

1     **The impact of gymnastics on children’s psychological and movement skill development**  
2  
3                                     **in primary schools**

3     **Abstract**

4     Purpose: This study evaluated the effectiveness of an eight week gymnastics curriculum on  
5     children’s movement competence and their physical self-concept (PSC). Method: 113  
6     children (46% girls, 49 % intervention) with a mean age of 9.4 years (sd = 1.8) participated.  
7     Intervention children underwent eight weeks of gymnastics and the comparison group  
8     continued with their standard curriculum. Results: age was a significant co-variate, separate  
9     analysis was conducted on the lower (grade 2 &4) and upper (grade 6) groups. The lower age  
10    group showed significant improvement in favour of the gymnastic group in fundamental  
11    movement skills (FMS). The upper age group showed a significant improvement for the  
12    control group in general body coordination and FMS. For all grades the PSC showed a  
13    significant main effect in favour of the gymnastics group. Conclusion: the gymnastics  
14    intervention was found to be of particular benefit for developing children’s movement  
15    competence and PSC in younger children.

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17    **Keywords:** fundamental movement skills, general body coordination, physical education,  
18    intervention.

19

20 **Introduction**

21 There appears to be a decline in children's movement skill performance from previous  
22 generations (Bardid, Rudd, Lenoir, Polman, & Barnett, 2015; Tester, Ackland, & Houghton,  
23 2014). Children who possess high levels of movement skill have been found to have  
24 increased health and physical activity benefits during childhood (Lubans, Morgan, Cliff,  
25 Barnett, & Okely, 2010).

26 Physical Education (PE) offers an excellent opportunity to reverse the current decline. Burton  
27 and Miller (1998) have argued that the physical education curriculum should be consistent  
28 with a theoretical model of movement competence. To this end, a recent study (Rudd et al.,  
29 2015) provided a model of movement competence which included Fundamental Movement  
30 Skills (FMS), in the form of locomotor and object control skills, as well as children's general  
31 body coordination. A broad model of movement skill competence fits with the growing body  
32 of evidence suggesting that children should sample a wide range of movement activities  
33 during primary school years (Côté, Lidor, and Hackfort 2009). Children who actively sample  
34 many types of sports and activities see benefits to their movement skill performance and  
35 psychological outlook, compared to children who have experienced a less diverse range of  
36 sporting activities (Bridge and Toms 2013; Côté and Fraser-Thomas 2007; Wall and Côté  
37 2007).

38 Traditionally, interventions to improve movement skills in the school setting have had a  
39 relatively narrow focus, concentrating on the main locomotor and object control skills  
40 (Morgan et al. 2013). To align with sampling research a broader approach was taken to  
41 investigate if an educational gymnastics based curriculum where children undertook a  
42 curriculum of tumbling, jumping, controlled falling and moving in gravity-defying ways  
43 improves multiple aspect of movement skill competence. It has been suggested that

44 gymnastics improves all aspects of movement skill competence, including object control  
45 skills (Rudd et al. 2016). The improvement in object control skills is important, as these are  
46 the more challenging to improve and are deemed the most complex skills to acquire due to  
47 sensory demands (Morgan et al. 2013). They are however integral as they have been found to  
48 be associated with high levels of physical activity in childhood (Lubans et al. 2010) as well as  
49 tracking through to adolescence (Barnett et al. 2010). Further research is needed to  
50 understand if this finding can be replicated. It would also be beneficial to know if the  
51 improvements in object control skills for lower primary school can be found in upper primary  
52 school children following a gymnastics curriculum. This is important, as evidence highlights  
53 that a significant number of children leave primary school in Year 6 with inadequate ball  
54 skills (Booth et al. 1999; Hardy et al. 2013; Okely and Booth 2004).

55 There is also a need to understand the psychological effect of a gymnastics curriculum  
56 upon primary school children's self concept. The term self-concept is a blanket term and  
57 refers to how an individual measures their own competence, attributes and characteristics  
58 compared to others (Gallahue, Ozmun & Goodway, 2012). Self-assessment occurs  
59 regularly during PE lessons because, as children try new skills, their physical skills are  
60 constantly on display to their peers. This can lead to feelings of both success and failure  
61 and will directly affect children's self-concept and its development. (Gehris, Kress, &  
62 Swalm, 2010; Goodwin, 1999). In PE, a positive physical self-concept has been found to  
63 be associated with higher engagement levels, skill development, and motor learning  
64 (Peart, Marsh, & Richards, 2005). It is our suggestion that gymnastics may be especially  
65 advantageous to primary school children's physical self-concept. This is because  
66 gymnastics is inherently task-oriented, meaning that skills are practised and developed in  
67 a non-pressured environment (Halliburton & Weiss, 2002) with few external distractions.  
68 Development of skills in this type of environment has been found to have a greater

