

# Investigating the effectiveness on educational attainment and behaviour of Commando Joe's: a school-based, military-ethos intervention

Mills HE<sup>1</sup>, McNarry MA<sup>1</sup>, Stratton G<sup>1</sup>, Mellalieu SD<sup>2</sup>, Mackintosh KA<sup>1</sup>

<sup>1</sup>Applied Sports Technology Exercise and Medicine Research Centre (A-STEM), College of Engineering, Bay Campus, Fabian Way, Swansea University

<sup>2</sup>Cardiff School of Sport, Cardiff Metropolitan University, Cyncoed Campus, Cardiff

**Objective:** Objectives: A military-ethos intervention can enhance engagement in learning and educational attainment. However, such programmes have typically been delivered in a residential setting. The purpose of this study was to investigate the effect of a twelve-month, military-ethos physical activity intervention on educational attainment, attendance and behaviour. **Methods:** Seven primary (five intervention) and five secondary schools (four intervention) were recruited and 228 primary school (152 intervention; 9.8±0.4 yrs) and 167 secondary school pupils (97 intervention; 13.8±0.4 yrs) participated. Attainment, attendance and behaviour ratings were collected at baseline, 3-, 6- and 12-months and analysed using multilevel modelling. **Results:** Significant intervention effects were found at 3 months for Maths, 3 and 6 months in English, 6 months for attendance and across time for both positive social and problem behaviours. Effects were independent of sex and school level. **Conclusions:** Findings support the utility of the Commando Joe's intervention as a whole-school strategy to enhance educational and behavioural outcomes.

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**Key Words:** English; maths; attendance; primary school; secondary school; physical activity

## INTRODUCTION

Academic achievement at school-leaving age is an important determinant of employment status, occupational functioning, and socioeconomic status in adulthood (31). The relationship between educational development and attainment is multifaceted. As much as 22% of the variation in learning progress has been attributed to the environmental characteristics of the primary and secondary school, neighbourhood and Local Education Authority (27). Indeed, factors such as socioeconomic status impact on academic attainment. Sixty three percent of primary aged children eligible for free school meals reached Level 4 in English reading and writing and mathematics compared to 82% not eligible for free school meals (Department for 5). This gap is further accentuated in secondary age children, with 36% compared to 63%

achieving an A\*-C grade in English and Mathematics for those eligible and not eligible for free school meals, respectively (Department for 4). However, despite recognition of this gap in educational attainment, effective intervention strategies remain to be elucidated.

An emerging body of research indicates that regular participation in physical activity may be associated with enhanced brain function, cognitive performance, classroom behaviour, attitude and academic achievement through a variety of direct, and indirect, physiological, cognitive, emotional and learning mechanisms (3, 6, 28, 33). These studies found that physical activity interventions ameliorated the disparity in educational attainment. McCelland Pitt and Stein (22) also demonstrated a substantial effect of a physical embodied cognition, classroom-based intervention on academic performance. This was

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### Corresponding author

Kelly A. Mackintosh: Applied Sports Technology Exercise and Medicine Research Centre (A-STEM), College of Engineering, Swansea University Bay Campus, Fabian Way, Swansea, United Kingdom • Email: [k.mackintosh@swansea.ac.uk](mailto:k.mackintosh@swansea.ac.uk)

particularly for pupils performing below the 20<sup>th</sup> percentile. Furthermore, physical activity-based, military-style residential interventions have elicited significant, short-term effects on academic engagement (24, 37, 38). These studies have reported enhanced attitudes, perceptions and behaviours associated with significant increases in problem solving skills, self-esteem, and perceptions of control (e.g. 24, 37, 38). According to social cognitive theory and self-determination theory, such enhancements are attributable to the impact of role models, and a structured and autonomous delivery style, respectively (1, 2, 7, 12-15, 21, 30, 32, 34). However, it remains to be elucidated whether increases in educational engagement translates to an increased educational attainment *per se*. Moreover, the applicability of residential interventions may be questioned; given that children spend approximately 40% of their waking time at school (8), a school-based military style physical activity intervention may represent an effective approach.

