

Kids Active: Evaluation of an Educator-Led Active Play and Fundamental Movement Skill Intervention in the Irish Preschool Setting

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The Kids Active program was developed with the aim of increasing physical activity (PA) and fundamental movement skill (FMS) levels of children in preschool services in Ireland through training educators to encourage active play opportunities. In this study, the impact of a six-week pilot program on educator confidence, as well as children's PA levels and FMS proficiency, is evaluated. Educators' ($n = 32$) confidence to teach PA was measured through questionnaire, while data (anthropometric data, PA via accelerometry, and proficiency in four FMS; run, vertical jump, overhand throw, and catch) were collected from 141 children in five intervention and four control services. Educators in the intervention group achieved significantly higher confidence scores at post-intervention testing in comparison to the control group. No significant differences between control and intervention groups were found for children's PA across the three-hour period. Children in the intervention group significantly increased scores in the overhand throw. Small positive changes in educator confidence to teach PA and in children's performance of the skill of overhand throw indicate potential effects of the Kids Active intervention that warrant further investigation of efficacy over longer periods of time.

Keywords: childcare, early childhood education, physical activity

Physical activity (PA) is any bodily movement produced by skeletal muscle that results in energy expenditure (Caspersen, Powell, & Christenson, 1985). Low levels of PA are a major risk factor for numerous chronic diseases and conditions, such as Type 2 diabetes and coronary heart disease (Scarborough et al., 2011).

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Physical activity plays a vital role in the health, development, and learning of children (Roth et al., 2010), and evidence has shown that early intervention through the continuous promotion of PA throughout childhood is essential (Bürge et al., 2011). Physical activity in childhood most often takes the form of physically active play, or active play (Truelove, Vanderloo, & Tucker, 2017). Active play has been defined in various ways, including play that is distinguished by the characteristics of a playful context combined with a dimension of physical vigor (Pellegrini & Smith, 1998), and, more recently, gross motor movement in which energy is exerted in a freely chosen, fun, and unstructured manner (Truelove et al., 2017). For the purpose of this study, active play is defined as any non-sedentary activity in which the child uses movement of the body to play at light, moderate, or vigorous intensity.

Early childhood, from birth to age six, represents a critical period for general motor development (Hardy, King, Farrell, Macniven, & Howlett, 2010), as innate primitive reflexes are replaced with independent movement and basic coordination patterns are learned. Fundamental movement skills (FMS), movement patterns involving various body parts that are the precursor to more complex and sport-specific skills, are considered to be the building blocks for PA throughout the lifespan (Clark & Metcalfe, 2002). While proficiency in FMS is positively associated with PA participation (Cliff, Okely, Smith, & McKeeney, 2009; Fisher et al., 2005), failure to develop these fundamental skills can lead to lower levels of PA through the lifespan (Larsen, Kristensen, Junge, Rexen, & Wedderkopp, 2015). Although FMS begin to develop in early childhood through structured and free play (Colella & Morano, 2011), studies have shown that competence in these skills does not merely develop naturally, but requires elements of teaching, practice, and reinforcement (Adamo et al., 2016; Logan, Robinson, Wilson, & Lucas, 2012). As such, the early childhood education environment provides an ideal opportunity to develop solid foundations for improving children's PA and FMS (Adamo et al., 2014).

The Ireland North and South Report Card on Physical Activity for Children and Youth (Harrington et al., 2016) highlights that there is a gap in PA data for the early childhood population, as almost all investigations into childhood PA in Ireland have focused on children from the age of seven years old. Although, as yet, no specific PA guidelines exist for early childhood in Ireland, other countries have set specific evidence-based PA guidelines for babies, toddlers and preschool. In the United Kingdom, this guideline states that children under five years of age should be active every day for 180 minutes spread throughout the day, at any intensity, which includes light, moderate and vigorous, and that time spent sedentary for long periods should be minimized (Chief Medical Officers, 2011). More recently, Canada (Tremblay et al., 2017), Australia (Okely et al., 2017), and South Africa (Laureus Sport for Good Foundation, 2018) have published 24-hour movement guidelines for early childhood, which also recommend at least 180 minutes of PA (with at least 60 minutes of MVPA or 'energetic play'), as well as less than one hour at a time of sedentary time and 10–13 hours of sleep. Despite a paucity of research into PA of children under seven years old in Ireland, national research indicates that children and young people in Ireland are insufficiently active, with only 23% meeting the national guidelines (Gavin et al., 2015). Coupled with data showing that 25% of children in Ireland are obese or overweight by age three (Williams, Murray, McCrory, & McNally, 2013) it can be deduced that children in Ireland are insufficiently active from a young age.