69 influence upon children's FMS development (Martin, Rudisill, & Hastie, 2009), as well  
70 as having a positive impact upon their physical self-concept (Papaioannou, 1998;  
71 Standage, Treasure, Hooper, & Kuczka, 2007). This is not the case for all PE lessons, as  
72 many lessons can be inherently competitive and ego-oriented with a focus on winning or  
73 losing (Duda, 1996). This pressurised environment can undermine physical self-concept,  
74 which in turn can negatively influence skill development in the short and long term  
75 (Marsh & Peart, 1988).

76 The aim of this study was to evaluate the effectiveness of an eight week gymnastics  
77 curriculum in developing children's movement skill competency and physical self-concept  
78 across a broad primary school age range. It was hypothesised that a gymnastics curriculum  
79 would significantly improve all aspects of movement skills competence more than the control  
80 group. It was also hypothesised that the gymnastics cohort would experience greater  
81 improvements in physical self-perception compared to the control cohort due to the task-  
82 oriented nature of the gymnastics curriculum.

### 83 **Method**

#### 84 **Participants**

85 Data was collected in one Melbourne school (Australia) over a whole school term. A total of  
86 113 children, 54% male (56 intervention and 57 control) between the ages of 7-12 (*M* age =  
87 9.4; *SD* 1.8) participated. Written informed consent was obtained from the parents or  
88 guardians of each participant. The study was approved by a University Ethics Committee and  
89 the Department of Education and Early Childhood Development.

#### 90 **Study Design**

91 In order to investigate the effects of the gymnastics curriculum across the primary school  
92 spectrum, Years 2, 4, and 6 were selected in a quasi-experimental design. After consent forms  
93 had been collected two classes from each of these years were randomly assigned to either  
94 control or intervention. All children underwent pre- and post-assessment testing during weeks  
95 1 and 10 using the Koorperkoodinatin test fur kinder (KTK; Kiphard & Schilling, 2007) and  
96 Test of Gross Motor Development (TGMD-2; Ulrich 2000) to examine changes in movement  
97 competence. Children in both the gymnastics and control cohort had a controlled dose of two  
98 one hour PE lessons per week for a total of eight weeks.

### 99 **Measurements**

100 The Test of Gross Motor Development-2 (TGMD-2) (Ulrich, 2000) assesses proficiency in  
101 six locomotor skills (run, hop, slide, gallop, leap, horizontal jump) and six object control  
102 skills (strike, dribble, catch, kick, overhand throw, and underhand roll). Each participant  
103 completes all 12 skills and is permitted one practice attempt and two assessment trials.  
104 During each assessment trial, the assessor marks the skill component as being 'present' or  
105 'absent'.

106 Koorperkoodinatin test fur kinder (KTK) was administered according to the manual  
107 guidelines (Kiphard & Schilling, 2007). The KTK consists of four outcome-based subtests.  
108 Reverse balance (RB) involves participants walking backwards along three different balance  
109 beams, with increasing levels of difficulty as the width of the beams reduces from 6 cm to 4.5  
110 cm to 3 cm. Three trials are offered with a maximum score of 8 steps awarded for each beam,  
111 creating a maximum score of 72 steps. Hopping for Height (HH) requires participants to hop  
112 on one leg over an increasing number of five cm foam blocks to a maximum height of 12  
113 stacked blocks. A successful trial requires participants to stand 1.5 m from the foam blocks,  
114 then hop up to, and over, the foam blocks, completing a further two hops on landing. Three

115 trials are given for each height with 3, 2 or 1 point(s) given for a successful performance  
116 during the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> trial respectively. Continuous Lateral Sideways Jumping (CS)  
117 requires participants to complete as many sideways jumps as they can, with feet together,  
118 over a wooden slat in 15 seconds. Moving Platforms (MP) involves participants using two  
119 wooden platforms to move across the floor. Participants step from one platform to the other,  
120 each time moving the vacant platform, with the aim of travelling as far as possible in 20  
121 seconds. Two trials each are provided for CS and MP. The KTK requires little time to set-up  
122 and takes approximately 15-20 minutes to administer.