Therefore, the purpose of this study was to evaluate the influence of a school-based, military-ethos, physical activity intervention on educational attainment, attendance and behaviour in primary and secondary school children. The mediatory role of sex on the influence of this intervention was also investigated.

## **MATERIAL AND METHODS**

The present clustered, controlled intervention was conducted in schools from the Midlands and North West England. Schools within the top 20% most deprived nationally and with a high percentage of pupils eligible for free school meals were recruited to the study. In total, seven primary and five secondary schools were recruited to participate in this study; five primary and four secondary schools were assigned to the intervention group. This resulted in 228 primary school (152 intervention) and 167 secondary school participants (97 intervention). Of these, 108 primary school girls participated and 69 secondary school girls participated.

### ***Intervention***

The Commando Joe's school-based intervention integrated a military-style ethos into the school day with lessons delivered for a minimum of one hour per week throughout the school year. Commando Joe's intervention was delivered to either whole school classes or specifically identified sub-groups and was designed to complement the Physical Education (PE) curriculum strand of 'Knowledge and understanding of health and fitness' and Personal, Social, Health

Education (PSHE) curriculum strand of 'Developing a healthy, safer lifestyle'. The core theme of the intervention was to provide positive role models in the form of ex-military service personnel with the specific delivery of the school-tailored intervention.

Weekly sessions involved team building, problem solving and fitness activities which incorporated key health and fitness messages. In addition to this, participants received extra-curricular sessions such as: i) late-attendance monitoring and motivation via an instructor on the gate at the start of school; ii) maths and English booster classes; iii) mentoring and iv) physical activity sessions such as wake and shake. The instructors acted as positive role models and were autonomous yet structured in their delivery style. Interpersonal relationships with children were built and expectations and rules were clearly communicated. Furthermore, encouragement, positive feedback and behavioural rewards were provided, to facilitate the development of intrinsic and autonomous motivation in participants.

### ***Measures***

Stature to the nearest 0.1 cm (Seca Ltd. Birmingham, UK) and body mass the nearest 0.1 kg (Seca Ltd. Birmingham, UK) were measured using standard techniques (19) and BMI calculated. Waist circumference was measured as the narrowest point between the bottom of the ribs and the iliac crest using a non-elastic measuring tape to the nearest 0.1cm (Seca Ltd. Birmingham, UK).

To assess participant behaviour, teachers completed the Nisonger child behavior rating form which is a 76-item scale consisting of 10 social competence and 55 problem behaviour items. The Social Competence items are rated on a four-point likert scale ranging from 0 (not true) to 3 (completely or always true). The problem behavior items are rated from 0 (behavior did not occur or was not a problem) to 3 (occurred a lot or was a severe problem). Problem behavior items are distributed on the following six subscales: conduct problems, insecure/anxious, hyperactive, self-injury/stereotypic, self-isolated/ritualistic, and overly sensitive. Teachers were instructed to rate behaviours within the last month.

To assess participant levels of moderate-to-vigorous physical activity (MVPA), pupils completed the Physical Activity Questionnaire for Older Children (PAQ-C; 16) consisting of 11 questions, the first nine of which ask about how much MVPA pupils participated in over the last seven days, within varying contexts and at varying times of the day. The first nine questions are rated on a 5 choice response scale. The tenth question asks if the child has been sick or been unable to do any MVPA for another reason.

