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Learning in Motion: Teachers' Perspectives on the Impact of Stationary Bike Use in the Classroom

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Abstract. The potential of physical activity to support self-regulated learning in the classroom has encouraged the implementation of stationary bicycles across Canada and the United States. Positive testimonials suggest that their use by students has positive outcomes, but there is limited empirical evidence supporting the efficacy of this pedagogical practice. The current study analyzes teachers' perceptions of the use and impact of stationary exercise bicycles in classrooms as part of a community running program initiative through a nationwide survey of 107 participants. Key findings identify teacher perceptions of positive outcomes in students' social, emotional, and cognitive development, as well as to the learning environment. A small set of unique challenges were posed by the bike integration, including limited distraction and some scheduling difficulties. Teachers approached the integration of the bikes on a spectrum of control from "student-regulated" to "teacher-regulated" with some combination of both, and movement from teacher-directed use to more student-initiated use after the bike was in use for some time. The implications for the use of stationary bikes as a tool for self-regulated learning in an active classroom are discussed and future research measuring learning outcomes is suggested.

Keywords: self-regulated learning; active learning; elementary education; aerobic activity; teacher perceptions

Research across disciplines suggests that physical fitness and exercise have a positive effect on brain activity, working-memory, executive function, and emotion regulation, as well as a mitigating effect on age-related cognitive decline and disease (Berg, 2010; Pontifex, Hillman, FernHall, Thompson, & Valentini,

2009; Van Praag, 2009; Ratey, 2008; Shanker 2012; Sibley & Beilock, 2007; Tomporowski, Lambourne, & Okumra, 2011). Aerobic exercise acts as a stimulant to the brain, increasing cerebral blood flow, synaptic activity and neural connections, which potentially improve learning (Berg, 2010; Pontifex et al., 2009). Multiple studies testing brain function before a period of moderate to significant weekly exercise and afterward found that exercise improves overall brain function (Van Praag, 2009).

The cognitive effects of exercise are not limited to an increase in overall brain activation, but physical activity enhances neurotransmitter activity affecting higher order cognitive functioning, executive control, and working memory as well. A variety of studies have shown a relationship between exercise and complicated task performance, including increased inhibitory control, increased focus, and an improved ability to resist distractions (Hillman, Pontifex, Raine, Casterlli, Hall, & Kramer, 2009; Hillman, Snook, and Jerome, 2003; Pontifex et al., 2009; & Sibley & Beilock, 2007). It is therefore suggested that children's ability to regulate their emotions can be enhanced by aerobic activity which helps in the management of anger, stress, fatigue, and restlessness which can present roadblocks to on-task behaviour and readiness to learn (Berg, 2010; Mahar, Murphy, Rowe, Golden, Shields, & Raedeke, 2006; Ratey, 2008).

The importance of physical activity to the overall functioning of the human brain is recognized by scientific literature. One study found that aerobic exercise led to improved behavioural and academic performance for children with Attention Deficit Hyperactivity Disorder (ADHD) when compared to a control (Pontifex, Saliba, Raine, Picchietti, & Hillman, 2013). Additionally, Ratey (2008) describes the correlation between physical exercise and academic performance in a case study of a secondary school in Naperville, Illinois. Naperville students engaged in moderate to vigorous physical exercise *before* learning, resulting in improvements to student achievement, including increased test scores and an enhancement of students' attention, alertness, and relaxation. In addition to improving overall cognitive functioning, morning exercise increased students' capacity to ignore distractions and effectively regulate their emotions, thus improving students' ability to learn. The success of the Naperville Project provided the impetus for the adoption of similar programs throughout the United States, including the PE4life programs, which "have trained over one thousand educators and 350 schools to emulate their program" (Stattlesmair & Ratey, 2009, p. 370).

This evidence suggests that exercise can be used as a tool by teachers to help maintain and facilitate cognitive functioning in children. Tranter & Kerr (2016) identified physical exercise as an important 'up-regulating' strategy, to be used throughout the school day, particularly when students' focus might dwindle. Exercises included activities such as stretching, yoga, jumping jacks, and dancing. In Ontario, Canada, the Ministry of Education mandated 20 minutes of compulsory Daily Physical Activity (DPA) in response to research that identified advantages to student self-regulated learning (SRL), including student attitude, and willingness to meet the challenges of daily life (Ontario Ministry of Education, 2005).