123 Raw item scores were converted into standardized German normative data (Kiphard &  
124 Schilling, 1974 & 2007) which adjusts for age (all items) and sex (HH and CS). The  
125 standardized score items were then summed and transformed into a total Movement Quotient  
126 (MQ).

### 127 **Intra rater Reliability**

#### 128 **Reliability**

129 Prior to assessments in the field setting, 10 Research Assistants (RAs) received six hours  
130 training in testing administration using the same method as reported by Rudd et al. (2016).  
131 KTK reliability was assessed using percent agreement, all RAs in training achieved 98%  
132 agreement or higher when compared to the gold standard coordination score. For reliability of  
133 the TGMD-2 the RAs and lead author subset scores were assessed through intra-class  
134 correlation coefficients (ICC) prior to testing in the field at pre- and again at post-assessment.  
135 Subtest scores were found to be good for locomotor (Pre - test: ICC = 0.87; 95% CI: 0.69 -  
136 0.93, Post - test: ICC = 0.90; 95% CI: 0.78 - 0.96) and object control (Pre -test: ICC = 0.81;  
137 95% CI: 0.52 - 0.93, Post - test: ICC = 0.88; 95% CI: 0.70 - 0.97).

**138 Anthropometry**

139 Height and weight were measured to an accuracy of 0.1 cm and 0.1 kg respectively. Height  
140 was assessed using a Mentone PE087 portable stadiometer (Mentone Educational Centre,  
141 Melbourne, Australia) and weight was assessed using a SECA 761 balance scale (SECA  
142 GmbH & Co. KG., Birmingham, UK). Height and weight values were used to calculate body  
143 mass index (BMI) [BMI = weight (kg) / height<sup>2</sup> (m<sup>2</sup>)].

**144 Physical-Self Description Questionnaire short form (PSDQ-s)**

145 The physical self-description questionnaire short form (PSDQ-s) (Marsh, Martin, & Jackson,  
146 2010) comprises nine factors specific to physical self-concept: appearance, activity,  
147 coordination, body fat, flexibility, health, endurance, sport, strength, and two global scales –  
148 global physical and global self-esteem. The PSDQ-s has good validity and reliability in  
149 primary school children (Ling et al. 2015) and also in an Australian cohort (Marsh et al.  
150 2010). Marsh et al. (2010) reported in a sample of children cronbach alphas between .57 and  
151 .90 and in the present study alphas ranged between .68 and .91 for pre- and post-testing.

**152 Procedure**

153 The PSDQ-s was completed one day prior to the actual movement competency testing. A  
154 research assistant helped Year 2 and 4 children with question comprehension where required.

155 All motor competence assessments were conducted by 10 trained assessors in a large sports  
156 hall. For the physical assessment, children were barefooted and wore their regular PE attire.  
157 First, children's anthropometric measurements (height, weight and grip strength) were taken  
158 and then their motor competence was assessed with the KTK and TGMD-2.

159 Groups of five participants moved in rotation around four skill stations and one  
160 anthropometric station. The TGMD-2 was divided between two stations, a locomotor skills

161 station (run, hop, slide, gallop, leap, horizontal jump) and an object control skills station  
162 (strike, dribble, catch, kick, overhand throw, and underhand roll). The four KTK tasks were  
163 divided into two stations with the RB and CS tasks on one station and MP and HH tasks at  
164 the other station. Before undertaking each task, children were shown both live and pre-  
165 recorded demonstrations.

### 166 **Intervention Cohort Curriculum**

167 LaunchPad is designed for children aged under 12 years and its resources are divided into  
168 three levels: KinderGym aimed at children aged 0-5 years; GymFun for children aged 5-7  
169 years; and GymSkills for children aged 8-10 years. For this study the GymSkills curriculum  
170 was extended to 8-12 years; the rationale for this was that Grade 6 children have poor  
171 movement competency (Hardy et al., 2010; Tester, Ackland, & Houghton, 2014) and would  
172 most likely benefit from the intervention. All LaunchPad lessons have five teaching sections  
173 that follow a set sequence: warm-up, brain challenge, main activity, circuit and cool down.  
174 Importantly, each of these sections contains clear content descriptors of what should be  
175 taught and each section has a recommended timeframe for how long the specific section  
176 should be taught. While these resources are broadly age related they are not age dependent.  
177 This means that deliverers should use age as a guide to the selection of resources but the  
178 deciding factor should be a child's actual competence level. Each set of resources contains a  
179 set of chronological lesson plans, with each lesson building upon the previous one, with skill  
180 cards to complement the lesson plans (see Table 1).