**Table 1.** Anthropometric characteristics at baseline in primary and secondary school participants

		Primary School		Secondary School	
		Control	Intervention	Control	Intervention
Age (years)	Boys	10.0 ± 0.4	9.7 ± 0.4 <sup>#</sup>	13.8 ± 0.3	13.8 ± 0.4
	Girls	9.9 ± 0.4	9.8 ± 0.3 <sup>#</sup>	13.9 ± 0.3	13.9 ± 0.6
	All	9.9 ± 0.4	9.7 ± 0.3 <sup>*</sup>	13.8 ± 0.3	13.8 ± 0.5
Stature (m)	Boys	1.40 ± 0.08	1.38 ± 0.07	1.63 ± 0.11	1.64 ± 0.07
	Girls	1.40 ± 0.08	1.37 ± 0.07	1.61 ± 0.08	1.59 ± 0.07 <sup>†</sup>
	All	1.40 ± 0.08	1.38 ± 0.07 <sup>*</sup>	1.62 ± 0.10	1.62 ± 0.08
Body mass (kg)	Boys	36.8 ± 11.0	35.8 ± 8.5	54.4 ± 11.0	53.7 ± 15.0
	Girls	36.9 ± 9.9	35.4 ± 9.6	55.2 ± 12.4	56.5 ± 12.8
	All	36.9 ± 10.4	35.6 ± 9.0	54.7 ± 11.6	54.8 ± 14.1
BMI (kg·m <sup>-2</sup> )	Boys	18.4 ± 3.7	18.6 ± 3.6	20.2 ± 2.7	19.8 ± 4.1
	Girls	18.6 ± 4.0	18.7 ± 4.1	21.2 ± 3.1	22.2 ± 4.4 <sup>†</sup>
	All	18.4 ± 3.8	18.6 ± 3.8	20.7 ± 2.9	20.8 ± 4.4
PAQ-C	Boys	3.0 ± 0.8	3.0 ± 0.7	2.8 ± 0.7	2.6 ± 0.8
	Girls	2.8 ± 0.8	2.9 ± 0.6	2.2 ± 0.6 <sup>†</sup>	2.6 ± 0.7 <sup>#</sup>
	All	2.9 ± 0.8	3.0 ± 0.7	2.5 ± 0.7	2.6 ± 0.7

Mean ± SD. BMI, body mass index; PAQ-C, Physical activity questionnaire – children. <sup>\*</sup> Significant difference between control and intervention group, irrespective of sex; <sup>#</sup> Significant difference between control and intervention within sex; <sup>†</sup> Significant difference between boys and girls within group.  $p \leq 0.05$ .

Finally, to assess academic achievement and attendance, each school provided end of term national curriculum grades and point scores (Maths and English at secondary school; Maths, English reading and writing at primary school) and full academic term attendance percentages for each pupil.

### Data Analyses

Baseline characteristics were investigated using a two-factor ANOVA (group and sex). All analyses were conducted using SPSS v17.0 (SPSS Inc. Chicago, IL), with a statistical significance level of  $p \leq 0.05$ .

To account for inherent hierarchical structure (17) and nested nature of the pupil data within the schools, multilevel modelling was performed for the main analyses to determine the effects of the intervention. This technique is an extension of ordinary multiple regression and is considered as the most appropriate analysis method for longitudinal nested designs (9, 23), and shown to be robust against homoscedasticity and sphericity violations, and missing data (26). To control for the effect schools could have on children's behaviours (36), a three-level data structure was used with school included as the third level, participants the second level, and measurement time points the first level unit of analyses.

Primary outcome variables were attainment (Mathematics, English/Reading, and Writing) and attendance. Secondary outcome variables were

behavioural factors (compliant/calm, adaptive social, conduct problem, insecure/anxious, hyperactive, self-injury/stereotypic, self-isolated/ritualistic, and irritable). Association models were used to assess the average effects of CJ's intervention on the outcome variables over the 3-, 6- and 12-month time-points, after being adjusted for potentially confounding variables (29), as they may influence the change in the magnitude of the intervention effect (36). To enable the interpretation of the influence of serial time-points, three dummy time-variables (3, 6 and 12 months) were generated. Coding schemes for each dummy variable were constructed to model discontinuous longitudinal data using a linear growth model (23). Group (intervention or control), sex and school type (primary or secondary school) were included as potential confounding variables.

