Article

Reducing Key Barriers to Classroom Physical Activity Improves Implementation Fidelity in Ontario Elementary Classrooms

Hannah Bigelow, Shelby Singh and Barbara Fenesi *

Faculty of Education, Western University, ON N6A 3K7, Canada; hbigelow@uwo.ca (H.B.); ssing826@uwo.ca (S.S.)
* Correspondence: bfenesi@uwo.ca

Abstract: Background: Schools are the front lines of children's physical activity. Students who participate in daily physical activity (DPA) within their classrooms show improved physical strength, physical fitness, academic success, and mental well-being. However, teachers face many barriers to DPA implementation. The current study evaluated whether providing a DPA toolkit that offers greater access to DPA resources and requires minimal training for teachers to implement could improve DPA implementation. Methods: A total of 343 teachers from Ontario, Canada, completed a pre-survey assessing DPA practices and were given access to a DPA toolkit containing easily accessible and usable DPA resources to implement between January and March 2023. A total of 142 participants completed the post-survey to assess for changes in DPA practice. Several repeated measures of ANOVA were conducted with a three-level factor of grade level (1–3, 4–6, and 7–8) and within the subject factor of time (pre- to post-survey) on key outcome variables. Results: Findings revealed that the DPA toolkit improved DPA fidelity ($p = 0.007$, $\eta2p = 0.053$) and promoted teacher confidence in implementing DPA ($p < 0.001$, $\eta2p = 0.285$) and enjoyment in implementing DPA ($p < 0.001$, $\eta2p = 0.177$). Many improvements were most prominent among teachers teaching grades 1–3 and 4–6. Conclusions: By providing teachers with adequate DPA resources that minimize teacher training, there can be significant improvements in DPA implementation with notable cognitive and psycho-emotional benefits for both teachers and students.

Keywords: daily physical activity (DPA); classroom physical activity; physical activity; barriers to classroom physical activity

1. Introduction

Physical activity provides a multitude of health benefits throughout the lifespan and plays a vital role in the prevention of non-communicable diseases, including obesity, cancer, Type 2 diabetes, coronary heart disease, dementia, and many others [1,2]. However, only half (49%) of Canadian adults (18–79 years old) and fewer than half (44%) of Canadian children and youth (5–17 years old) met international physical activity guidelines for their health during the period of 2018–2019 [3]. Schools are the front lines for children's physical activity. No other institution has as much influence on children during their first two decades of life [4]. Physical activity in schools is associated with academic achievement, including lower drop-out rates, better classroom behaviour, self-esteem and engagement in school, and on-task behaviour [5,6]. Unfortunately, although most schools require Physical Education (PE) classes as part of their curriculum, PE classes may occur infrequently, and reports indicate that children are often inactive in them [1,7,8]. Increasing the frequency and duration of PE is not always feasible, given competing curriculum demands. It is thus essential to promote physical activity within academic classrooms themselves.

Extensive research has shown that children who participate in classroom-based physical activity are more likely to meet the World Health Organization (WHO)'s recommendation of 60 min of daily physical activity [1,9,10] and show improved physical strength,

attentional focus, overall academic achievement, and reading and math proficiency [11–15]. Classroom-based physical activity has also been shown to increase students' feelings of joy and motivation to learn, as well as positive classroom behaviour (i.e., time-on-task); these effects can be seen both acutely and over the long term [15–18]. Students who are more physically active are also less likely to suffer from mental health concerns such as depression and anxiety [19–21].

In Canada, several provinces and territories have implemented a Daily Physical Activity (DPA) policy to promote active lifestyles for children in school settings [22]. In Ontario, the DPA policy aims to ensure all elementary school children receive a minimum of 20 min of physical activity each school day during instructional time [22]. Teachers have been documented as using a variety of resources to implement DPA, including video-based activities (e.g., GoNoodle or YouTube dance), playing active games like Simon Says, and incorporating physical activity directly into learning activities ($2 \times 5 = 10$ jumping jacks) [9,10,12]. However, a recent evaluation found that only 23% of Ontario teachers were meeting this expectation [23], which is a significant drop from 50% in 2015 [24,25]. Several studies have investigated barriers to DPA implementation and identified lack of access to DPA resources and inadequate teacher training as important barriers to DPA implementation [24–32]. These barriers are noteworthy to empirically address as they can be targeted most directly and efficiently compared to the more systemic barriers such as school culture, implementation climate, and leadership support, given the extensive resourcing available, albeit across disparate sources, which require minimal teacher training to effectively implement [1].