As of September 2016, the universal Early Childhood Care and Education (ECCE) program in Ireland (under which all children in Ireland are entitled to three hours of free preschool education, five days a week for the school year, with the option to pay for extra hours) has been expanded to two years, and children can now be enrolled on the scheme from age 2 years and 8 months, and participate up to age 5.5 years (Department of Children and Youth Affairs, 2015). As more young children now have access to childcare and early education, this represents not only a movement towards equity in education, but an opportunity to improve the physical health of children by creating supportive environments that promote PA and the development of healthy behaviors from an early age (Bower et al., 2008).

The Kids Active intervention aims to increase PA and FMS levels of children within the Irish early childhood setting, specifically through training preschool educators to deliver FMS and active play opportunities in their service throughout the day. While it is acknowledged that an educator-led program somewhat contradicts the “freely chosen” aspect of active play, the goal of the Kids Active intervention is for educators to not just lead structured PA, but to recognize and encourage affordances and facilitators for child-led playful PA, and introduce FMS in an enjoyable way so that children will ultimately choose to perform these skills in their own play. The program (managed by Early Childhood Ireland and the Irish Heart Foundation) sees ECCE educators trained by specialists to deliver PA and FMS activities. This approach was chosen to ensure sustainability of the program, with similar approaches shown to be effective in other studies within this population (Adamo et al., 2016; Van Cauwenberghe, De Craemer, De Decker, De Bourdeaudhuij, & Cardon, 2013; Williams, Carter, Kibbe, & Dennison, 2009).

This study represents a pilot evaluation of the Kids Active intervention, using a quasi-experimental randomized controlled trial, with two specific research questions: 1) Are preschool educators more confident in providing PA and active play opportunities in their schools following Kids Active training? and 2) Does the implementation of Kids Active over a six-week period result in an increase in PA accumulation and FMS proficiency level in young children? For the purpose of this research, PA will be used as an outcome measure for active play.

Methods

Participant Recruitment

Childcare services offering the ECCE scheme were invited to take part by Early Childhood Ireland in January 2016 through an online expression of interest form. A total of 40 expressions of interest were received that met the inclusion criteria of being located in one of three geographical areas (Dublin, Athlone and Tullamore). Of the services in Dublin, 10 were randomly chosen for collection of children’s data, while all educators from the remaining services were invited to attend Kids Active training and take part in the educator evaluation. Written consent for participation was obtained from managers for all preschool services involved in the children’s research. Informed consent was also obtained from the selected educators involved, as well as from parents or guardians for children’s participation, along with verbal assent from the children themselves. Ethical approval was granted by Dublin City University Research Ethics Committee (DCU/REC/2016/013).

Study Design

There were two key aspects to the evaluation, the first phase involving the educators, and the second phase involving the children. Educators from all services who completed the training were invited to participate in the educator evaluation ($n=55$). For the children's aspect of the research, ten services from the Dublin region were randomly allocated to the control ($n=5$) or intervention arm ($n=5$), with data being collected on two occasions immediately before and after the six-week intervention period. Using a wait-list control design, control groups were requested to continue their usual preschool curriculum and would receive Kids Active program training and resources following completion of post-intervention data collection. One intervention service was unable to take part in the educator training or post-intervention testing, and therefore data from four intervention services were included in final analyses. A detailed overview of the flow of participants is presented in Figure 1.

The 'Kids Active' Intervention program

The Kids Active pilot program consisted of educator training and a resource pack. The program focused on training educators to integrate PA opportunities throughout the preschool day, and to help children improve performance of FMS. The length of the pilot was constrained by the summer break within the ECCE term and therefore the pilot was six weeks in duration. Due to this short timeframe, only four FMS (two locomotor skills: run and vertical jump; two object control skills: catch and overhand throw) were included in the pilot program. Educators attended two, two-hour training sessions, before implementing the program over six weeks using the resource pack. All activities in the program aligned with the themes and principles of Aistear, the Irish national curriculum framework for children from birth to six years ([National Council for Curriculum Assessment, 2009](#)). All equipment required for implementation of the Kids Active program were low cost, recycled or homemade, in order to remove the potential barrier of equipment costs by demonstrating alternatives to purchasing equipment. A detailed overview of the program is presented in Table 1.