181 \*\*\* Insert Table 1 here \*\*\*

### 182 **Control cohort curriculum**



183 The control cohort received eight two-hour lessons of their normal physical education  
184 curriculum. This was conducted during the summer term with athletics scheduled in the  
185 curriculum (see Table 2).

186 \*\*\* Insert Table 2 here \*\*\*

### 187 **Fidelity**

188 Six out of the 16 lessons were observed (weeks 2, 4 and 6) using a teacher observation  
189 checklist adapted from the school's teacher peer assessment tool. The checklist included  
190 general teacher initiated behaviour and traits, lesson preparation, lesson presentation, safety  
191 and behaviour management. Lessons were observed and graded on a four point Likert scale  
192 with 1= poor, 2 = fair, 3 = good, and 4 = excellent.

### 193 **Data analysis**

194 Data were analysed using SPSS Statistics 20 for Windows. Alpha levels were set at  $p < 0.05$   
195 and considered statistically significant for all analyses. Multivariate analysis of co-variance  
196 (MANCOVA) was conducted on the difference score (post-test – pre-test) for the KTK (RB,  
197 MP, HH, CS). The main factor under investigation was condition (intervention vs. control)  
198 with age, sex and BMI included as covariates. Univariate analysis of covariance (ANCOVA)  
199 was conducted on the difference scores for KTK Motor Quotient (MQ), total fundamental  
200 movement skills (combined object control and locomotive raw scores), locomotive and object  
201 control subtest scores separately and the summed PSDQ-s. In this instance, age was found to  
202 be a significant covariate, so separate analysis was conducted on the lower year groups  
203 (Years 2 & 4) and upper year groups (Year 6).

### 204 **Results**

205 The retention rate for the assessment of movement competence was 100%. However, for  
206 physical self-concept 13 children were unable to complete post-testing due to non-attendance.  
207 Table 3 provides summed scores for the KTK, TGMD-2 and PSDQ-s (see Table 3). All  
208 observed lessons were graded as good to excellent.

209 \*\*\* Insert Table 3 here \*\*\*

### 210 **Koorperkoordination Test Fur Kinder**

211 The MANCOVA for the four KTK raw test scores did not show a condition main effect  
212 (Wilk's  $\lambda = .96$ ;  $p = .42$ ;  $\eta^2 p = .04$ ). However, age was a significant covariate (Wilks'  $\lambda = .84$ ;  
213  $p = .001$ ;  $\eta^2 p = .16$ ) whereas sex ( $P = .97$ ) and BMI ( $P = .51$ ) did not influence the findings.  
214 The ANCOVA for the KTK MQ did not show a condition main effect ( $F(1,112) = 3.40$ ;  $p =$   
215  $.07$ ;  $\eta^2 p = .03$ ). Age and sex were not included in this analysis as the process of standardising  
216 the scores accounts for this. BMI did not influence findings ( $p > .05$ ).

### 217 Fundamental movement skills

218 The ANCOVA for the Total FMS summed score did not show a significant condition main  
219 effect ( $F(1,76) = 2.10$ ;  $p = .15$ ;  $\eta^2 p = .09$ ). Age was a significant co-variate ( $F(1,76) = 5.1$ ;  $p$   
220  $= .05$ ;  $\eta^2 p = .04$ ) whereas both sex and BMI did not influence the findings ( $p > .05$ ). The  
221 ANCOVA for locomotive skills did not show a significant condition main effect ( $F(1,76) =$   
222  $2.70$ ;  $p = .38$   $\eta^2 p = .03$ , Age, sex and BMI did not influence the findings ( $p > .05$ ). Finally, the  
223 ANCOVA for object control skills provided a near significant condition main effect  $F(1,76)$   
224  $= 3.14$ ;  $p = .06$ ;  $\eta^2 p = .03$ ). Near significant differences were also observed for age ( $p > .06$ ),  
225 but there were no differences for sex or BMI ( $p > .05$ ). Due to age being a significant  
226 covariate in the KTK raw and overall FMS score, and approaching significance for the object

227 control skills, it was decided to examine results separately for the lower year and upper year  
228 children.