Although several classroom-based physical activity programs exist (e.g., ABC [11], Take10! [12], and FUNtervals [33]), many do not address key barriers to implementation. For example, a significant drawback of previous interventions is that they rely heavily on teacher initiative and require specific teacher training to ensure implementation success. These programs required that schools provide ongoing training opportunities for new incoming teachers, as well as annual training for long-term teachers to ensure the upkeep of skills and knowledge. Schools also often require a dedicated teacher champion to encourage colleague accountability. And while dedicated DPA intervention programming may not be at the disposal of many schools, there is a plethora of physical activity resources available via various online mediums (e.g., Go Noodle, YouTube channels, OPHEA, and Jumpstart) that teachers could use in their classrooms. However, this is often met with an additional barrier—insufficient teacher time to research and collate videos and activities as they are dispersed across a variety of sources [24–32]. Furthermore, prior studies investigating the efficacy of classroom-based physical activity interventions have primarily focused on student outcomes such as physical activity levels, fitness, and academic success [11,12,15,33]. While it is imperative to demonstrate the efficacy of classroom-based physical activity programs for student success, it is equally critical to understand the teacher experience, as they are critical to engaging students in classroom physical activity [32]. Lastly, there is a dearth of research on the differential impact of classroom physical activity depending on grade level and gender [1]. Thus, the literature has called for additional subgroup analyses that examine how these group difference factors interact with the efficacy of classroom physical activity to provide a more holistic representation of DPA effectiveness.

Taken together, the current study aimed to evaluate whether providing access to a DPA toolkit that improved access to curated DPA resources and that did not require teacher training to utilize would improve DPA fidelity, teachers' confidence and enjoyment in implementing DPA, and teachers' perceptions of DPA.

2. Materials and Methods

2.1. Participants

To achieve an acceptable margin of error (5% with 95% confidence intervals) based on a population size of Ontario teachers who teach elementary grades (in 2021–2022, it was 85,574) [34], we recruited a total of 344 participants in December 2022 who completed the

pre-survey. The post-survey was completed by 142 participants, leading to an 8% margin of error (8%). The survey was open to all participants who taught between grades 1–8 in Ontario publicly funded school boards and who had at least one full school year of experience in a substitute, long-term occasional or full-time teaching position. Participants were recruited via personal and public social media accounts, as well as via snowball sampling. Digital poster advertisements were shared in the teacher Facebook groups "Ontario Teachers Resource and Idea Sharing" and "Ontario Educators and Mental Health". The online poster provided a direct link to the pre-survey. This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Approval for the study was obtained from Western University's Research Ethics Board under approval code 12142 on 20 September 2022.

2.2. Instrumentation

2.2.1. DPA Toolkit

The DPA toolkit contained over 200 physical activity videos, classroom physical activity games and activity posters (dpatoolkit.ca). The toolkit was developed via an extensive search of publicly available YouTube videos, posters, and activities. Several posters and activities were independently created. The search for media occurred multiple times between June and August of 2022 to ensure the inclusion of up-to-date media. Video search terms included classroom exercise, classroom physical activity, classroom physical activity breaks, DPA videos, DPA activities, active brain breaks for children, workouts for classrooms, and workouts for children. Grade levels were searched separately with the addition of the terms "Grade 1", "Grade 2", etc., in front of the search terms. Search terms for posters on Google and Pinterest included Canadian physical activity posters, classroom physical activity posters, Ontario DPA posters, Ontario physical activity posters, and exercise posters for classrooms. Search terms for activities on Google and Pinterest included Ontario DPA activities, classroom exercise activities, classroom exercise games, classroom DPA games, classroom physical activity games, and classroom active games. All media were added to an Excel sheet and further divided into groups including grade level (1–3, 4–6, and 7–8), curriculum ties based on the Ontario curriculum (history and language, math and science, and general movement), intensity level (low and moderate-high), and video length (1–5 min and 5+ mins), which were then built into a matrix of activity options on the website. Media were included if they fit into the above categories, were publicly available, were age appropriate, and appeared engaging. The goal of the DPA toolkit was to be a "one-stop-shop" for teachers and reduced the need to go to varied websites and locations to find DPA resources. Furthermore, the DPA toolkit categorized all content into important categories to improve teacher usability, including by grade level (1–3, 4–6, and 7–8) and by curriculum-based content (e.g., DPA with math and science learning, DPA with history and language, and non-academic DPA). While we recognize that there is a multitude of pre-existing valuable resources, the DPA toolkit aims to create a hub for these excellent resources to improve accessibility, visibility and, ultimately, usability.