Measures

Educator Data. Both control and intervention educators were asked to complete an adapted version of the Confidence about Activity and Nutrition Teach (CAN-Teach) questionnaire ([Derscheid, Kim, Zittel, Umoren, & Henry, 2014](#)) in advance of the first educator training session, and immediately after the six weeks of Kids Active intervention rollout. The CAN-Teach Questionnaire was developed to measure preschool educators' self-efficacy and knowledge of healthy nutrition and PA practices for preschool children, and has been previously validated against expert ratings of how difficult it would be for educators to complete each activity ($r=-.67$, $p<.001$), with high internal consistency (Cronbach's $\alpha=.98$) ([Derscheid et al., 2014](#)). For this study, the questionnaire was amended to omit the questions that focused solely on nutrition. A total of 28 items from the original 46 items were included in the final questionnaire for this study, maintaining high

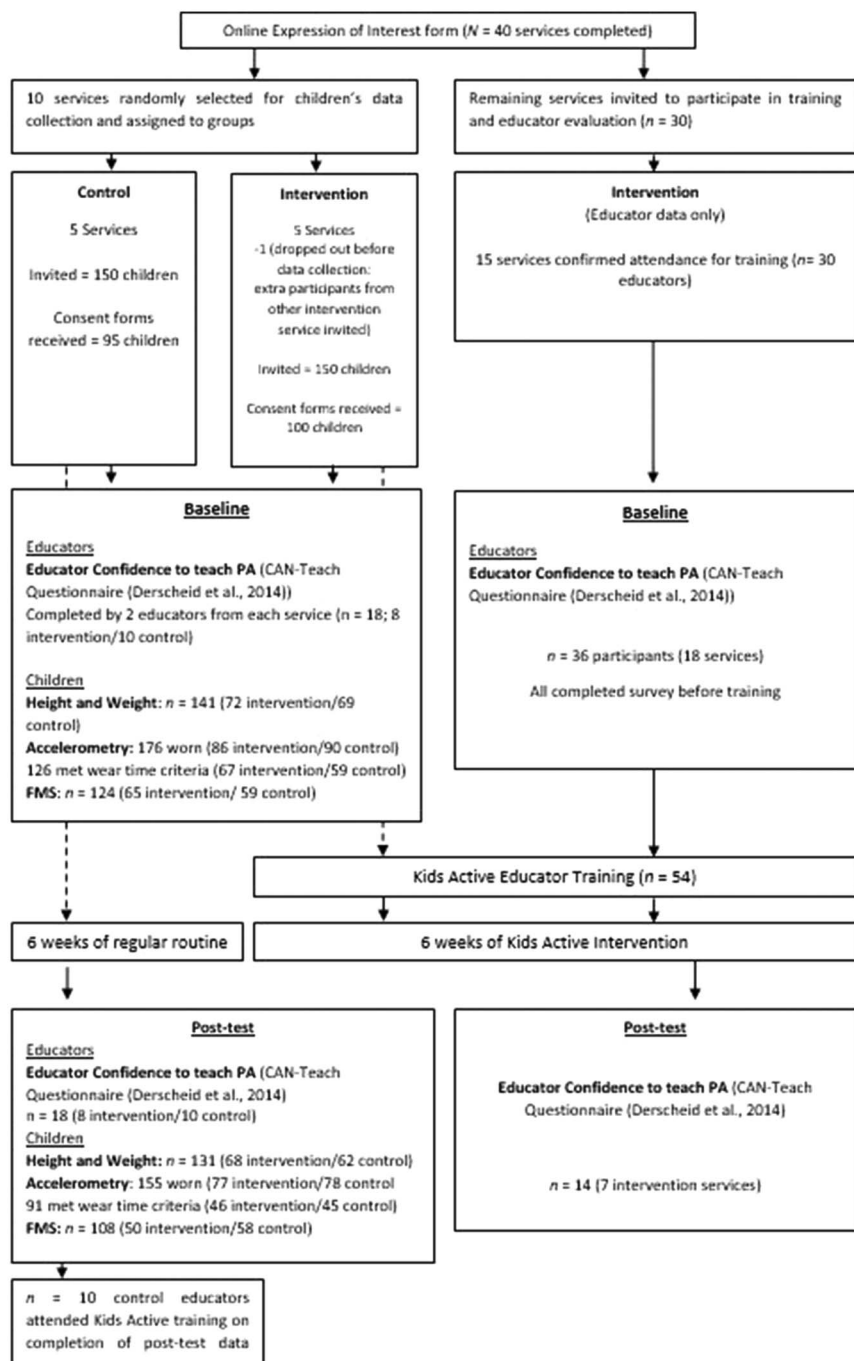


Figure 1 — Flow of Kids Active intervention recruitment, measures, and responses.