### 229 **Results for lower primary (Years 2 and 4)**

230 **Kooperkoodination Test Fur Kinder.** The MANCOVA for the KTK did not show a  
231 condition main effect (Wilks'  $\lambda = .84$ ;  $p = .50$ ;  $\eta^2p = .04$ ). BMI and sex did not influence  
232 results ( $p > .05$ ). The ANCOVA for the KTK MQ did not show a condition main effect either  
233 ( $F(1,76) = .21$ ;  $p = .65$ ;  $\eta^2p = .03$ ). In addition, BMI and sex did not influence the findings ( $p$   
234  $> .05$ ).

235 **Fundamental movement skills.** Summed FMS score ANCOVA showed a significant  
236 condition main effect ( $F(1,76) = 7.8$ ;  $p = .006$ ;  $\eta^2p = .09$ ) with the intervention cohort showing  
237 larger gains; neither sex nor BMI influenced the findings ( $p > .05$ ). The ANCOVA for  
238 locomotive skills subset score did not show a condition main effect  $F(1,76) = 1.3$ ;  $p = .24$ ;  $\eta^2p$   
239  $= .02$ ). BMI and sex did not influence the findings ( $p > .05$ ). The object control skills were  
240 largely responsible for the significance in total FMS score, as the ANCOVA for object  
241 control skills did show a significant main effect in favour of the intervention cohort ( $F(1,76)$   
242  $= 4.52$ ;  $p = .04$ ;  $\eta^2p = .06$ ).

### 243 **Results for upper primary (Year 6)**

244 The MANCOVA for the KTK showed a condition main effect (Wilks'  $\lambda = .56$ ;  $p = .008$ ;  $\eta^2p$   
245  $= .44$ ). Follow-up ANCOVA showed larger gains in the control cohort in comparison to the  
246 intervention cohort. The ANCOVA for the KTK MQ showed a significant condition main  
247 effect ( $F(2,26) = 4.42$ ;  $p = .045$ ;  $\eta^2p = .15$ ) with the control cohort showing larger  
248 improvements. BMI and sex did not influence the findings ( $p > .05$ ).

249 Total FMS ANCOVA showed a significant condition effect in favour of the control cohort  
250  $F(1,26) = 9.5$ ;  $p = .005$ ;  $\eta^2p = .27$ ). BMI and sex did not influence the findings ( $p > .05$ ). The  
251 ANCOVA for locomotive skills subset score also showed a significant condition main effect  
252 ( $F(1,26) = 11.5$ ;  $p = .002$ ;  $\eta^2p = .31$ ). BMI and sex did not influence the findings ( $p > .05$ ).  
253 ANCOVA for object control skills did not show a significant main effect ( $F(1,26) = 4.41$ ;  $p$   
254  $= .52$ ;  $\eta^2p = .02$ ).

### 255 **Physical self-description questionnaire- s (overall)**

256 The ANCOVA for the total score of the PSDQ showed a significant condition main effect  
257 ( $F(1,97) = 6.12$ ;  $p = .02$ ;  $\eta^2p = .06$ ) with the intervention cohort showing larger gains in  
258 overall PSDQ scores compared to the control cohort which showed a decrease in PSDQ  
259 scores. BMI and sex did not influence the findings ( $p > .05$ ).

260 **Lower primary (Years 2 and 4).** ANCOVA for the PSDQ showed a significant condition  
261 main effect ( $F(1,66) = 5.8$ ;  $p = .02$ ;  $\eta^2p = .08$ ) with the intervention cohort showing larger  
262 gains. BMI and sex did not influence the findings ( $p > .05$ ).

263 **Upper primary (Year 6).** The ANCOVA for the PSDQ did not show a significant condition  
264 main effect for upper primary school children ( $F(1,28) = 1.61$ ;  $p = .22$ ;  $\eta^2p = .05$ ). BMI and  
265 sex did not influence the findings ( $p > .05$ ).

### 266 **Discussion**

267 The aim of this study was to examine the efficacy of a gymnastics curriculum on the  
268 development of movement skill performance and physical self-concept in primary school  
269 children compared to the school's standard PE curriculum. Overall, no difference was found  
270 between the two curricula in terms of improvements in actual movement competence when  
271 combining all grades, although the gymnastics cohort showed significant improvement in

272 physical self-concept for all children compared to children participating in the standard PE  
273 curriculum.