2.2.2. Surveys

The pre-survey consisted of 27 questions and used a mix of multiple-choice and short-answer questions to query participants about their demographic information, their use of physical activity in the classroom, perceived differences in how their male versus female students responded to classroom physical activity, and their perceptions of DPA. The post-survey consisted of 22 questions and was identical to the pre-survey but excluded demographic questions and included additional questions asking for feedback on the DPA toolkit, such as, "What features would you like to see in the DPA toolkit in the future?", "Do you have any other recommendations to improve the DPA toolkit?", and "Do you see yourself using the DPA toolkit in the future?". Survey questions are provided in a Supplementary file S1. Participants also completed a weekly DPA log sent to them via email every Friday that asked whether they used the DPA toolkit and, if so, how many

hours per week; the weekly log also asked participants which toolkit resources were most often used that week.

2.2.3. Physical Activity in the Classroom

Questions assessing teachers' use of physical activity within their classrooms were based on work by Dinkel, who piloted questions with teachers, academic experts, and community health experts [35,36]. The survey was validated in a previous study measuring the willingness of teachers to implement physical activity [35].

DPA Fidelity

DPA fidelity refers to the number of minutes per week that DPA was implemented, with the ideal value being a minimum of 100 min per week (20 min per day as per the DPA policy). This value was derived using responses to three separate survey questions: (1) I incorporate physical activity into my classroom _____ days per week; (2) I incorporate physical activity into my classroom _____ times per day; and (3) The physical activities that I incorporate into my classroom are typically _____ minutes in duration. These values were multiplied to obtain a DPA fidelity score of DPA minutes per week.

Teacher Confidence and Enjoyment Implementing DPA

Two items probing for teacher enjoyment and confidence were used, including I enjoy implementing DPA in my classroom; and I feel confident implementing DPA in my classroom. These items were completed using a 4-point Likert scale (1 = strongly disagree...4 = strongly agree).

Teachers' Perceptions of Gender Differences in DPA Engagement and Enjoyment

Several questions assessing teachers' perceptions of differences in male versus female reception of DPA were based on previous work assessing student responses to DPA [23]. Three items using a 4-point Likert scale (1 = strongly disagree...4 = strongly agree) were included pertaining to both genders (only female items are shown here): Female students were engaged in DPA activities; female students enjoyed the DPA activities; female students were less restless and more manageable following DPA.

2.2.4. Perceptions of DPA

An adapted version of the Attitudes Towards Physical Activity (ATPA) questionnaire was used to measure the attitudes, beliefs, and self-efficacy toward DPA implementation. The ATPA was validated in previous work assessing attitudes toward physical activity [37]. The items were adapted in consultation with the research team and with reference to previous work using DPA-specific questions. The ATPA targets conceptions of physical activity specifically; the adapted questions target *daily* physical activity in the context of the classroom. Respondents were oriented to the type of physical activity being targeted in the preface of the survey questions, e.g., "Consider classroom-based daily physical activity and indicate how much you agree or disagree with the following statements". Five items were used with a 4-point Likert scale (1 = strongly disagree...4 = strongly agree), including Elementary school teachers play a major role in DPA programs at schools; DPA improves the mental health of students; DPA improves the physical health of students; DPA improves the academic performance of students; DPA improves the cognitive functioning of students (e.g., their ability to think, pay attention and complete tasks).

2.2.5. Weekly DPA Log

Participants were emailed a DPA log on the Friday of every week. The DPA log asked them to answer three questions: (1) Did you use the DPA toolkit this week? (Yes/No); (2) How many minutes per week did you use the DPA toolkit this week? (open-ended); and (3) Which resources did you use from the DPA toolkit this week? (videos, activities, or posters).

2.3. Procedure

In December 2022, interested participants accessed the pre-survey via the recruitment flyer. In January 2023, participants who completed the pre-survey received the DPA toolkit via email. Explicit instructions to use the DPA toolkit were not provided as researchers did not want to coerce participants to use the toolkit if it was not beneficial for them. Instructions simply indicated that the DPA toolkit was to be used as desired over the next few months until the end of March. Participants were asked to complete the weekly DPA log that they received via email each week on Friday. Participants completed the post-survey at the end of March 2023. Participants received CAD 10 per survey in the form of an Amazon gift card (a total of CAD 20 across the study).