Table 1 Overview of the Kids Active Intervention

Resource Pack	Overview	Description
	4 double-sided FMS cards	• Front of FMS cards featured a different character for each FMS demonstrating an action story that represented the different components of the skill (e.g., the jump card depicted a space explorer crouching in preparation for jumping and blasting off into space). • Reverse side of the cards contained illustrations of how the skill may look at the early stages of development, and advice for creating opportunities to practice the skill.
	4 FMS posters	• FMS posters depicted each character and action story from the FMS cards and were designed to be displayed on the wall at child height.
	6 double-sided activity cards	• Each activity card featured 5 activities (2 of which were specifically linked to one of the FMS) under a theme. • Themes included Summer, Body Parts and Animals. • Front displayed an illustrated overview of each activity and an associated learning goal from the Aistear curriculum framework. • Reverse side contained suggestions for equipment and layout, as well as how to adapt or progress the activity for different ages and abilities.

(continued)

Table 1 (continued)

	Overview	Description
Training	Training Session 1 (2 hours)	• Aimed to increase educators' awareness of the importance of PA for the health, development and wellbeing of children and addressed the barriers to PA in the context of the ECCE setting. • Lecture style session with interactive discussion and group work.
	Training Session 2 (2 hours)	• Practical workshop introduced the Kids Active program and resource pack, as well as FMS in much greater detail. • Participants were given the opportunity to try the activities from the different cards, and encouraged to come up with their own ideas and activities using the equipment. • The resource pack was distributed after the second training session to ensure that educators attended both sessions.
Implementation	Six-week program	• Educators were asked to choose a minimum of 3 activities per week including 2 FMS-specific activities from any of the activity cards. • Activities were not prescriptive but instead provided prompts and ideas for simple activities that could be adapted and extended in numerous ways. In this way it was hoped to guide not only structured play but to inspire children to embed elements of the activities into their own unstructured play.

internal consistency with a Cronbach's α coefficient of .95. The questionnaire remained divided into its original five sub-sections, which include four sections relating to self-efficacy (Best practice for preschoolers = five questions with Cronbach's α of .84; Curriculum for large motor activity = eight questions with Cronbach α of .94; Daily activities with PA = four questions with Cronbach's α of .89; Community involvement = seven questions with Cronbach's α of .93), with each question using a 7-point Likert scale (1 = Not Confident, 7 = Highly Confident). Furthermore, there was one 'Readiness to Learn' section, comprised of four questions with Cronbach's α of .82 using a 5-point Likert scale (1 = No Interest, 5 = Already Learning). Educators had the option of completing the survey either online (SurveyMonkey) or in hard copy format.

Educators were also asked to fill out weekly evaluation sheets in hard copy detailing (1) which of the FMS they had focused on, (2) a summary of the resource activities used, (3) how these were integrated into the day, and (4) barriers they faced in implementing the program.

Children's Data. All children's data were collected on site at each of the nine services, by two trained researchers, on two occasions; prior to and immediately following the six-week intervention period. The testing protocol, which involved measurement of height, weight, FMS, as well as distribution and fitting of the accelerometers, took approximately two hours to complete. Details on each specific measure are given below.

Anthropometrics: All physical measurements were taken without shoes. Weight was measured to the nearest 0.1 kg, using a Seca (Seca GmbH & Co. KG, Germany) mechanical dial weighing scales. Standing height was measured to the nearest 0.1 cm using a Leicester Height Measure (Child Growth Foundation, United Kingdom). Body Mass Index (BMI) was calculated, with status classified according to the Centers for Disease Control and Prevention (CDC) Children's BMI tool for schools based on CDC growth charts (Kuczmarski et al., 2002).

Accelerometry: PA was measured using ActiGraph GTIM and GT3X accelerometers which have been validated for use with young children (Costa, Barber, Cameron, & Clemes, 2014; Pate, O'Neill, & Mitchell, 2010; Van Cauwenberghe, Gubbels, Bourdeauduij, & Cardon, 2011). The accelerometer was worn on the right hip, set at 10-second epochs to capture bursts of PA with short duration and frequent changes, characteristic of preschool children (Dwyer, Baur, & Hardy, 2009). Educators were shown how to attach the belts in the correct position and were asked to put the belts on the children each morning, and to remove the belt before they went home for a total of five school days. The monitors were collected at the end of the two-week period by a member of the research team for download and data processing.