Self-regulation can be conceptualized as a process of ongoing mental adjustment; one that requires the constant monitoring and modification of

emotions; focussing or shifting attention; controlling impulses; tolerating frustrations; and, delaying gratification (Shanker, 2012). Self-regulated learning (SRL) deals with equipping students with the skills necessary to observe their bodies and adjust their states of arousal to maximize the potential for learning to occur. This 'optimal' state requires staying alert, focused, and relaxed, and necessitates an intimate knowledge of one's emotional and physical states so that one could discern how these states are distracting or contributing to processing and assimilating information (Shanker, 2012). Cognitive mechanisms including executive functioning, inhibitory control, and concentration, necessary for self-regulation and a readiness to learn, are enhanced by physical exercise (Pontifex et al. 2009; Van Praag, 2009; Ratey, 2008; Sibley & Beilock, 2007; Tomporowski et al., 2011; Woltering & Lewis, 2009).

Monitoring and adjusting negative emotions is a necessary component of emotional self-regulation, but it is not sufficient. In addition to regulating or managing negative emotions, children must be encouraged to develop positive ones through nurturing feelings of self-worth and security (Shanker, 2012). Physical exercise could be seen as an activity that builds self-esteem and well-being in addition to countering stress, fatigue, anger, and anxiety. Physical activity has the potential to support self-regulation of negative emotions in a learning environment as well as increase feelings of self-esteem.

Educators across Canada have introduced classroom use of stationary bikes in an effort to improve SRL in children, promoting the control of both negative and positive emotions in preparation for learning. Bikes were intended to provide an opportunity for any student who is feeling distracted, anxious, tired, or angry throughout the school day to 'hop on' and pedal until he or she is ready to learn. Canadian national news media have reported largely positive teacher and student feedback following the implementation of stationary bike programs in public schools (Senick 2017; Thomson 2016; Mitton & Barth, 2016). Yet, one opinion piece (Bennett 2016) is more critical, stating that "Self-regulation – with or without spin bikes – may turn out to be another passing fancy in education reform." Further, in his opinion piece, Bennett (2016) notes the lack of research on the subject and asks "where's the research to support these classroom spin bike experiments?"

Indeed, the growing popularity of stationary bicycles in the classroom setting is contrasted with the absence of empirical study on the impact of this intervention on classroom dynamics and student learning. An analysis of the use of stationary bikes in classrooms should discern its effects on classroom management and dynamics, as well as its influence on student emotions and behaviours, including self-esteem, relaxation, mental awareness, and well-being. The current study initiates this necessary evaluation by examining teachers' perspectives of the impact of classroom use of stationary bikes, and the variables that might predict student self-regulation and learning outcomes.

Method

One hundred and seven Canadian teachers from urban, suburban, and rural schools from across the country completed a 44-question online survey about the use of stationary exercise bikes in their schools. Participating teachers worked in

varied school contexts, in which schools were either publicly or privately funded, with populations ranging from under 100 to over 500 students, with students in Kindergarten to Grade 12. All participants were enrolled in Sparksfly, a stationary bike program offered by Run for Life--a non-profit community organization that deploys bicycles into classrooms to support students' active learning and self-regulation.

The survey (see appendix A) was comprised of five parts including both forced-choice and open-ended questions examining consent; pedagogical strategies related to bike use; perspectives on observed behavioural outcomes; any challenges encountered during the implementation; and, demographic questions describing the schools and classrooms, funding, and future recommendations. Qualitative answers were recorded in Word documents and coded by two researchers for emerging themes. Any discrepancies were resolved through discussion.

Results

Description of Stationary Bike Use

The majority of teachers (83%) indicated that their stationary bikes were located in their classrooms, while the remainder were located in a resource room or in another type of shared space. The specific location within the classroom varied across respondents. Teachers indicated that their bikes had been in their current location for a range of time; from less than a month (11%) to more than a year (24.3%). A slight majority of teachers (52%) indicated that the bikes were somewhat new, in the present location for a few months.

The clear majority of teachers indicated that students used the bikes at least once per week (98%). Seventy five percent of teachers provided their students with specific bike-use guidelines while the remaining 25% did not. Among those teachers that did provide guidelines to their students, 68% gave instructions on turn-duration, ranging from one minute to 30 minutes, with 74% of teachers instructing their students to use the bikes for less than 10 minutes at one time. Qualitative answers indicated that duration of use depended on several factors, including demand and student need, e.g., "10 – 15 minutes depending on demand," or "at least 5 minutes," or "in my case, there is no misuse, and no time limit."