2.4. Data Analysis

All statistical analyses were conducted using SPSS (Version 29). Descriptive statistics (frequencies) are provided in Table 1 for demographic characteristics. Several repeated measures of ANOVA were conducted with a three-level factor of grade level (1–3, 4–6, and 7–8) and within the subject variable of time (pre- to post-survey) to evaluate whether the DPA toolkit could improve DPA fidelity, teachers' confidence and enjoyment implementing DPA, and teachers' perceptions of DPA. The purpose of stratifying by grade level was to provide nuanced insight into the efficacy of the DPA toolkit at various grade levels. Five participants indicated that they taught all grade levels and were thus removed from the dataset as their data could not be stratified by grade level (N = 136). Paired-samples t-tests were conducted between pre- and post-survey outcomes where a main effect of time or interaction was present to elucidate whether observed differences existed at specific grade levels. There were no extreme outliers consistent across outcome variables and grade levels using the SPSS step of $1.5 \times$ IQR (interquartile range).

Table 1. Demographic characteristics of study sample for pre- and post-surveys.

		Pre-Survey	Post-Survey
	Variables	N (%)	N (%)
	Total	342 (100)	136 (100)
Demographic characteristic			
Gender	Man	19 (5.6)	9 (6.6)
	Woman	322 (94.2)	126 (92.6)
	Non-binary	1 (.3)	1 (0.7)
Age			
	20–29	85 (24.9)	37 (27.2)
	30–39	133 (38.9)	60 (44.1)
	40–49	98 (28.7)	33 (24.3)
	50–59	23 (6.7)	4 (2.9)
	60+	1 (0.3)	0 (0)
	Prefer not to answer	2 (0.6)	2 (1.5)
Highest level of education			
	Bachelor's Degree	280 (81.9)	112 (82.4)
	Master's Degree	60 (17.5)	23 (16.9)
	Doctoral Degree	2 (0.6)	1 (0.7)
Years teaching			
	1–10	185 (54.1)	81 (59.6)
	11–20	128 (37.4)	45 (33.1)
	21–30	29 (8.5)	10 (7.4)

Table 1. *Cont.*

	Pre-Survey	Post-Survey
Typical class size		
1–10	10 (2.9)	3 (2.2)
11–20	49 (14.3)	22 (16.2)
21–30	258 (75.4)	101 (74.3)
30+	25 (7.3)	10 (7.4)

3. Results

3.1. Demographic Information

Table 1 provides demographic information. The weekly DPA log was completed by an average of 84 participants per week across the duration of the study (range of 65–96 participants), which represents a 59% response rate. Participants used the DPA toolkit on average for 43 min per week, and the most used features in order of popularity were videos, activities, and posters.

3.2. Goal 1

Does providing a DPA toolkit that offers greater access to resources and requires minimal training for teachers to implement improve DPA fidelity? Table 2 shows the results of the repeated measures ANOVA and paired-samples t-tests. Findings suggest that there was an improvement in DPA fidelity and that teachers teaching grades 1–3 and 4–6 benefitted the most from the toolkit, and those teaching grades 1–3 spent the most time (mins/week) engaging in DPA overall.

Table 2. Repeated measures ANOVA and paired-samples *t*-test results assessing changes in DPA fidelity.

Outcome Variable	Grade Level Mean (SD) Pre-Survey	Grade Level Mean (SD) Post-Survey	ME Time (p, η2p)	ME Grade (p, η2p)	Interaction (p, η2p)	*t*-Test (p, d)
DPA fidelity	1–3 = 59.78 (50.09) 4–6 = 41.08 (32.72) 7–8 = 35.35 (49.41)	1–3 = 120.24 (197.85) 4–6 = 69.59 (70.23) 7–8 = 57.13 (146.82)	* $p = 0.007$, η2p = 0.053	* $p = 0.015$, η2p = 0.062	$p = 0.399$, η2p = 0.014	**1–3: * $p = 0.018$, d = 0.42** **4–6: * $p = 0.023$, d = 0.52** 7–8: $p = 0.128$

Note. **DPA fidelity refers to the number of minutes per week teachers implemented DPA.** SD refers to standard deviation; η2p refers to partial eta squared as a measure of effect size; ME refers to main effect; bold typeface with * indicates $p < 0.05$ significance; d refers to Cohen's d as a measure of effect size; 1–3 ($n = 65$), 4–6 ($n = 40$), 7–8 ($n = 30$).