Fundamental Movement Skills: Four FMS were assessed: run, vertical jump, overhand throw, and catch. Skills were assessed using the guidelines from the Test of Gross Motor Development-2 (TGMD-2) (Ulrich, 2000) for run, catch and overhand throw, and the Victorian Fundamental Skills Manual (Department of Education Victoria, 1996) for vertical jump. During the data collection, children were divided into groups of five. A trained researcher provided each group of five participants with an accurate demonstration and description of the skill to be performed. No verbal feedback was given to children during the testing. Participants performed each skill three times, which included one familiarization

practice and two performance trials. Video cameras were used to record each participant's performance of each of the skills. The FMS scoring process was completed in a lab on a later date by trained researchers who achieved 95% inter-observer agreement with an expert scorer.

Data Processing and Analysis

All data were analyzed using IBM SPSS Statistics 23, with alpha set at $p < .05$. CAN-Teach data raw scores were calculated for each of the five sub-sections of the educator questionnaire, as well as total score for the questionnaire overall. A 2×2 (Group [intervention, control] $\times$ Time [pre, post]) repeated measures analysis of variance (ANOVA) was computed to assess significant differences between groups over time.

Accelerometer data were processed using ActiLife software version 6.13.3. Data from the y-axis was used as it has been shown to be comparable across monitors (Sasaki, John, & Freedson, 2011). Wear time criteria of at least 150 minutes (2.5 hours out of three-hour preschool day) for a minimum of three days was applied to capture PA close to the typical hours of an ECCE setting, allowing for time to put on and remove the belts. Periods of 60 minutes or more of continuous zeroes were considered non-wear time. Cut points developed for preschool children (España-Romero, Mitchell, Dowda, O'Neill, & Pate, 2013; Pate, Almeida, McIver, Pfeiffer, & Dowda, 2006) were applied to determine minutes of sedentary, light, moderate and vigorous PA (sedentary = 0–799 counts per minute (CPM), light = 800–1679 CPM, moderate = 1680–3367 CPM, vigorous $\geq$ 3368 CPM). Intensities were also combined to give an overview of all 'non-sedentary' time of total PA (TPA) at any intensity (i.e., light PA + moderate PA + vigorous PA = TPA).

Physical Activity was analyzed for the three-hour ECCE period (from 9 am to 12 pm, 9:15 am to 12:15 pm, or 9:30 am to 12:30 pm, depending on the time of the ECCE morning session in each service) at each of the five intensity classifications.

FMS was analyzed as raw scores (total score achieved in both trials) for each of the four skills individually and for the four skills combined. Literature has consistently shown gender differences in preschool children for both PA (Trost et al., 2002) and FMS (Hardy et al., 2010). With this in mind, independent t -tests, with gender as the independent factor, were conducted for both PA and FMS to determine if there were significant gender differences at baseline. For PA, significant differences by gender were found at all intensities over the three-hour period. Therefore differences by group and gender for PA at pre- and post-measurement periods were examined with a $2 \times 2 \times 2$ (Group [intervention, control] $\times$ Time [pre, post] $\times$ Gender [male, female]) ANOVA. For FMS, independent t -tests showed no significant gender differences at baseline for any of the four FMS, or total FMS. Therefore, gender was not included as a level for FMS analysis. Differences between groups across the two time periods were examined using 2×2 (Group [intervention, control] $\times$ Time [pre, post]) ANOVAs for each of the four FMS individually and overall. To estimate effect sizes, partial eta squared (η^2) were computed and interpreted using guidelines set by Cohen (2013) of 0.01 = small, 0.06 = moderate and 0.14 = large.

Results

Educator Data

A total of 58% of educators ($n=32$; 10 control, 22 intervention) completed the questionnaire both pre- and post-intervention. Table 2 below displays the total and sub-section scores for the CAN-Teach Questionnaire for control and intervention educators, both pre- and post-intervention.

The results in Table 2 indicate that educators in the control group scored higher on the full CAN-Teach questionnaire and all self-efficacy subsections at baseline and significantly decreased over time, while the intervention group increased significantly or maintained scores for all sections over time. Results of the ANOVA show that significant interaction effects for Time $\times$ Group were found for all self-efficacy subsections, with the intervention group scoring higher after the six-week intervention and the control group scoring lower after this same six-week period.

A total of 11 educators completed and returned the weekly evaluation sheets, representing a 25% response rate from the intervention group. Due to the low response rate, this data was not analyzed as part of the current study.