Participants were also asked to describe how they decided which students used the bikes and when. Qualitative answers were coded into four categories according to the degree of teacher/student control over the decision of by whom, and when, the bikes were used. Fifty-five percent of answers were coded as *student regulated,* while 19 percent of answers were coded as *teacher regulated*. A significant number of responses were coded as a *combination* of the two (17%), and 9 percent *changed approaches* beginning with a teacher regulated approach and later moved to a more student regulated method.

There were two *student regulated* subcategories, based on the degree of autonomy students were given to determine bike use. Some teachers allowed students to use the bikes on a *permission-basis*, according to which students first recognized their need to self-regulate, and then asked the teacher if bike use was permitted at that moment by raising their hand or displaying some type of

signal, e.g., "Students can use a hand signal to ask to use the bike any time when the teacher is at the front of the room teaching or explaining." Some teachers created an open/closed sign for the bike, and 'opened' the equipment's use during work periods or other independent work time and 'closed' it during instruction, while others allowed for constant student-controlled bike- use. The second subcategory in the *student regulated* theme, granted the most student control in determining bike-use. Decisions in this subcategory were based on a *first-come-first serve* basis. If students felt the need to regulate because of boredom, agitation, anxiety, or other distracting emotion or sensation, they were allowed to simply get out of their seats and use the bikes.

The '*teacher regulated*' category included three subcategories that also varied in degree of teacher control. The first subcategory included *teacher-identified use* where the need for bike use was recognized by the teacher rather than the student based on the student's agitation, anxiety, or boredom. The teacher recognized the need and suggested that the student use the bicycle, e.g., "if I see subtle cues to anxiousness I will ask if the student might like to jump on the Spark Bike." A second subcategory divided access across students but with some students having priority over others based on their specific needs, e.g., "we have a schedule made so all students get an opportunity to use the bike. However, some names are on the schedule more than others." The third subcategory still included teacher control but in a *scheduled approach*. Turns on the bikes were offered to all students equally and students were allowed to choose to either take their turn or to forfeit it. An example illustrating this subcategory is one teacher's invention of 'The Bike Cup', which passed "from student to student. The student may choose to pass or ride the bike. If they pass, the cup goes to the next student. If they bike, they bike for two-three minutes and then pass the cup to the next student. In the morning, the cup is placed on a random student's desk and they decide which direction the cup will go."

Seventeen percent of teachers reported using both types of approaches simultaneously, typically allowing for student-regulation, but electing students to go when a student's need to self-regulate goes unnoticed by that student. For example, one teacher said "the students decide when I am teaching and they feel they have sat too long on the mat or when they are finished work; I decide when they are needing a refocus."

Lastly, 9% of teachers described their experience as one in which the bikes went through an initial period of teacher-control, and as students became more familiar with the equipment they were granted more autonomy for regulation. One teacher explains: "At first, there was a class list and they went in order. After a few days, we developed a signal (twirl your finger in the air). As the novelty faded, kids don't require permission. They just hop on whenever they want."

Additional Classroom Physical Activity

In addition to stationary bike use, 77% of teachers surveyed indicated that they incorporated other physical activity opportunities in the classroom for their students. These other activities were categorized into three themes: *dynamic full-*

body movements, outdoor physical activity, and *stationary activities in their seats*. Eighty-five percent of responses fit in the *full body* category, and included activities like: BrainBreak, Gonoodle, Daily Vigorous Physical Activity (DVPA), yoga, running on the spot, jumping around, dancing, Zumba, and stretching. A smaller percentage (8%) of responses indicated that they took their students for *outdoor physical activity*, and six percent had their students perform different *stationary activities in their seats*, such as under-the-desk pedalling, active seating, breathing exercises, and meditation.

Teachers were also asked if they modeled bike use in the classroom, and if so, how often students saw them using the stationary bike, on a five-point scale, ranging from 1 (*Not at All)* to 5 *(More Than Once a Week)*. The mean score of 2.56 and standard deviation of 1.73 suggests significant variance amongst teachers, wherein a large number (45%) of teachers do not model bike-use to their students at all while 35% use the stationary bikes in front of their students at least once a week.

