, $p < .001$] [Figure 1]. The partial eta-squared was $\eta 2 = .76$, indicating a large effect.

When the participants received no physical activity intervention half way through their lesson there was a significant decrease in their ability to stay on-task (78.7% ±6.1 to 68.9% ±9.8, $p < .05$). This was in contrast to an improved ability (65.1% ±9.9 to 78.7% ±6.1, $p < .001$) to stay on-task when the participants received a physical activity break half way through the lesson. There was also a significant difference ($p<.05$) in the end of lesson scores in the non-active lesson phase and the active lesson phase. During a lesson with no physical activity intervention the on-task behaviour percentage of the class was 68.9% for the last 15 minutes of the class. However, when the participants did receive the physical activity intervention the on-task behaviour percentage at the end of the class was 78.7%. Mean on-task behaviour percentages are shown in table 2.

Table 2
Mean Percentages of On-Task Behaviour

Percentage of on-task behaviour	Non-active lessons		Active lessons	
	Beginning of lesson	End of lesson	Beginning of lesson	End of lesson
Mean	78.7	68.9*	65.1	78.7***
SD	6.13	9.8	9.9	6.1
Minimum	69.2	53.6	46.4	69.2
Maximum	91.76	84.4	78.5	91.8

*Differences in on-task behaviour were statistically significant, $p < 0.05$
*** Differences in on-task behaviour were statistically significant, $p < 0.001$

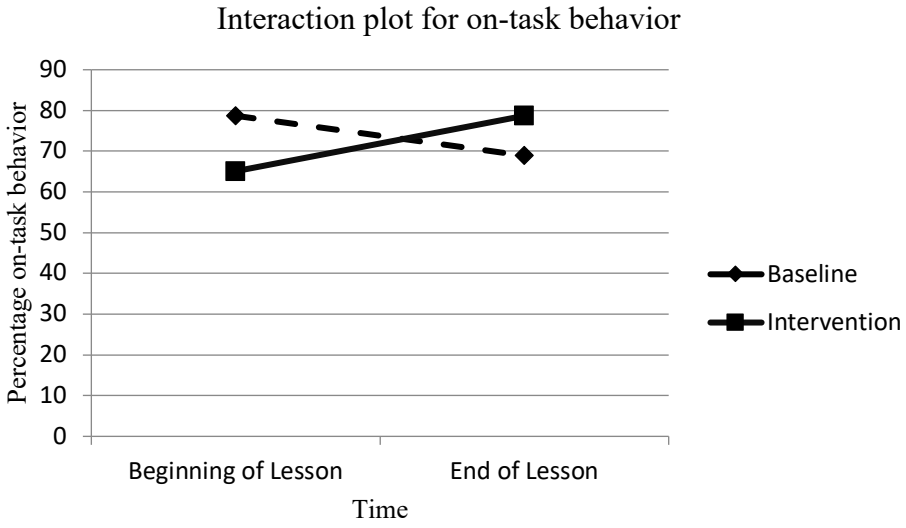

Figure 1. Interaction between phase and time predicting on-task behaviour for children in grades 4 and 5.

Discussion

On-task behaviour is critical to student learning and an enabling factor in academic achievement (Carlson et al., 2015; Greenwood, 1991; Greenwood et al., 2002). This study demonstrates that physical activity that occurs in the classroom and integrates curricular content may be a way to improve on-task behaviour. These findings are consistent with the literature available on movement integration and on-task behaviour. Previous studies with similar designs and participant ages showed improvements in on-task behaviour in the range of 2% to 20%. Mahar et al. (2006) demonstrated an 8% increase in on-task behaviour when examining the effect of *Energizers* in grades three and four students, while Grieco et al. (2009) only showed a slight increase of 2% in on-task behaviour after a movement integration intervention in a group of grade three students. A 20% difference in on-task behaviour with children age 10-12 was noted by Riley et al. (2015) between the movement integration intervention group and control group. Ma et al. (2014) showed a 9% difference in on-task behaviour between the control and intervention group with children in grades three and four. Results from the current study showed that the participants improved their on-task behaviour score by nearly 14% after movement integration, situating the findings within the range seen in previous research.

In order to further support academic success in Indigenous children there needs to be more high quality research assessing strategies to improve Indigenous children's learning (Canadian Council on Learning, 2009; Congress of Aboriginal Peoples, 2010). This study reveals information on an instructional strategy that may assist Indigenous children in staying on-task at school, and this could lead to increased academic success. Moreover, this research utilized rigorous methods to investigate an instructional strategy. Accordingly, an important strength of this study was that it examined an instructional method through rigorous research.