274 Age was found to be a significant covariate for actual movement skill competency on both  
275 overall FMS and general body coordination variables. When examining the findings for the  
276 upper and lower primary children separately, it was found that the lower primary school  
277 children responded more positively to the gymnastics intervention than upper primary school  
278 children. In particular, children who participated in the gymnastics curriculum demonstrated  
279 a significant improvement in total FMS score, object control skills and in their physical self-  
280 concept compared to the control cohort.

281 The improvement in the lower primary intervention group in total FMS was mainly due to  
282 improvements in object control skills. This is in line with Rudd et al. (2016) which also found  
283 children with a mean age of 8 years showed significant improvement in object control skills  
284 compared to a control group after a gymnastics intervention. This current study reinforces a  
285 possible transfer between gymnastics and the development of more complex fundamental  
286 skills. The improvement in object control skills is essential as these skills have been  
287 associated with increased fitness and physical activity outcomes later in life (Barnett et al.,  
288 2008; Stodden, Gao, Goodway, & Langendorfer, 2014; Vlahov, Baghurst, & Mwavita, 2014).

289 The upper school (Year 6) did not reflect the lower school's results. The upper school control  
290 group showed significant improvements in locomotive skills and general body coordination,  
291 but there was no difference between the cohorts for object control skills. The athletics  
292 curriculum involved many activities which focused on locomotor skills and this may explain  
293 the apparent enhancement in this set of skills. Another factor that may have influenced the  
294 lack of development in the gymnastics cohort was the gymnastics curriculum was not  
295 sufficiently challenging for year 6 children, meaning that the task they were doing was too

296 easy to acquire FMS and general coordination beyond what they already possessed. This  
297 hypothesis is reinforced when it is considered that the curriculum was designed for children  
298 up to the age of 10 and the average age in the year 6 group was 12. It had previously been  
299 decided there was sufficient justification for including year 6 children as it was felt the  
300 curriculum may have been beneficial to them, due to the poor levels of movement skills  
301 reported in the literature (Booth et al. 1999; Hardy et al. 2013; Okely and Booth 2004).

302 In this study, all children in the gymnastics cohort showed significant improvement in  
303 physical self-concept compared to the standard PE curriculum. A potential reason for the  
304 improvement is that gymnastics is non-competitive and may therefore lead to a less-  
305 threatening learning environment, which is more aligned to a task oriented mastery climate  
306 which, has been associated with positive student outcomes (Papaioannou, 1998, Standage et  
307 al., 2007; Martin., et al 2009). Children in the lower primary school who undertook the  
308 gymnastics curriculum demonstrated the simultaneous development of physical self-concept  
309 and movement skill competence. Marsh et al., (2006) suggest that such balanced  
310 improvement will foster long term benefits to a child's self-belief and movement skill  
311 competence. Conversely, the upper primary school gymnasts also improved their self-concept  
312 although no actual movement skill improvement was observed. In accordance with Marsh et  
313 al., (2006), it is likely that these children will experience only short-term benefits in self-  
314 belief and movement skill competency since there is not a balance between the children's  
315 self-concept and motor skill performance; hence the importance of having a curriculum that  
316 meets children's development needs.

317 This study has highlighted the increasing need for PE teachers and schools to implement an  
318 evidence based approach to the assessment/ evaluation of the taught PE curriculum, with a  
319 focus on how it is impacting upon the individual child's motor skills and psychological  
320 development. This is of paramount importance given the growing body of evidence of

321 decreasing levels of movement skill performance being found in children (Bardid et al. 2015;  
322 Tester et al. 2014)

### 323 **Conclusion and Future Study**

324 This paper further highlights the importance of gymnastics for lower primary school  
325 children's movement skill development. In particular, it reinforces the potential of  
326 gymnastics to help children perform complex movement skills such as object control skills.  
327 This paper also underpins the positive psychological benefits of young children undertaking  
328 gymnastics through improved physical self-concept. The lack of skill improvement for the  
329 older children who undertook the gymnastics curriculum is worthy of further investigations  
330 and it is recommended that these children should be taught an appropriately challenging  
331 curriculum. It would, in particular, be interesting to see if the gymnastics curriculum could be  
332 made more relevant to the older primary school years. A limitation was not collecting socio-  
333 economic and ethnic demographics data at the individual level as, without this information,  
334 we cannot be certain the sample was representative of the wider school population. Future  
335 studies should also explore longitudinal follow up to see if following a gymnastics  
336 curriculum in the lower primary school has lasting benefits to long-term self-concept and  
337 movement skill competency (Lai et al., 2014).

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