Perceived Outcomes of Bike Use: Benefits

Teachers were asked to *agree* or *disagree* with six statements about the perceived benefits of stationary bike use for students, on a five-point scale ranging from 1 (*Strongly disagree*) to 5 (*strongly agree*), 3 *(neutral)*. These questions asked whether teachers believed that the use of the stationary bikes increased students' sense of accomplishment, relaxation, mental-alertness, and self-esteem; whether they had observed any positive physical changes in students; and whether students enjoyed using the stationary bike (see Table 1 for means and standard deviations).

Table 1. Means and standard deviations for perceived positive outcome variables.

Outcome	Mean	SD	n
Enjoyment	4.5	.67	102
Accomplishment	3.93	.87	88
Relaxation	4.24	.64	98
Mental Alertness	4.24	.68	95
Self-Esteem	3.96	.76	91
Physical Changes	3.23	.87	78

A Perceived Positive Outcomes variable was calculated as an aggregate of the six separate questions (α = .89) for participants who answered each of the relevant questions (n=66). Overall, teachers reported that the stationary bikes had a positive effect on students in their classrooms (*M= 4.05, SD = 0.59*). A multiple regression analysis was conducted to determine what specific variables might predict teachers' perceived positive outcomes. Six variables were entered into the regression: *how long the bike has been in its location*; *how often an individual student gets to use the bike*; *intensity with which the students use the bike*; *how often the*

students see their teacher using the stationary bikes; *physical activities in the classroom other than the bikes*; and *teacher perception of targeted use* (whether the teacher found that students with attention or behavioural difficulties were particularly drawn to the stationary bike). The linear combination of these six measures was significantly related to perceived positive outcomes, $F(6, 94) = 10.51$, $p < .001$. The adjusted R square was .37, indicating that approximately 37% of the variance of perceived positive outcomes can be accounted for by the linear combination of the measures outlined above. Five out of the six independent variable were statistically significant (smallest $t = 2.12$, $p = .04$ to largest $t = 3.96$, $p<.001$). The only variable that did not significantly add to the regression was *how long the bike has been in its location,* $t=1.25$, $p=.21$.

In addition to perceived positive outcomes, teachers were asked to use their own words to describe any other benefits that they perceived to result from student bike use. Thirty-six percent of participants provided answers that were categorized by five themes describing benefits related to *physical, cognitive, emotional,* and *social development*, as well as *the learning environment*. Teachers reported observing several *physical* improvements in their students due to the use of the stationary bikes, e.g., one kindergarten teacher said that the bike they have in their classroom "helps strengthen our students' gross motor development", while another reported that bike use "increased better cardio in students."

Perceptions that bike use led to *cognitive* improvements were detailed as an increase in students' attention capacities, time-management skills, and ability to take effective breaks from learning. For example, one teacher reported that "some [students] are able to sustain attention longer than they were doing before I got my bike", and that "students [were] becoming more independent in their break choices."

Improvement in students' *emotional development* were primarily related to an increased capacity for emotional regulation. For example, one teacher said that they "have found that for some students it helps to reduce anxiety to have that physical release. They are also more aware of their own moods and feelings as it has prompted us to do more focused learning of the recognition of these things." Another teacher reported that students "generally seem more relaxed and ready to settle in to work", another that students are "more aware of their bodies and brain development", and lastly, "as well as having a calming effect, it [the bike] can also pep up tired students."

Indications of improvements to students' s*ocial development* were found in teachers' reflections on students' ability to share objects, take turns, and avoid or resolve conflicts with no teacher involvement. For example, "[there is] less conflict in cases where specific students who have issues around anger management have shown a tendency, in part from use of the bike, to avoid asserting themselves aggressively toward other students."

Finally, references to the stationary bike's impact on *the learning environment* included comments such as "students can remain in class more, as they can go on a bike rather than going for a walk" and "when they work while they are on the bike with the portable table that they put on the handles, they are more focused on what they are doing."