To further examine the influence of group, potential effect modification was assessed by constructing interaction terms between group and sex, group and school type, and group and each time-point dummy variable. Sub-group analyses were conducted in the event of significant interactions. The effect of the predictor variables on each outcome variable in the main models were assessed for significance by comparing the log likelihood for each model using a Chi-square distribution with 1 degree of freedom and regression coefficients assessed for significance using the Wald statistic (36). The Wald statistic is calculated

**Table 2.** Educational attainment and attendance at baseline in primary and secondary school participants

		Primary School		Secondary School	
		Control	Intervention	Control	Intervention
Maths	Boys	21.9 ± 5.0	20.9 ± 4.4	37.8 ± 6.7	28.6 ± 7.3 <sup>#</sup>
	Girls	21.8 ± 3.2	20.0 ± 3.8 <sup>#</sup>	36.7 ± 8.0	25.8 ± 7.0 <sup>#</sup>
	All	21.8 ± 4.3	20.4 ± 4.1 <sup>*</sup>	37.3 ± 7.3	27.5 ± 7.3 <sup>*</sup>
English Reading	Boys	22.0 ± 5.1	20.1 ± 4.7	-	-
	Girls	20.6 ± 4.0	23.0 ± 3.9 <sup>#</sup>	-	-
	All	22.4 ± 4.6	20.3 ± 4.3 <sup>*</sup>	-	-
English Writing	Boys	20.3 ± 5.4	19.5 ± 4.0	-	-
	Girls	22.6 ± 3.5 <sup>†</sup>	20.8 ± 3.5 <sup>#</sup>	-	-
	All	21.3 ± 4.8	20.1 ± 3.8	-	-
English	Boys	-	-	31.5 ± 2.8	27.0 ± 6.7 <sup>#</sup>
	Girls	-	-	32.7 ± 3.3	26.8 ± 7.3 <sup>#</sup>
	All	-	-	32.0 ± 3.1	26.9 ± 6.9 <sup>*</sup>
Attendance	Boys	96.8 ± 3.3	95.8 ± 4.5	94.1 ± 6.7	89.8 ± 9.0 <sup>#</sup>
	Girls	97.1 ± 3.5	95.9 ± 5.2	94.8 ± 5.9	92.4 ± 5.8
	All	96.9 ± 3.4	95.9 ± 4.8	94.4 ± 6.3	90.9 ± 7.9 <sup>*</sup>

Mean ± SD. \* Significant difference between control and intervention group, irrespective of sex; <sup>#</sup> Significant difference between control and intervention within sex; <sup>†</sup> Significant difference between boys and girls within group. p≤0.05.

using the following equation: Wald statistic = (Regression Coefficient/Standard Error)<sup>2</sup>. Participants were included in the analyses regardless of missing data which was accounted for in the multilevel models. All analyses were conducted on an intention-to-treat basis. Statistical significance was set at p<0.05 and p<0.1 for interaction terms (36). Data were analysed using MLwiN 2.32 software (Centre for Multilevel Modelling, University of Bristol, UK).

## RESULTS

At baseline, primary and secondary school control and intervention participants did not differ significantly in anthropometric characteristics, with the exception of age, stature and 20m shuttle run test performance in primary school participants, as presented in Table 1. Intervention group participants demonstrated significantly lower attainment in English and Mathematics in both primary and secondary school. Furthermore, the secondary school intervention group also demonstrated a lower attendance than the control group (Table 2).

As shown in Table 3, whilst there were no overall significant differences between intervention and control, English and Mathematics scores were

significantly improved in the intervention relative to control group at three months (English: β=1.07 (95% CI=0.61, 1.53); Maths: β=0.81 (95% CI=0.22, 1.40), p≤0.001 and p≤0.01, respectively), with these significant influences maintained at six months in English (β=1.08 (95% CI=0.57, 1.60), p≤0.001). Furthermore, at six months there was a significant interaction with group for attendance (β=1.37 (95% CI=-0.25, 3.00), p≤0.1), indicating that the intervention group improved their attendance more than the controls during this period. There were no significant differences between sex and potential effect modification analyses revealed no significant modulatory effect of sex on educational or attendance parameters.