3.3. Goal 2

Does providing a DPA toolkit that offers greater access to resources and requires minimal training for teachers to implement improve teachers' perceptions of DPA? Table 3 shows the results of the five repeated measures ANOVAs that were conducted for each DPA perception outcome variable: teachers' role in DPA school programming, DPA improves students' mental health, DPA improves students' physical health of students, DPA improves students' academic performance, and DPA improves students' cognitive functioning. Findings suggest that there was no change in teachers' perceptions of their role in DPA programming after receiving access to the toolkit, as well as no change in teachers' perceptions of the role of DPA in student physical health, regardless of the grade level being taught. However, there was a significant positive change in teachers' perceptions of the role of DPA in students' mental health (grades 4–6 and 7–8), students' academic performance (grades 4–6), and students' cognitive functioning (grades 4–6).

Table 3. Repeated measures ANOVA and paired-samples t-test results assessing changes in teachers' perceptions of DPA.

Outcome Variable	Grade Level Mean (SD) Pre-Survey	Grade Level Mean (SD) Post-Survey	ME Time (p, η2p)	ME Grade (p, η2p)	Interaction (p, η2p)	*t*-Test (p, d)
Teachers' role in DPA programming	1–3 = 2.34 (0.62) 4–6 = 2.15 (0.59) 7–8 = 2.32 (0.54)	1–3 = 2.36 (0.63) 4–6 = 2.33 (0.53) 7–8 = 2.35 (0.66)	$p = 0.246$, η2p = 0.010	$p = 0.525$, η2p = 0.010	$p = 0.510$, η2p = 0.010	N/A
DPA's role in student mental health	1–3 = 2.71 (0.46) 4–6 = 2.33 (0.57) 7–8 = 2.48 (0.46)	1–3 = 2.60 (0.58) 4–6 = 2.55 (0.50) 7–8 = 2.71 (0.46)	$p = 0.062$, η2p = 0.026	* $p = 0.018$, η2p = 0.058	* $p = 0.03$, η2p = 0.051	1–3: $p = 0.211$ **4–6: * $p = 0.048$, d = 0.41** **7–8: * $p = 0.05$, d = 0.44**
DPA's role in student physical health	1–3 = 2.60 (0.52) 4–6 = 2.31 (0.57) 7–8 = 2.42 (0.67)	1–3 = 2.46 (0.73) 4–6 = 2.41 (0.50) 7–8 = 2.45 (0.51)	$p = 0.987$, η2p < 0.001	$p = 0.304$, η2p = 0.018	$p = 0.154$, η2p = 0.028	N/A
DPA's role in student academic performance	1–3 = 2.51 (0.54) 4–6 = 2.16 (0.55) 7–8 = 2.23 (0.63)	1–3 = 2.51 (0.67) 4–6 = 2.39 (0.55) 7–8 = 2.47 (0.57)	* $p = 0.019$, η2p = 0.042	* $p = 0.044$, η2p = 0.048	$p = 0.178$, η2p = 0.027	1–3: $p = 1.00$ **4–6: * $p = 0.018$, d = 0.42** 7–8: $p = 0.07$
DPA's role in student cognitive functioning	1–3 = 2.52 (0.53) 4–6 = 2.16 (0.59) 7–8 = 2.26 (0.68)	1–3 = 2.49 (0.59) 4–6 = 2.37 (0.54) 7–8 = 2.48 (0.51)	* $p = 0.029$, η2p = 0.036	* $p = 0.034$, η2p = 0.050	$p = 0.108$, η2p = 0.033	1–3: $p = 0.727$ **4–6: * $p = 0.009$, d = 0.37** 7–8: $p = 0.129$

Note. SD refers to standard deviation; η2p refers to partial eta squared; ME refers to main effect; bold typeface with * indicates $p < 0.05$ significance; d refers to Cohen's d as a measure of effect size; 1–3 (*n* = 65), 4–6 (*n* = 40), 7–8 (*n* = 30).

3.4. Goal 3

Does providing a DPA toolkit that offers greater access to resources and requires minimal training for teachers to implement improve teachers' confidence and enjoyment in implementing DPA? Table 4 shows the results of the two repeated measures ANOVAs that were conducted to assess changes in teacher confidence and enjoyment implementing DPA. Findings suggest that teachers teaching all grade levels experienced a significant increase in their confidence in implementing DPA, and those teaching grades 4–6 and 7–8 also experienced an increase in their enjoyment of implementing DPA. Additionally, those teaching grades 4–6 had the greatest gains in confidence, while those teaching grades 4–6 and 7–8 had the greatest gains in enjoyment.

Table 4. Repeated measures ANOVA and paired-samples t-test results assessing changes in teachers' confidence and enjoyment implementing DPA.