Perceived Outcomes of Bike Use: Challenges

When asked to rate the bikes as a source of distraction on a five-point scale, teachers indicated that the bikes were generally not seen as a distraction M=1.82, (SD = 0.95), ranging from 1 (*Strongly disagree*) to 5 (*strongly agree*), 3 *(neutral)*. Correlation analyses between scores on the distraction variable and three other variables indicated a significant relationship: duration of bike in classroom; frequency of student use; and perceived positive outcomes. The duration in which the bike had been in its specific location was negatively correlated with the perceived distraction-level of the bikes, R= -0.26, p<.01, suggesting that the longer a bike had remained in its location, the less distracting it was perceived to be. An independent samples t-test found a statistically significant difference $t(96)$= 2.54, p<.01 in the mean scores of perceived distraction between participants who had bikes for less than one year (M= 2.0, SD= .88) when compared to those who had the bikes for one year or longer (M= 1.51, SD=.99). It appears that teachers that have had the bike for one year or less perceived them to be significantly more distracting than teachers that have had the bike for one year or longer. Distraction was also significantly correlated with Frequency of student use, R= -0.31, p <.01; more frequent bike use was related to lower levels of perceived distraction. Not surprisingly, the level of the bike's distraction was negatively correlated with the perceived positive outcomes composite variable, R= -0.4, p <.01.

Nearly one quarter of teachers (23%) reported a situation in which a student was unable to use the stationary bikes, and one third (29.3%) faced a situation in which a student was reluctant or did not want to use the bikes. Explanations for students' inability to use the bikes were classified into two main categories: *physical limitations* of the student and *inappropriate dress*. Forty-two percent of answers referenced situations in which a student was not able to use the stationary bike because of physical limitations, such as the student's size, injury, or disability. It is important to note, however, that physical disability did not necessarily inhibit bike use. Indeed, teachers identified situations in which a student with physical or other limitations still managed to "one little girl who has a disability in a lower grade was really good on the bike. […] she loved it!"

Explanations about student reluctance to use the bikes were grouped into three subcategories: *the student did not like the bike; the bike was too difficult for the student to use;* and *the student was afraid or socially intimidated*. It appears that "some students just don't like it, find it too hard, or [the bikes are] of no interest to them." Some students are hesitant to use the bikes, and others appear to be afraid, e.g., "student was scared. Student may not feel that they will be successful." Some teachers reported that students may perceive the stationary bikes as socially intimidating, and would prefer to avoid the unwanted attention that using the bicycle attracts, e.g., "some students do not feel comfortable to exercise in front of others, so they started off passing, but now most students use it daily."

Nearly half of the survey's respondents (49) answered an open-ended question asking what other challenges they encountered due to stationary bike integration. Participants' answers were categorized into three general themes:

classroom management concerns, difficulties with the bike itself, and *access challenges*. *Classroom management concerns* accounted for the largest percentage of the reported challenges (76%), and included student misconduct, horseplay, and inappropriate use of the bicycles, problems with turn-taking, bikes being used during inappropriate times, and bikes being used to avoid work. Examples of these behaviours include reports of "times that students are interrupting the lesson to discuss who gets to use the bike" or instances of students "hogging the bike", and "disputes over who has the right to be on it." A smaller number of additional problems involved *difficulties with the bicycle itself*, including reports that students cannot "do work on or read while they are biking", and complaints over the bike's tension knob not working, or wheels becoming squeaky with use. The remaining comments reported *access challenges*, including not having enough bikes in the school/classroom and wanting more, issues with the cost of the bikes, and challenges encountered while fundraising for the equipment.

Solutions to Challenges

Participants were asked to share some of their solutions to address the challenges that they reported. Forty percent responded. The majority of responses (79%) addressed *classroom-management challenges*, suggesting things like "students need to self-regulate the taking of turns", and "having a sign-up list has been helpful for some teachers in our school." Teachers also discussed the importance of explaining the purpose of the bikes to students, namely the principles of self-regulation and how these relate to different students' needs. One teacher asserted students should know "that fair doesn't always mean even. Many of my students require the bike more than others." Other teachers stressed establishing clear expectations with students on the consequences that might result from breaking guidelines by saying things like "stay firm and consistent on the consequences." Other proposed solutions to challenges included using an open/closed sign for the bicycles to prevent their use during inappropriate times, and providing safety/usage instructions.

A much smaller percentage of responses (13%) addressed *access* and *technical issues*, and included suggestions on how many bikes a school/classroom should have, fundraising tips, and ideas for how to modify the bikes to make them better, e.g., "having more bikes (2-3) per class"; "the community [should] get involved in fundraising efforts"; "a table top for completing work"; or "building a frame/box in front of the bike to allow students to place something so they can work/read while they bike"; and, assembling a "small tool kit with some extra parts so that it can be fixed easily and promptly" in case the bicycle malfunctions and requires repair.