Another strength of this study was that it assessed an instructional method to improve the on-task behaviour of Indigenous children instead of only examining cognitive abilities or standardized tests of intelligence as the outcome. Measuring a child's intelligence does not help

improve that child's academic success, nor does it consider the individuality of the learner (Congress of Aboriginal Peoples, 2010; Musquash & Bova, 2007). Moreover, standardized measures of intelligence that draw out information that has been delivered to the masses in a standardized format are Eurocentric in origin (Battiste, 2002). What Eurocentric methods of assessment lack is a life-long learning approach; teaching and assessing a child's ability to learn in diverse contexts and apply knowledge to unfamiliar situations (Battiste, 2002; Congress of Aboriginal Peoples, 2010).

A distinct feature and strength of this project, was that it was done in collaboration with an Indigenous community and with Indigenous educators through a participatory action research framework. For over 150 years' Indigenous communities had no say in the education of their children (The Truth and Reconciliation Commission of Canada, 2015). To begin to reconcile it is imperative that Indigenous communities are enabled to lead the development of education strategies for their children and be true partners on educational research (The Truth and Reconciliation Commission of Canada, 2015). When Indigenous leaders, educators, and parents who know their children and community intimately become curriculum decision makers, education can be tailored for success.

The study design, intervention, and methods described in this paper are very similar to those used by Mahar and colleagues in their 2006 study examining on-task behavior and movement integration with grade three and four students. This is a strength of the research presented, as replication of interventions is rarely done (McPherson, 1978; Rotheram-Borus, Rebchook, Kelly, Adams, & Neumann, 2000). Replication is a valuable scientific exercise as it helps ensure that findings and theories hold true over time and in similar, but different, contexts (McPherson, 1978). Interventions that are based upon rigorous research, replicated where possible, can add to a teacher's repertoire.

A limitation of this study was the significant difference ($p < .001$) between the beginning of lesson scores of on-task behaviour in the non-active lesson phase and the active lesson phase. In the non-active lesson phase, the on-task percentage during the first 15 minutes of class was 78.7% and in the active lesson the average was 65.1% for the first 15 minutes of class. The participants were more on-task at the beginning of the lesson in the non-active lesson phase and it could be argued that because of this they were more likely to decline in their ability to stay on-task. Likewise, in the active lesson intervention phase the students started the lessons less on-task and subsequently were more likely to improve their on-task ability. These findings indicate that there may be a regression towards the mean issue and thus the intervention may not have been the only reason the participants increased their ability to stay on-task during the active lesson phase. The reason for this difference in beginning of lesson scores is unknown. One potential reason, that has not been substantiated, is that the participants may have been less attentive in the time prior to the start of the intervention because they were excited in anticipation of the *Energizers*. Although this is a limitation, it should be noted that the participants in both of these phases were in the third quartile of on-task behaviour scores (between 50-75% on-task).

A further limitation present in this study was that the researcher was the person who ran the intervention activities, not the classroom teacher. The teacher stated she would feel more comfortable if the researcher ran the movement integration intervention so that she could watch and learn. Because the researcher delivered the intervention the interval validity of the study was increased and the intervention was delivered as planned; however, this resulted in a lack of ecological validity.

The research assistant and primary researcher were not blinded to the hypothesis or what phase the study was in (non-active phases or active phases) resulting in a further limitation. The study would have been strengthened if the individuals collecting data were not aware of whether

they were collecting on-task data in the control or intervention phase of the study. However, this would be challenging, as the principal investigator was the person conducting the intervention activities. Furthermore, even if research assistants were brought in to collect the on-task data and blinded to the research phase they would still be able to clearly see that the children were just active (heavy breathing, sweating, need for water) when brought into the classroom to collect data.

A final limitation in this study was that the key collaborators at the school, those who worked most closely with the primary researcher and championed the project, did not live in the First Nation community where the study took place. Many members of the school community who lived and worked in the First Nation consulted on the project and worked to support it, but they were not the champions of the project. When it came time to evaluate the PAR process and determine what further actions could occur two of the three key collaborators had moved to different schools causing interest in the project to diminish. Future research with schools in First Nation communities should make every effort to find key collaborators and project champions who reside within the community, as this may increase the likelihood of them staying with the school community for longer periods of time.

Conclusion

The findings from this research have shown that movement integration may improve the on-task behaviour of Indigenous children in grade four and grade five. Movement integration has the potential to fill two needs with one action. It can increase physical activity and increase on-task behavior. Moreover, movement integration can be done in almost any classroom and does not require equipment, gym scheduling, or specific clothing. In addition to these pragmatic benefits, movement integration has many features that complement Indigenous pedagogy. Indigenous pedagogy features learning through movement, authentic experiences, and enjoyment (Battiste, 2002), all of which movement integration has the ability to realize. Future collaborations and research on movement integration with Indigenous communities should seek to develop and assess movement integration activities that integrate cultural teachings, to further align with Indigenous pedagogy.

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