Outcome Variable	Grade Level Mean (SD) Pre-Survey	Grade Level Mean (SD) Post-Survey	ME Time (p, η2p)	ME Grade (p, η2p)	Interaction (p, η2p)	*t*-Test (p, d)
Teachers' confidence in implementing DPA	1–3 = 2.08 (0.63) 4–6 = 1.53 (0.72) 7–8 = 1.68 (0.70)	1–3 = 2.36 (0.65) 4–6 = 2.37 (0.49) 7–8 = 2.16 (0.64)	* $p < 0.001$, η2p = 0.285	* $p = 0.004$, η2p = 0.079	* $p = 0.004$, η2p = 0.082	**1–3: * $p = 0.008$, d = 0.44** **4–6: * $p < 0.001$, d = 1.39** **7–8: * $p < 0.001$, d = 0.72**
Teachers' enjoyment of implementing DPA	1–3 = 2.41 (0.64) 4–6 = 1.85 (0.78) 7–8 = 1.84 (0.74)	1–3 = 2.48 (0.64) 4–6 = 2.41 (0.60) 7–8 = 2.32 (0.60)	* $p < 0.001$, η2p = 0.177	* $p = 0.002$, η2p = 0.093	* $p = 0.004$, η2p = 0.079	1–3: $p = 0.415$ **4–6: * $p < 0.001$, d = 0.81** **7–8: * $p = 0.001$, d = 0.72**

Note. SD refers to standard deviation; η2p refers to partial eta squared; ME refers to main effect; bold typeface with * indicates $p < 0.05$ significance; d refers to Cohen's d as a measure of effect size; 1–3 (*n* = 65), 4–6 (*n* = 40), 7–8 (*n* = 30).

3.5. Goal 4

Does providing a DPA toolkit that offers greater access to resources and requires minimal training for teachers to implement improve students' engagement and enjoyment with DPA, along with their classroom restlessness? And what is the effect of gender on these outcomes? Table 5 shows the results of the six repeated measures ANOVAs that were conducted to assess changes in male and female students' engagement and enjoyment with DPA, along with their classroom restlessness. Findings show that there was

no change in male student engagement with or enjoyment of DPA after receiving access to the toolkit and that male students in grades 7–8 found DPA the most engaging and enjoyable compared to the other grade levels. When considering changes in male student restlessness, however, findings showed an improvement after access to the DPA toolkit and that this improvement was specific to male students in grades 4–6. For female students, teachers noted that the DPA toolkit improved their engagement with and enjoyment of DPA, irrespective of grade level. In contrast to the male students, there was no change in female students' restlessness after access to the toolkit.

Table 5. Repeated measures of ANOVA and paired-samples t-test results assessing changes in male and female students' engagement with and enjoyment of DPA, along with their classroom restlessness.

Outcome Variable	Grade Level Mean (SD) Pre-Survey	Grade Level Mean (SD) Post-Survey	ME Time (p, η2p)	Main Grade (p, η2p)	Interaction (p, η2p)	*t*-Test (p, d)
Male students' engagement with DPA	1–3 = 2.06 (0.95) 4–6 = 2.46 (0.88) 7–8 = 2.50 (1.00)	1–3 = 2.23 (1.04) 4–6 = 2.46 (1.05) 7–8 = 2.83 (1.09)	$p = 0.124$, η2p = 0.018	* p = **0.010,** η2p = 0.068	$p = 0.513$, η2p = 0.010	N/A
Male students' enjoyment of DPA	1–3 = 1.97 (0.77) 4–6 = 2.17 (0.96) 7–8 = 2.50 (0.90)	1–3 = 2.20 (0.86) 4–6 = 2.30 (0.79) 7–8 = 2.50 (0.94)	$p = 0.189$, η2p = 0.013	* p = **0.029,** η2p = 0.052	$p = 0.566$, η2p = 0.009	N/A
Male students' restlessness	1–3 = 2.67 (0.94) 4–6 = 2.3 (0.88) 7–8 = 2.3 (0.75)	1–3 = 2.63 (0.83) 4–6 = 2.80 (0.72) 7–8 = 2.63 (1.00)	* p = **0.010,** η2p = 0.049	$p = 0.440$, η2p = 0.012	* p = **0.042,** η2p = 0.047	1–3: $p = 0.725$ **4–6: * p = 0.008, d = 0.62** 7–8: $p = 0.134$
Female students' engagement with DPA	1–3 = 1.92 (0.84) 4–6 = 1.92 (0.78) 7–8 = 1.67 (0.92)	1–3 = 2.08 (0.82) 4–6 = 2.16 (0.89) 7–8 = 2.03 (0.97)	* p = **0.005** η2p = 0.058	$p = 0.511$, η2p = 0.010	$p = 0.614$, η2p = 0.007	1–3: $p = 0.184$ 4–6: $p = 0.163$ 7–8: $p = 0.062$
Female students' enjoyment of DPA	1–3 = 1.92 (0.76) 4–6 = 1.75 (0.87) 7–8 = 1.73 (0.74)	1–3 = 2.09 (0.79) 4–6 = 1.95 (0.78) 7–8 = 2.03 (0.93)	* p = **0.003,** η2p = 0.063	$p = 0.474$, η2p = 0.011	$p = 0.771$, η2p = 0.004	1–3: $p = 0.078$ 4–6: $p = 0.186$ **7–8: * p = 0.048, d = 0.36**
Female students' restlessness	1–3 = 2.60 (0.81) 4–6 = 2.44 (0.72) 7–8 = 2.27 (0.79)	1–3 = 2.57 (0.75) 4–6 = 2.69 (0.66) 7–8 = 2.53 (0.86)	$p = 0.067$, η2p = 0.025	$p = 0.345$, η2p = 0.016	$p = 0.229$, η2p = 0.022	N/A