Intervention children demonstrated significantly less positive social behaviours throughout the intervention. However, this gap was significantly reduced across all time points with a significant increase at three, six and twelve months in both compliant/calm (3 months: β=1.76 (95% CI=0.51, 3.01); 6 months: β=0.99 (95% CI=0.19, 1.79); 12 months: β=1.43 (95% CI=0.61, 2.25), p≤0.01, p≤0.1 and p≤0.001, respectively) and adaptive social (3 months: β=1.77 (95% CI=0.53, 3.00); 6 months: β=1.22 (95% CI=0.42, 2.01); 12 months: β=1.42 (95% CI=0.61, 2.23), p≤0.01, p≤0.01

**Table 3.** Average change in educational attainment and attendance across 12 months from baseline following the Commando Joe's intervention

	Maths		English		Attendance	
	$\beta$	95% CI	$\beta$	95% CI	$\beta$	95% CI
Constant	21.74 <sup>‡</sup>	18.65, 24.82	23.38 <sup>‡</sup>	19.70, 27.05	96.95 <sup>‡</sup>	95.21, 98.68
0 to 3 months	1.17 <sup>‡</sup>	0.75, 1.60	1.42	1.09, 1.75	0.02	-1.19, 1.23
0 to 6 months	2.00	1.57, 2.42	2.14	1.81, 2.47	-1.13	-2.34, 0.08
0 to 12 months	3.66 <sup>‡</sup>	2.73, 4.59	3.79	3.06, 4.52	0.09	-1.50, 1.69
Group †	-1.60	-5.65, 2.43	-2.54	-7.30, 2.23	-0.40	-2.73, 1.93
Sex ††	0.59	-1.29, 2.46	-1.32	-2.73, 0.08	0.34	-1.46, 2.14
School Type †††	14.80 <sup>‡</sup>	9.94, 19.65	8.92 <sup>#</sup>	2.79, 15.06	-2.98 <sup>‡</sup>	-4.81, -1.16
Group x Sex	0.43	-2.18, 3.00	0.01	-1.93, 1.96	-1.38	-3.80, 1.05
Group x School Type	-8.87 <sup>#</sup>	-14.76, -2.99	-2.79	-10.09, 4.52	-2.38 <sup>*</sup>	-4.82, 0.07
Group x (0 to 3 months)	0.81 <sup>#</sup>	0.22, 1.40	1.07 <sup>‡</sup>	0.61, 1.53	-1.28	-2.93, 0.37
Group x (0 to 6 months)	-0.18	-0.84, 0.48	1.08 <sup>‡</sup>	0.57, 1.60	1.37 <sup>*</sup>	-0.25, 3.00
Group x (0 to 12 months)	-0.61	-1.67, 0.46	-0.03	-0.86, 0.80	-1.70	-3.83, 0.43

† Reference category = Control group; †† Reference category = Girls; ††† Reference category = Primary School. \* $p \leq 0.1$ ; #  $p \leq 0.01$ ; ‡  $p \leq 0.001$ . The regression coefficients ( $\beta$ ) reflect the average differences in educational attainment and attendance for the Intervention schools against the Control schools when covariates are included in the final model. A positive  $\beta$  value indicates a positive intervention effect on the educational outcomes of the Intervention children compared with the Control school children.