Recommendations

When asked if they would recommend the implementation of stationary bicycles to other teachers, 99% of respondents said they would and 38 teachers gave a rationale. Favourable comments generally spoke to recommendations based on the observed benefits related to physical exercise and self-regulation in the classroom. Teachers suggested that the stationary bicycle provided students with a convenient means of exercising and lead to an increased awareness of the benefits of exercise. Teachers' comments also noted that the bicycles had a role

in improving student focus, motivation, productivity, processing, calmness, and well-being, for example, "I think it is a great way to teach students that even a little bit of exercise has many benefits- helps with concentration and attention, alleviates stress, gets rid of nervous energy, [and] is fun." and "it's a no-brainer. Kids need to move and the spin bike is a wonderful and sustainable strategy to promote wellness, mind-body connections and self-awareness!" Teachers suggested that "bikes help students regain focus and they can produce more work and remain in the classroom while having a physical/emotional break.", and that the bikes are a "fantastic addition to the classroom. Self regulation and exercise are huge benefits. Try sitting for five hours!" Overall, there was wide agreement across answers that stationary bicycle use is "an outlet for kids", and that students generally "process better if they are moving."

Discussion

When reviewing teachers' responses across a variety of survey questions, it is apparent that the perceived effects of stationary bike integration were largely positive, although the unique set of challenges posed by integration should not be overlooked. Key reflections made by teachers included proposed solutions to the challenges reported. One specific concern of integration of a new technology or pedagogical approach is the distraction and impact due to its novelty. Results suggest that this was a challenge that dissipated with time. The perceived positive outcomes of bike use reinforced the importance of incorporating learner-centred pedagogies to effectively support self-regulated use of stationary bikes.

The study's 107 participants were a diverse group of teachers that used stationary exercise bikes as participating members of Run for Life's SparksFly program. Participants came from 8 different provinces/territories, a variety neighbourhood types, worked in broadly different settings in which school and class size varied widely, and taught different grades, ranging from Kindergarten to Grade 12. The survey followed a mixed-methods design containing both open and closed-ended questions. The collection of data by researchers independent of participating schoolboards ensured that teachers were free from any possible job-related repercussions, which allowed teachers to share both positive and negative opinions of the SparksFly program and its impact.

The perceived benefits of stationary bike implementation on individual students were captured in participants' scores on the perceived positive outcomes variable and qualitative responses to open ended questions about bike use and its impact on student development. Those outcomes were aspects of self-regulated learning including enjoyment, sense of accomplishment, relaxation, mental alertness, self-esteem and physical changes. All of the perceived outcomes were seen as neutral to higher with the largest impact related to enjoyment, relaxation and mental alertness. Physical changes were scored lowest on average, more neutral than agreement, however. This is not surprising as the average frequency and duration of bike use was limited. The integration of stationary bike use was intended to capitalize on the connection between physical activity and readiness to learn rather than having any great impact on the level of physical fitness more generally. The bike use was one

aspect of what were recognized as physically active learning environments. Indeed, most teachers reported integrating other class-wide physical activity routines in addition to the stationary bikes, and about half of those surveyed used the bikes themselves.

Qualitative data analysis revealed that following the introduction of the stationary bikes, teachers reported improvements in their students' physical, cognitive, emotional, and social development, as well as benefits to the learning environment. Some teachers' answers included perceived improvements in students' physical development due to bike use, for example, "increased better cardio", "students biking to school", and observations that the bike "helps strengthen our students' gross motor development."

Perceptions that bike use led to cognitive improvements were detailed as increases in students' attention capacities, improvement in time-management skills, and independent choice to take effective breaks from learning. The reported benefits on students' emotional development included students' ability to observe, reflect, and regulate their emotions. Students' social development manifested in positive changes to students' ability to share objects, take turns, and avoid or solve conflicts. Teachers identified an increase in students' ability to recognize not only their need to self-regulate through the bike use but an overall increase in empathy toward other students and their individual needs, for example, "My students are very empathetic to students who need the bike in a moment of distress or disruption." Finally, references to improvements in the learning environment included the ability to keep students in the learning context and working while they took a physical break from sitting.