Children's Data

A total of 141 children (50.3% male, 49.7% female) took part in the Kids Active research, with a mean age of 3.9 ± 0.5 years (51.7% 3 years; 43.9% 4 years; 4.2% 5 years). Baseline BMI measurements ($n=141$) indicated that 79.4% of children were within the normal weight category, with 1.4% underweight, 12.1% overweight and 7.1% obese.

For PA data, only those who wore the accelerometer across both time periods and met the wear time criteria were included in the final analysis ($n=76$; control = 38, intervention = 38). For FMS, numbers varied by skill, as some children did not want to take part in testing for certain skills both at pre-and post-testing. A total of 88 children performed all four skills (control = 47, intervention = 41) at both pre-and post-intervention testing.

Physical Activity. At baseline, significant gender differences were found for nearly all PA intensities over the three-hour period. Results of the $2 \times 2 \times 2$ ANOVA, however, indicated an absence of gender effects across all measures from pre- to post-testing. Table 3 outlines the mean minutes for each group at different intensities, with an overview of findings from the ANOVA. Time was found to be the main factor behind all changes, with no significant Time $\times$ Group interactions evident for this overall three-hour period; there was a decrease in sedentary time and increase in TPA between pre- and post-intervention testing for both groups over this period.

Fundamental Movement Skills. Table 4 displays the FMS mean raw scores, individually and combined, for control and intervention groups, at both pre-and post-intervention, along with results of the 2×2 ANOVA. Overall, increases in raw scores were achieved for both groups at post-intervention testing. A significant small Time $\times$ Group interaction effect was found for overhand throw [Wilks'

Table 2 Mean ($\pm$ SD) Educator CAN-Teach Scores ($n = 32$)

CAN-Teach score	Control		Intervention		Effect p	Effect Size η^2
	Pre	Post	Pre	Post		
Total	164 (15.5)	157 (21.8)	141 (22.8)	156 (25.8)	(txg) .002	.271*
Self-efficacy	147 (14.3)	140 (21.2)	124 (22.3)	138 (24.8)	(txg) .003	.257*
Best Practice	32 (3.0)	30 (3.9)	25.67 (5.5)	30 (4.3)	(txg) <.001	.375*
Curriculum for large motor activity	51.85 (4.0)	50 (6.3)	43.62 (8.3)	48 (8.3)	(txg) .019	.169*
Daily activities with PA	25.15 (2.7)	25 (3.8)	22.71 (3.9)	25 (3.5)	(txg) .024	.159*
Community Involvement	38 (8.8)	36 (10.4)	32 (8.7)	36 (11.1)	(txg) .033	.143*
Readiness to Learn	17 (2.4)	17 (1.8)	17 (1.4)	18 (1.4)	(t) .02	.167*

Note. t = time; txg = Time $\times$ Group interaction effect; Effect Size * = large.

Table 3 Mean ($\pm$ SD) Minutes PA at Different Intensities for the 3-hour ECCE Period ($n = 76$)

Intensity	Control		Intervention		Effect	Effect Size
	Pre	Post	Pre	Post	p	η^2
Sedentary	140.8 (24.5)	125.1 (13.1)	130.1 (20.9)	122.2 (10.2)	(t) <.001	.205**
Light	18.0 (3.9)	19.0 (3.4)	16.5 (3.7)	17.8 (3.1)	(t) .036	.060*
Moderate	14 (4.0)	15.2 (3.7)	14.1 (4.0)	15.4 (3.6)	(t) .012	.085*
Vigorous	7.5 (3.4)	8.8 (3.1)	9.6 (4.8)	10.5 (4.0)	(t) .028	.066*
TPA	39.4 (10.6)	43.0 (8.8)	40.2 (10.5)	43.5 (9.4)	(t) .006	.096*

Note. t = time; Effect Size * = moderate, ** = large.

Table 4 Mean Raw FMS Scores ($\pm$ SD) Pre- and Post-Intervention

	Control		Intervention		Effect	Effect Size
	Pre	Post	Pre	Post	p	η^2
Total FMS Score (maximum score 34)	(n = 47)		(n = 41)			
	18.7 (3.3)	21.2 (2.8)	18.5 (3.4)	22.4 (3.5)	(t) <.001	.382**
Run (maximum score 8)	(n = 58)		(n = 45)			
	6.9 (1.1)	7.1 (0.9)	6.8 (1.1)	7.2 (1.2)		
Vertical Jump (maximum score 12)	(n = 57)		(n = 46)			
	7.4 (1.5)	8.2 (1.6)	6.9 (2.1)	8.2 (2.0)	(t) <.001	.174**
Catch (maximum score 6)	(n = 55)		(n = 49)			
	1.9 (1.3)	2.9 (1.1)	2.4 (1.3)	2.9 (1.1)	(t) <.001	.166**
Overhand Throw (maximum score 8)	(n = 57)		(n = 51)			
	2.6 (1.7)	2.8 (1.8)	2.5 (1.9)	3.8 (2.0)	(txg) .049	.036*

Note. t = time; txg = Time $\times$ Group interaction effect; Effect Size * = small, ** = large.