and  $p \leq 0.001$ , respectively) positive behaviours (Table 4). No interaction existed between group and sex for either positive behaviour; a significant sex difference was found for adaptive social behaviour with boys scoring 1.23 less than girls. Finally, as shown in Table 5, hyperactivity ( $\beta = -1.20$  (95% CI = -2.34, -0.07),  $p \leq 0.05$ ), self-isolated/ritualistic ( $\beta = -1.20$  (95% CI = -2.37, -0.03),  $p \leq 0.05$ ) and irritable behaviours ( $\beta = -1.13$  (95% CI = -2.10, -0.16),  $p \leq 0.05$ ) decreased at three months and self-injury/stereotypic behaviours decreased at 6 ( $\beta = -0.25$  (95% CI = -0.46, -0.03),  $p \leq 0.05$ ) and 12 months ( $\beta = -0.17$  (95% CI = -0.39, 0.05),  $p \leq 0.1$ ). In contrast, at twelve months, conduct problems increased in the intervention group ( $\beta = 1.16$  (95% CI = -0.10, 2.41),  $p \leq 0.1$ ). Hyperactive behaviour was significantly higher in boys but no interaction was found between sex and group, whereas whilst there was no sex difference in self-injury/stereotypic behaviours, there was a significant interaction between sex and group, indicating that the intervention demonstrated a greater effect on this behavioural item in boys.

## DISCUSSION

The present study, which investigated the effectiveness of a novel, school-based, military-ethos, physical activity intervention in primary and secondary school children, demonstrated significant improvements in educational engagement and attainment up to six months. Furthermore, the intervention was associated with concomitant beneficial changes in both positive social and problem

behaviours at all time-points throughout the study. Pertinently, these findings were largely independent of school type (i.e. primary or secondary school) and participant sex, suggesting that the Commando Joe's intervention represents an effective behavioural intervention for children and adolescents.

Although numerous school-based physical activity interventions have been implemented, there remains a paucity of evidence regarding the efficacy of such interventions on enhancing educational attainment as physical activity levels are commonly utilised as the primary outcome variable (10, 18, 29). Nonetheless, the present findings with regard to educational attainment are largely in accord with the limited evidence available (3, 6, 22). Interestingly, in the present study, the influence on educational attainment and attendance was not sustained at twelve months, despite the continued delivery of the intervention. These findings contrast those of McClelland et al. (22) who demonstrated significant improvements in academic performance following a twelve week physical embodied cognition intervention that were sustained for twelve months post-intervention. This discrepancy may be related to differences in the characteristics of the study populations, such as age at which the intervention was received and baseline academic performance. However, as this is the first study to investigate the effectiveness of an intervention in both primary and secondary school participants, further conclusions regarding the source of these discrepancies are presently precluded. Nonetheless, these findings highlight the necessity for continual adaptations in intervention design and

**Table 4.** Average change in positive social behavioural outcomes across 12 months from baseline following the Commando Joe’s intervention

	Compliant/Calm		Adaptive Social	
	$\beta$	95% CI	$\beta$	95% CI
<b>Constant</b>	13.24 <sup>‡</sup>	12.29, 14.19	13.11 <sup>‡</sup>	12.16, 14.05
<b>0 to 3 months</b>	-1.02	-2.16, 0.12	-1.04	-2.17, 0.10
<b>0 to 6 months</b>	0.13	-.048, 0.73	0.11	-0.49, 0.71
<b>0 to 12 months</b>	0.09	-0.52, 0.69	0.22	-0.38, 0.82
<b>Group †</b>	-1.51 <sup>#</sup>	-2.69, -0.32	-1.80 <sup>#</sup>	-2.98, -0.62
<b>Sex ††</b>	-0.92	-1.92, 0.09	-1.23 <sup>§</sup>	-2.23, -0.24
<b>School Type †††</b>	-0.11	-1.12, 0.91	0.08	-0.93, 1.09
<b>Group x Sex</b>	-0.78	-2.06, 0.50	-0.52	-1.79, 0.75
<b>Group x School Type</b>	-1.35 <sup>§</sup>	-2.66, 0.04	-0.85	-2.14, 0.45
<b>Group x (0 to 3 months)</b>	1.76 <sup>#</sup>	0.51, 3.01	1.77 <sup>#</sup>	0.53, 3.00
<b>Group x (0 to 6 months)</b>	0.99 <sup>*</sup>	0.19, 1.79	1.22 <sup>#</sup>	0.42, 2.01
<b>Group x (0 to 12 months)</b>	1.43 <sup>‡</sup>	0.61, 2.25	1.42 <sup>‡</sup>	0.61, 2.23