Note. SD refers to standard deviation; η2p refers to partial eta squared; ME refers to main effect; bold typeface with * indicates $p < 0.05$ significance; d refers to Cohen's d as a measure of effect size; 1–3 ($n = 65$), 4–6 ($n = 40$), 7–8 ($n = 30$).

3.6. Goal 5

Regarding recommendations for improving the DPA toolkit, teachers suggested more multilingual resources, more age-appropriate resources for grades 7–8, more resources connected to the curriculum, and more resources for neurodivergent students. Ninety percent of teachers said that they would be using the DPA toolkit in future teaching.

4. Discussion

The current study aimed to evaluate whether classroom DPA could be improved by providing teachers with a DPA toolkit that improved access to DPA resources and reduced the need for teacher training on DPA implementation. Providing teachers with the DPA toolkit improved DPA fidelity, promoted teacher confidence and enjoyment in implementing DPA, and enhanced teachers' perceptions of the benefits of DPA for a variety of student outcomes, including mental health, academic achievement, and cognitive functioning.

In a 2020 evaluation of fidelity to the DPA policy in Ontario, researchers found that teachers were implementing DPA for 64.5 min/week [23]. This falls below the expected 100 min/week of DPA (20 min/day for 5 days/week). The pre-survey results from the current study showed that in 2023, DPA fidelity dropped to 48.8 min/week. However, with access to the DPA toolkit, DPA implementation increased to 91.2 min/week. Although this still falls slightly short of the 100 min/week goal, it is a significant improvement compared to the last several years [24,25]. Nonetheless, these findings also emphasize that

minimizing teacher-training requirements and improving access to DPA resources is not a panacea for improving DPA fidelity. Further barriers such as inadequate time and physical space [24–32] and school culture barriers [38] likely need to be addressed to adequately meet DPA guidelines. Additionally, the observed improvement in DPA fidelity was specific to those teaching grades 1–3 and 4–6. This is not surprising as it was more challenging to populate the toolkit with numerous and varied physical activities for older grade levels; most of the available resources were targeted at younger students. Indeed, classroom-based physical activity has been shown to be more challenging to implement among pre-teens and early teens [39,40]. Specifically, as teens develop more self-image, they often become more self-conscious and may resist classroom physical activity due to discomfort with their changing bodies, fear of social evaluation and judgment, and perhaps a developing resistance to authority and rules [39–41]. This study underscores the importance of further investigation into how physical activity can be optimally used in classrooms with older students (12–14 years old).

Providing teachers with easily accessible and usable DPA resources significantly improved their confidence and enjoyment in implementing DPA. Social Cognitive Theory [42] and Competence Motivation Theory [43] both highlight the role of self-efficacy and enjoyment in the initiation and maintenance of physical activity behaviour [44]. Although the current study was not specifically assessing teachers' physical activity behaviour, it was assessing their confidence (a component of self-efficacy) and enjoyment in implementing physical activity within their classrooms. These two theories posit that tools that improve confidence and enjoyment in any task will support long-term behaviours. Promisingly, both confidence and enjoyment in implementing DPA improved with access to the DPA toolkit and thus has the potential to support long-term application.