Lambda = .96, $F(1, 106) = 3.96$, $p = .009$, $\eta^2 = .036$]. Time was found to have a significant moderate to large effect for catch [Wilks' Lambda = .83, $F(1, 102) = 20.3$, $p < .001$], $\eta^2 = .17$] and vertical jump [Wilks' Lambda = .99, $F(1, 101) = 21.28$, $p < .01$, $\eta^2 = .174$], as well as overall FMS [Wilks' Lambda = .62, $F(1, 86) = 53.07$, $p < .001$], $\eta^2 = .382$] though no significant differences were found over time for run.

Discussion

Results show that educators in the control group scored higher on the full CAN-Teach questionnaire and all self-efficacy subsections at baseline and significantly decreased over time, while the intervention group increased significantly or maintained scores for all sections over time. Results of the ANOVA show that

significant interaction effects for Time $\times$ Group were found for all self-efficacy subsections, with the intervention group scoring higher after the six-week intervention and the control group scoring lower after the same six-week period. While it is acknowledged that the sample size of the control group was small, the results indicate that educators who received the six-week Kids Active intervention significantly increased their scores for the self-efficacy and readiness to change measures, in comparison to educators who did not receive the intervention. This is a positive result for the intervention, suggesting that the Kids Active preschool PA and FMS intervention can positively influence educators' self-efficacy, confidence to teach, organize and schedule PA and FMS throughout the day. For the subsection of self-efficacy, the greatest effect sizes were found for 'Best Practice' and 'Large Motor Activity', which included questions about recommending changes within the service, as well as teaching different skills, designing and planning PA opportunities; all of which were addressed in the Kids Active training and resource pack. While very few preschool educator training programs in Ireland include children's PA as part of their course of study, the increase in these scores after the intervention highlights that even short training programs for preschool educators can be effective in increasing confidence to teach PA. Research has shown that short programs can be efficacious within the early years setting, as highlighted by Martyniuk and Tucker (2014) who found that educators who had completed even one course devoted to PA had significantly higher self-efficacy to instruct and facilitate PA for preschool children.

Fidelity of implementation was not derived due to the poor response to the weekly evaluation sheets. This may have been influenced by a number of factors. Firstly, the design of the evaluation sheet may have had an impact on this, as the questions asked were open-ended and may have conveyed to educators that a high level of detail was necessary. It is possible that this represented an extra burden of paperwork for educators to complete each week. Simplification of this document into a checklist or multiple-choice questionnaire with optional comments may be a more user-friendly format for collecting this data which would streamline the process for educators (Bee & Murdoch-Eaton, 2016; McKenna, Flower, & Ciullo, 2014). Secondly, the evaluation sheets were collected at the end of the six weeks, at which point many educators may have forgotten to complete, or mislaid, the hard copy evaluation sheets. The use of an online questionnaire would remove these issues as this could be sent by email each week to prompt educators to complete the questionnaire. Similarly, if the weekly evaluation was not completed, the service could be contacted with a reminder to complete the questionnaire. This approach has been successful in other evaluation studies and resulted in high response rates (Gibson et al., 2008; Lee, Contento, & Koch, 2013).

In terms of sedentary behavior, the overall three-hour period showed decreases in sedentary minutes for both groups across the time periods. For PA, the overall three-hour period showed an increase in TPA for both groups between pre and post testing.

In line with the recommendation of 180 minutes of TPA every day for children under 6, any non-sedentary time is worth noting, and an increase in PA at any intensity represents desirable results (Adamo et al., 2014).

While increases in overall FMS were not significantly different between groups, a significant difference was found between the control and intervention

group post-intervention for overhand throw. A significant moderate Time $\times$ Group interaction effect was found for this skill, with the score of the intervention group increasing significantly more than the control group. This may be attributed to the Kids Active program and indicates that the intervention may have positively influenced this skill specifically, demonstrating that a short intervention may significantly improve performance of specific individual FMS.