Despite the numerous benefits of stationary bike implementation as indicated by teachers, the use of bikes in the classroom setting did pose a unique set of challenges, including physical limitations and student reluctance to use the stationary bikes; classroom management concerns; technical issues related to the bike itself; access difficulties; and the bike's potential to distract students from on-task behaviour. Although there was a range of scores related to perceived amount of distraction, the bikes were not *generally* seen as a distraction. The longer a bike remained in its location, the less distracting it was perceived to be. Although, perceived positive outcomes were significantly predicted by several variables, including intensity and frequency of use, the length of time that the bike had been in the same location was not a significant predictor, suggesting that positive outcomes may be seen right away. Teachers expressed that the challenges posed by stationary bike implementation are most palpable during the first few phases of the integration process, but lessen with the passing of time. In other words, when students are exposed to a classroom with a stationary bike for the first time, the bikes are extremely popular and it may seem like every student wants a turn. The great demand for the bike can lead to disruption and student conflict, especially when the bike is unregulated by the teacher. The constant activity surrounding bikes during this introductory period can be distracting for both teachers and students, and some teachers felt that they needed to be proactive regarding student bicycle use during this period, often coming up with creative ways to ensure students respectfully shared the bicycle without interrupting the learning of others. Suggestions to counter the

novelty effect that the bikes may elicit included having "discussions around it and development of rules by and with the students."

Qualitative responses regarding how bike use was regulated demonstrated a spectrum of control from student-regulated to teacher-regulated and a combination of both. According to respondents, as the novelty of this new equipment faded, the bicycles became more available for students that would benefit most from their use. Regulating students' bicycle use sometimes evolved as the class became better acquainted with the bike and teachers relinquished control. Some teachers initially chose to heavily regulate bike-use to allow every student to have a turn. After bike-use became normalized, some teachers lessened their control to a permission-based strategy in which students self-identified their need to use the bikes and then asked the teacher for permission to do so. Some teachers adjusted the rules so that bikes were used on a first-come-first-serve basis, in which any student who felt the need to self-regulate by using the stationary bicycle could do so without being a distraction. When the bike is implemented with the intent to develop self-regulation in students, it is important that teachers recognize and use pedagogical approaches that allow for student choice and decision-making. Differentiated instruction becomes the norm.

If students are instructed to use the bicycles with moderate to vigorous intensity until they feel relaxed and ready to learn whenever they feel hyper, angry, tired, anxious, or any other distracting emotion, they begin to actively 'monitor' their emotions and act on their self-evaluations. This mindfulness helps to mobilize SRL when coupled with a strategy (i.e. stationary bike use) intended to help mitigate the distracting emotions and lead to increased learning. The stationary bike is there for any student to just 'hop on' until they become "calm, alert, and learning" (Shanker, 2012).

Three key findings from this study include:

- The most common challenge of implementing stationary bikes in the classroom was the initial distraction. The distraction was limited, however, and readily overcome through discussion and practice. Introduction of the bike may have contributed to students' ability to recognize individual learning needs.
- Teachers perceived a number of positive outcomes in relation to the use of stationary bikes. The initial purpose of the bike, to improve self-regulation leading to an increase in learning, was accomplished on various levels, contributing to individual social, emotional, and cognitive outcomes as well as an overall positive impact on the classroom learning environment.
- The results of this study identified a spectrum of control around the use of the bike, ranging from student-regulated to teacher-regulated. The position of control along that spectrum has implications for the level of student self-regulation.

Implications and future research

The positive outcomes and limited challenges identified in this study suggest that use of stationary bikes in classrooms is one potential strategy for supporting self-regulated learning across grades and contexts. The

implementation of the bike should be part of an overall pedagogical approach to supporting self-regulated learning and should be treated as any other emerging instructional tool. Teacher knowledge, examples of success, easy access, and support are critical to ensuring a positive experience (Mueller, Wood, Willoughby, DeYoung, Ross, & Specht, 2008). Although the teachers in this study were perhaps 'champions for the cause' and included physical activity in other aspects of their classrooms, the findings of this study offer evidence to support a broader implementation of stationary bikes as a tool for self-regulated learning.

Although the current study included a survey of teacher perceptions rather than direct measurement of student outcomes, the findings and implications are a significant addition to the literature examining self-regulated learning and the impact of physical activity on learning. Wendel, Benden, Zhao and Jeffrey (2016) identified positive results of stand-biased desks versus seated classrooms on student BMI increases after two years of intervention. Future research that includes extended intervention projects and measurement of actual student learning outcomes following use of the bikes will expand on the evidence base and provide specific support for successful implementation.

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