† Reference category = Control group; †† Reference category = Girls; ††† Reference category = Primary School. \* p≤0.1; § p≤0.05; # p≤0.01; ‡ p≤0.001. The regression coefficients ( $\beta$ ) reflect the average differences in positive social behaviours for the Intervention schools against the Control schools when covariates are included in the final model. A positive  $\beta$  value indicates a positive intervention effect on positive social behavioural outcomes of the Intervention children compared with the Control school children.

delivery to ensure sustainability over a prolonged period of time.

Commando Joe’s intervention elicited significant improvements in both positive social and problem behaviours across the academic year relative to control schools, a finding which agrees with other military-ethos interventions (24, 37, 38). Whilst the Commando Joe’s intervention is multi-faceted and it is thus not possible to conclude which element was principally responsible for these changes, it is postulated that they are largely attributable to the impact of the positive role models provided by the instructors combined with the autonomous and structured delivery style. Indeed, the impact of positive role models is in accord with a large body of evidence highlighting the role of self-efficacy and its association with positive role models to elicit significant, beneficial behavioural changes (12, 21, 32). Specifically, Bandura theorized that learning is enhanced when role models verbally recognise behaviours that a participant has appropriately imitated (1, 2). Indeed, social cognitive theory further suggests that people are more likely to imitate the behaviours of those they perceive to have a high-status and to be both reliable and credible (1, 2). Moreover, the instructors use of an autonomous and structured delivery style is in line with self-determination theory (SDT) studies in Education which have shown that such styles facilitate both primary and secondary school pupils intrinsic and autonomous motivation, which impact positively on educational engagement and attainment (7, 13-15, 30,

34). The present findings also extend those of previous studies investigating military-ethos interventions, which have almost exclusively involved a residential intervention format (35, 38), to a school-based delivery format. Given that children spend approximately 40% of their waking time at school (8), such a format substantially increases the potential applicability of the intervention with the significantly improved educational and behavioural outcomes providing further support for the effectiveness of this model.

An interesting finding in the present study was the absence of sex differences in the magnitude of intervention-related effects. Specifically, there was no interaction between sex and group on educational attainment, engagement or behavioural components. Although not unique in this finding, many studies have reported disparities with regard to the effectiveness of an intervention between boys and girls (e.g. 11, 20, 25). This finding has important implications in terms of the applicability of the present intervention at a whole-school level and is especially pertinent given common preconceptions that a military-ethos intervention may be anticipated to be more influential in boys than girls (38). Indeed, a key novelty of the present study which represents a significant extension to previous studies is the equality in participant numbers between boys and girls at both primary and secondary school level which enables such conclusions to be drawn.

**Table 5.** Average change in problem behavioural outcomes across 12 months from baseline following the Commando Joe's intervention