As biological changes occur rapidly in the early years, physical growth and development would be expected to positively influence FMS performance over time, independent of external factors (Piek, Hands, & Licari, 2012). Interestingly in this sample, no significant differences were found between 3-year-olds and 4- to 5-year-olds at baseline, which is contrary to the expectation that the older children would demonstrate more advanced skill development, adding weight to the argument that FMS do not just develop ‘naturally’ and physical maturation alone is not sufficient to impact changes without teaching and practice (Clark, 2007). Raw scores for individual FMS and combined skills did however increase for both groups from pre-to-post testing, with a significant main effect for time, indicating that all children improved their FMS performance over the six-week period regardless of group. It is also possible that children in the control group may have experienced a familiarization effect from performing the skills during pre-intervention testing (Tomac & Hraski, 2016). It is worth noting, that while both age groups in the intervention group and 3-year-olds in the control group all increased scores in overhand throw over time, 4- to 5-year-olds in the control group showed no change in scores for this skill (data not shown). Considering that younger children in the control group improved overhand throw scores by 15% and older children in the intervention group improved by 66%, the fact that older children in the control group had no increase in scores highlights that while physical growth and maturation may contribute to small gains in FMS over time, there may be an age above which these gains plateau and targeted intervention is necessary to achieve proficiency. Gallahue suggests that children have the potential to master most FMS by age six or seven (Gallahue & Ozmun, 2006), but without appropriate reinforcement and opportunities mastery might not be reached (Malina, 2004). Further research is warranted to investigate the effect of interventions at different ages in early childhood and deduce how interventions can be designed to optimize windows of opportunity in terms of physical development.

The relative absence of gender effects for FMS in this study is corroborated by Donath and colleagues (Donath, Faude, Hagmann, Roth, & Zahner, 2015) who emphasize that the effects of gender should not be overrated in this age group in terms of promoting FMS. Previous studies have found significant differences between boys and girls of this age (Iivonen, Sääkslahti, & Nissinen, 2011; Kokštejn, Musálek, & Tufano, 2017; Zask, Adams, Brooks, & Hughes, 2012) though it has been suggested that since biological differences between genders (such as body type and composition) are not remarkably different prior to puberty, differences in FMS scores for young children are more likely to be associated with social and environmental factors, such as opportunities to engage in FMS activities, gender stereotyped games and parental and social expectations, than biological factors (Malina, Bouchard, & Bar-Or, 2004; Saraiva, Rodrigues, Cordovil, & Barreiros, 2013). The limited number of FMS measured, however,

may not have captured gender differences that may exist overall in this sample or for specific skills. Further research which fully assesses all FMS would be necessary to ascertain where differences lie.

The short duration of this pilot intervention may have limited potential for significant changes in PA behavior. It has been posited that for children of this age, six weeks during preschool hours may not be enough to impact FMS or PA behavior. In a recent meta-analysis of FMS interventions in preschool children (Van Capelle, Broderick, van Doorn, Ward, & Parmenter, 2017) the mean duration of the 20 studies analyzed was 21 (± 17) weeks, and those which demonstrated the greatest increases involved structured sessions of 30 minutes or more four to five days per week. Considering the short duration of this intervention and the fact that the program did not involve structured sessions, the significant increase in overhand throw proficiency of the intervention group is encouraging. Further research is warranted to investigate the impact of the program over a longer period utilizing additional FMS and capturing full days of PA.

Limitations

For the educator questionnaire, the control group sample size was small, as control services were only recruited as research sites for the children's data collection phase. The questionnaire was also administered immediately following the six-week Kids Active intervention and, as such, it is unclear if the gains in confidence that the intervention group show would be sustainable over time. The short time period for the intervention delivery, the relatively short educator training and small number of FMS addressed are also limitations of the study. Fidelity of the intervention implementation by educators was not clearly captured.

Incomplete wear times due to children finding the accelerometer belts uncomfortable, varied service hours, and different drop-off and collection times of children in the services also made it difficult to standardize wear times and analyze full hours of wear. The time of year must also be considered, as baseline testing took place in March and post-testing took place in June. Literature has shown that play is highly correlated with outdoor play time, and that seasonal variation can be a major factor in PA and sedentary behavior (Shen, Alexander, Milberger, & Jen, 2013).

Conclusions

Favorable overall results for the educator data verify that training educators can increase their self-efficacy and confidence to deliver PA and FMS opportunities in preschool services. While no significant positive changes in PA were detected during the three-hour ECCE day for children who received the intervention, a significant increase in overhand throw score for the intervention group highlights the potential for the Kids Active program in ECCE settings in Ireland. Further data over a longer intervention period, including retention testing, are warranted to support these initial positive findings, and further explore the potential of the Kids Active program.

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