Providing a toolkit that minimized key barriers to DPA implementation improved teachers' perceptions of the role of DPA in supporting student mental health, academic performance, and cognitive functioning, especially among those teaching grades 4–6. These findings may relate to other study results showing that male students were rated as less restless, and female students were rated as enjoying and engaging with DPA more following access to the toolkit. Perhaps teachers were noting an interrelatedness between enjoyment, engagement, restlessness, and positive cognitive and psycho-emotional outcomes. Promisingly, teachers who used the toolkit noted that their male students were less restless, which is a profound outcome given that males are more often described as hyperactive in traditional classroom settings or have formal attention deficit hyperactivity disorder diagnoses, and have challenges remaining on-task [42,43]. Importantly, these findings offer much-needed teacher-centric perspectives of the benefits of classroom physical activity, which complements previous student-centric perspectives showing the benefits of classroom-based physical activity on academic outcomes, on-task behaviours, and joy within the classroom [1,11,12,15,33]. These results also suggest that the DPA perceptions of those teaching grades 4–6 may be the most important to target as they showed the greatest shifts in DPA perceptions.

Access to the DPA toolkit did not affect several outcomes, however. First, teachers' views of the role that they play in DPA programming did not change. Given that teachers were self-selected into a study focused on evaluating how to improve DPA implementation, it is likely that they already had stable views of the importance of their participation. Second, teachers' perceptions of the role of DPA in supporting student physical health did not change. However, this is not surprising given that the DPA policy was instituted to improve children's physical activity participation during the day to mitigate poor physical health outcomes in childhood and the long term [23]. Thus, teachers likely had a good understanding of DPA's role in supporting student physical health, leaving it less susceptible to change from access to a DPA toolkit.

5. Implications for School Health Policy, Practice, and Equity

The current study demonstrates that by providing teachers with adequate DPA resources that minimize teacher training, there can be significant improvements in DPA implementation with notable cognitive and psycho-emotional benefits for both teachers and students. However, addressing these key barriers must be carried out in conjunction with addressing additional barriers that impede DPA practice, such as time and space restrictions and an incongruent school culture that undervalues physical activity in student well-being [24–32,38]. Furthermore, it is evident that more resourcing needs to be directed towards those teaching older grades (7–8), as those teaching younger grades have greater access to more varied and plentiful options for DPA. Lastly, the current study underscores how males and females experience DPA differently and that more research needs to be conducted to understand their diverse experiences and develop ways to engage their unique needs.

6. Limitations

There are several limitations to consider. First, self-selection in the study may have inflated the value of the DPA toolkit as it is likely that the study contained teachers who were already highly motivated to implement DPA. This baseline motivation for DPA may not reflect all teachers' perspectives, and thus, the efficacy of the toolkit may be specific to teachers with high DPA motivation. Second, the high attrition rate from pre- to post-survey may have skewed the data to be representative of highly motivated teachers rather than the overall population. We attempted to mitigate attrition a priori using several prescribed methods, including providing compensation, minimizing the number of follow-ups, making the pre- and post-surveys as similar, flexible, and convenient as possible, and sending routine reminders to prompt respondents. Third, teachers were aware that researchers were evaluating the utility of the toolkit and may have felt pressured in the post-survey to provide favourable ratings. Researchers tried to mitigate these risks of bias by using neutral language during study recruitment, throughout the surveys, and when in direct communication with participants. And fourth, our sample size, in comparison to the researched population, was relatively modest. Despite our efforts to address this limitation by allocating ample time for participant recruitment, it is essential to acknowledge that the educational landscape imposes stringent time constraints on teachers, potentially accounting for the more limited number of participants willing to enlist.

7. Conclusions

Taken together, this study provides valuable insight into the specific benefits of DPA implementation when minimizing key barriers of inadequate teacher training and lack of access to resources. Specifically, the DPA toolkit improved DPA fidelity, promoted teacher confidence and enjoyment in implementing DPA, enhanced teachers' perceptions of the benefits of DPA for student mental health, academic achievement, and cognitive functioning, decreased male student restlessness, and increased female student enjoyment and engagement with DPA. Many of these improvements were most prominent among those teaching grades 1–3 and 4–6, suggesting that they may reap the greatest benefits from easily accessible and usable DPA resources or perhaps that older grades (7–8) may require different resourcing to experience similar benefits. Future research aims to incorporate teacher feedback from the current study to improve the DPA toolkit and to disseminate it freely and widely for teacher use to support classroom physical activity and promote children's physical, cognitive and mental well-being.

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