	Conduct Problem		Hyperactive		Self-injury/Stereotypic		Self-isolated/Ritualistic		Irritable	
	$\beta$	95% CI	$\beta$	95% CI	$\beta$	95% CI	$\beta$	95% CI	$\beta$	95% CI
Constant	1.59 <sup>‡</sup>	-0.86, 4.03	1.12 <sup>‡</sup>	-0.22, 2.46	0.21 <sup>‡</sup>	-0.02, 0.44	0.97 <sup>‡</sup>	-0.38, 2.33	1.00 <sup>‡</sup>	-0.76, 2.77
0 to 3 months	0.79	-0.98, 2.57	0.86	-0.19, 1.90	0.00	-0.31, 0.30	1.67 <sup>#</sup>	0.60, 2.74	0.92 <sup>§</sup>	0.02, 1.81
0 to 6 months	-1.53 <sup>‡</sup>	-2.45, -0.61	-0.84 <sup>#</sup>	-1.38, -0.30	0.09	-0.08, 0.25	-0.26	-0.82, 0.29	-0.66 <sup>#</sup>	-1.12, -0.20
0 to 12 months	-1.31 <sup>#</sup>	-2.24, -0.39	-0.62 <sup>§</sup>	-1.17, -0.08	0.03	-0.13, 0.19	-0.09	-0.65, 0.46	-0.46	-0.92, 0.01
Group †	1.04	-1.90, 3.99	0.75	-0.87, 2.36	0.02	-0.27, 0.30	1.10	-0.53, 2.73	0.17	-1.93, 2.27
Sex ††	1.53	-0.06, 3.11	1.39 <sup>#</sup>	0.45, 2.33	-0.05	-0.27, 0.18	0.67	-0.14, 1.47	0.46	-0.27, 1.18
School Type †††	0.89	-2.77, 4.55	-0.22	-2.16, 1.72	-0.20	-0.45, 0.06	0.56	-1.49, 2.61	-0.01	-2.89, 2.88
Group x Sex	1.24 <sup>*</sup>	-0.79, 3.27	0.55	-0.65, 1.75	0.23 <sup>*</sup>	-0.06, 0.52	0.41	-0.62, 1.45	0.63	-0.31, 1.56
Group x School Type	1.61	-2.69, 5.90	1.11	-1.17, 3.40	0.08	-0.24, 0.40	-0.81	-3.20, 1.58	1.33	-1.99, 4.64
Group x (0 to 3 months)	-0.65	-2.58, 1.28	-1.20 <sup>§</sup>	-2.34, -0.07	-0.10	-0.43, 0.24	-1.20 <sup>§</sup>	-2.37, -0.03	-1.13 <sup>§</sup>	-2.10, -0.16
Group x (0 to 6 months)	0.47	-0.76, 1.70	0.18	-0.55, 0.90	-0.25 <sup>§</sup>	-0.46, -0.03	-0.04	-0.77, 0.70	0.33	-0.28, 0.95
Group x (0 to 12 months)	1.16 <sup>*</sup>	-0.10, 2.41	0.05	-0.69, 0.78	-0.17 <sup>*</sup>	-0.39, 0.05	0.53	-0.22, 1.28	0.33	-0.29, 0.96

† Reference category = Control group; †† Reference category = Girls; ††† Reference category = Primary School. \*  $p \leq 0.1$ ; §  $p \leq 0.05$ ; #  $p \leq 0.01$ ; †  $p \leq 0.001$ . The regression coefficients ( $\beta$ ) reflect the average differences in problem behaviours for the Intervention schools against the Control schools when covariates are included in the final model. A negative  $\beta$  value indicates a positive intervention effect on problem behavioural outcomes of the Intervention children compared with the Control school children.

Despite the novelty of this study which sought to combine a military-ethos intervention within a school-based setting, certain limitations should be acknowledged. Specifically, although participants in the intervention and control groups were generally matched for anthropometric characteristics, there were significant differences in educational attainment at baseline. These discrepancies may, at least in part, be attributable to a self-selection bias. Furthermore, while not the focus of the current study, a greater range of socioeconomic statuses may have provided interesting insights and would have increased the generalisability of the findings. Given the limitations associated with subjective physical activity, the utilisation of objective measurement techniques would have aided in the interpretation of the current findings. Finally, the absence of a post-intervention follow-up precludes conclusions with regard to the maintenance of educational and behavioural improvements; a novelty effect cannot be definitively refuted, especially given the observation that improvements in certain outcome variables were not manifest at twelve months.

## CONCLUSION

In conclusion, Commando Joe's, a military-ethos, physical activity intervention, significantly improved the educational attainment and engagement of primary and secondary school children over a six month period. Furthermore, the intervention was associated with significant improvements in both positive social and problem behaviours across an academic year.

Importantly, this intervention was effective irrespective of school level or sex, highlighting the applicability of this intervention at the whole-school level.

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